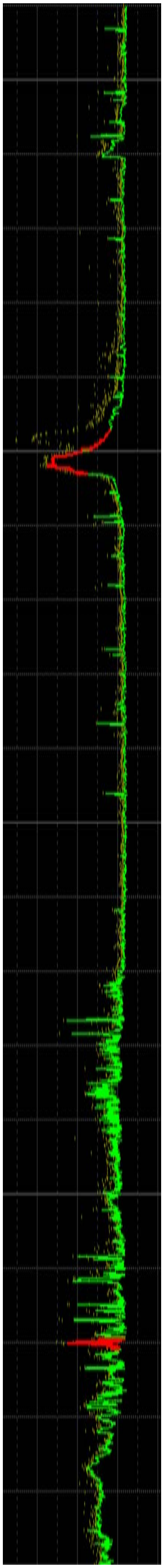

Signals Intelligence Support System

Software Programming and Operation Manual

Installer Release Control	**v1.41-1 | 64-Bit Application (Full Installer)**
Installer Release Date	**2020-07-07**
Installer Release Build	**5e98d8d4**
Beta Release Control	**v1.41-47DEV | 64-Bit Application (Drop File)**
Beta Release Date	**2020-10-08**
Beta Development Build	**af4c2262**
Manual Revision	**2020-09-17**
Classification	**Protected Proprietary | Intellectual Property**

Available Options

	OPT AEC	**Automatic Export Control (AEC) ™**
	OPT CLP	**Command Line Programming (CLP) ™**
v1.05	**OPT AMCS**	**Autonomous Measurement and Collection System (AMCS) ™**
	OPT TCP	**Tap Capture Plot (TCP) ™**
	OPT DTAP-GPS	**Dynamic Trace Autonomous Platform (DTAP-GPS) ™**
	OPT HELIX	**Third-Party HELIX SDK Encryption (OPT HELIX)**
	OPT KCV	**Kestrel Central Visualizer (KCV) ™**
	OPT GOV	**Government (Restricted) Application Programming Interface (API)**

Professional Development ***TSCM*** Group Inc.

Technical Security Branch (TSB)

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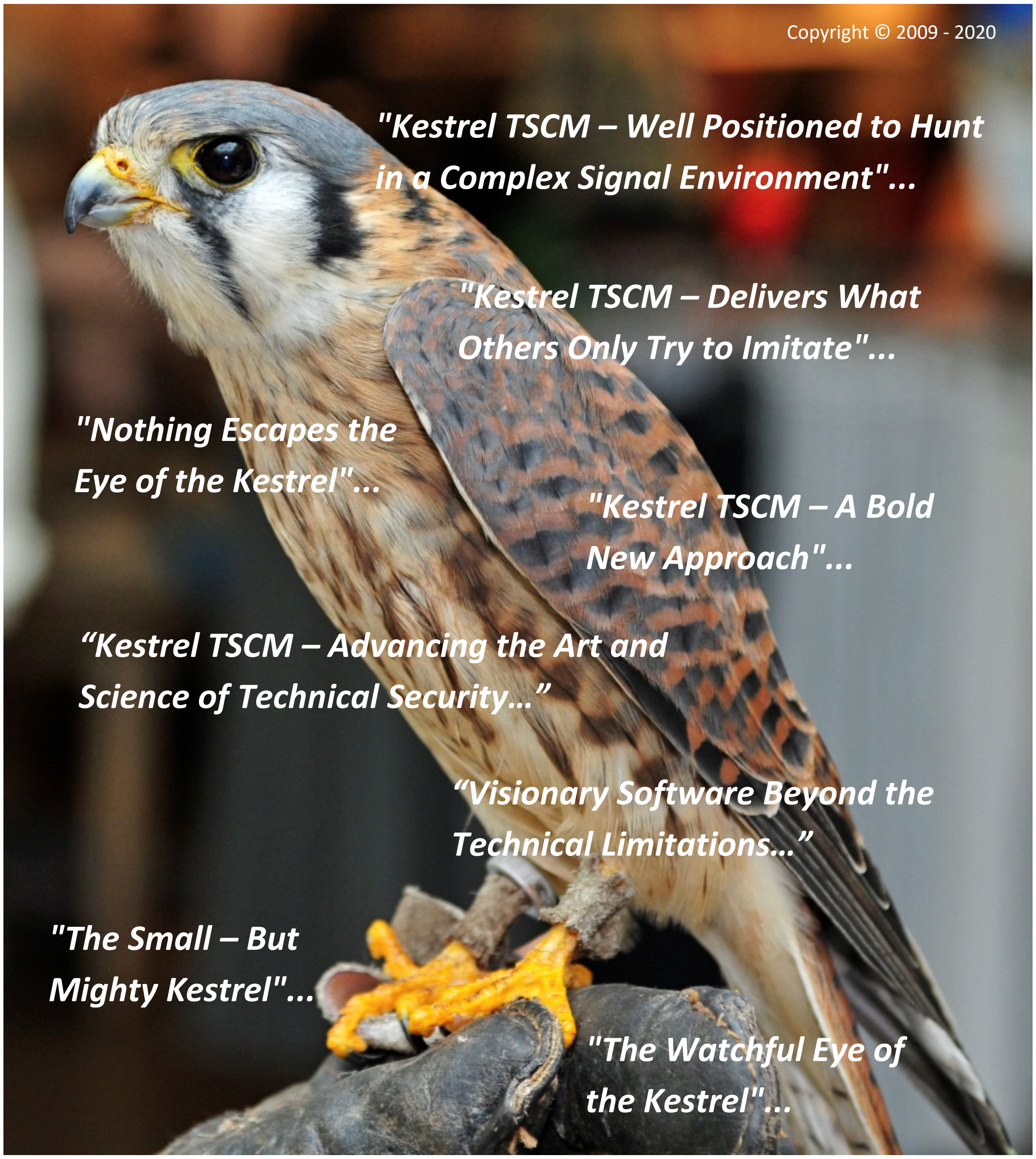
“Innovation is Simply the Beginning…”



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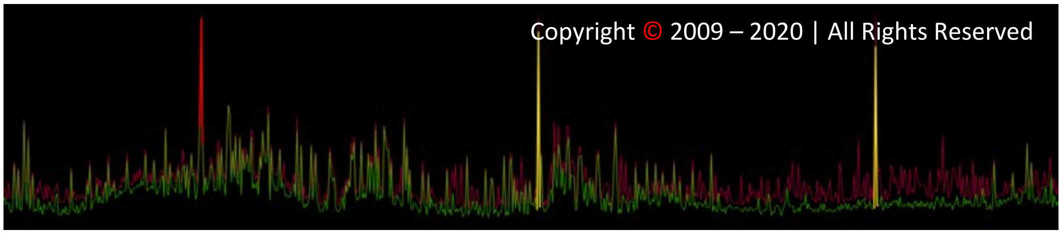

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For the elite, few among you that simply don't do software user manuals, I strongly recommend that you read this document at least once all the way through and repeat as necessary. The Kestrel TSCM ® Professional Software is a technically advanced and somewhat complex SDR application, within a modern deployment methodology, requiring a highly motivated, and well-trained professional and experienced technical operator, to gain the most benefit.

Paul D Turner, *TSS TSI*

Professional Development ***TSCM*** Group Inc.

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Software Programing and Operation Manual (SPOM)

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NOTE: Changes since the previous official software Release Control are indicated by a RED vertical margin bar, and a BLUE glow (border) surrounding an image indicates that the image is current with reference to published Release Control version of the software, as noted on the front cover of the user-manual.

Errors and Omissions Statement

Professional Development TSCM Group Inc., and our Software Development Group (SDG) ™ have made every effort to ensure that the Software Programming and Operation Manual (SPOM) ™ is as accurate as possible, in describing the many advanced features, and core functionality, of the Kestrel TSCM ® software application and operation.

The Kestrel TSCM ® Professional Software is a technologically complex product that is continually undergoing significant design and development enhancements on a release by release basis, to define and redefine new and innovative Software Defined Radio (SDR) concepts that are TSCM, RSSM ™, ELINT, and SIGINT specific, as well as being operator centric, within a modern moving target threat model.

The end-user therefore agrees to accept any errors and / or omissions at the software level, and within this document, as well as all other supplemental documentation, on an "as is" basis, which may or may not be suitable for all end-user mission requirements.

Kestrel ® is not a life safety system, and therefore must not be deployed in any such capacity, or for any use as an offensive trigger of Artificial-Intelligence (AI) based weapon systems such as Electronic Countermeasures (ECM) technologies without proper authority or due considerations of the possible legal and life-safety consequences.

We encourage technical operators, to report any noted runtime bugs, undesirable behaviour, or unusual characteristics of the software, to the Technical Support Group (TSG) ™ for review, as well as any errors and / or omissions, noted with this manual or other documentation.

We want to hear your ideas and team Kestrel ® encourages your input and feedback to help guide future software development priorities, and for the purpose of fixing any observed bugs, behaviour issues, or software instability. We ask that you delineate your ideas in an email explaining the rationale for the feature or capability.

We are strictly resolved, to providing the best possible experience for the technical operator.

Scientific Research and Development efforts are on-going as the threat environment continues to develop and Professional Development TSCM Group Inc., is committed to forward thinking software development.

Our unique TSCM focus brings clarity to the vast unknowns of the ambient RF spectrum environment within a modern moving target threat model.

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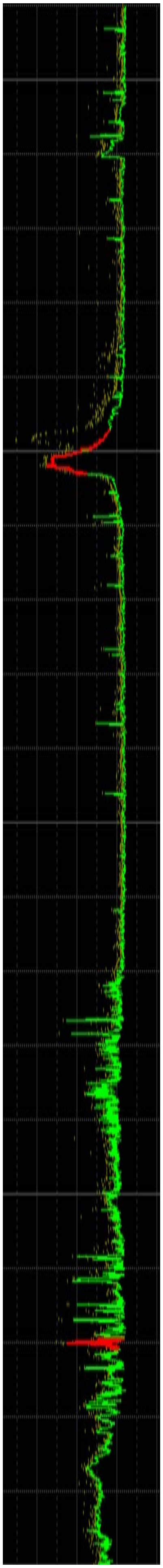

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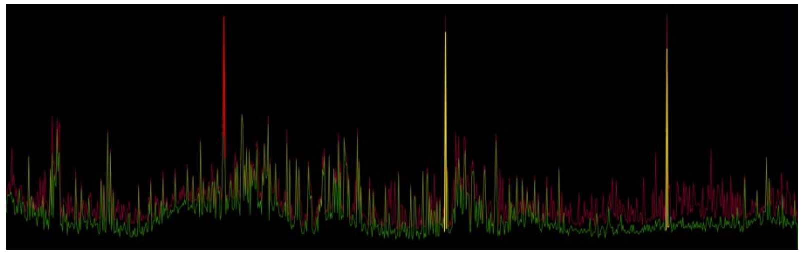


Forward | Introduction and Overview

Innovation is Simply the Beginning...

Review and Revision: 2020-05-10

Forward | Introduction and Overview

The Kestrel TSCM ® Professional Software is a bold new approach, with a proud history of more than a decade of excellence; taking advantage of significant, emerging and well-founded theoretical and practical technological advances in Software Defined Radio (SDR) principles and a new applied approach within the TSCM | SIGINT field deployment methodology, in face of a modern moving target threat model.

Professional Development TSCM Group Inc. has developed the Kestrel TSCM ® Professional Software based on 40 years of professional experience in providing Technical Surveillance Countermeasures (TSCM), Counter-Intelligence and Counter-Espionage services, as well as advanced Technical Security Specialist (TSS) ™ Designate Certification training, at all known and developing operational threat levels worldwide.

The Kestrel TSCM ® Professional Software is a powerful, field proven and fresh Canadian approach to a workflow based, full featured, professional level | Signals Intelligence Support System (SISS) ™ | by combining budget friendly, commercially available SDR hardware and software options that are packed with operator centric features and functionality, developed exclusively by Professional Development TSCM Group Inc. over many years, with worldwide distribution in 45 countries.

Our enhanced operator workflow management concept is based on years of practical field deployment experience that simply cannot be duplicated by engineering concepts alone.

With basic and advanced TSCM specific reporting capability; structured file management; exceptional user documentation and strong technical operator training; have been important missing elements in virtually every TSCM product developed during the past 35 years.

When you combine all of these powerful elements with the typical high cost factor of monopolistic competitive equipment resources, with many systems costing more than 5 to 10 times more than the Kestrel TSCM ® Professional Software, you will immediately see the many tremendous benefits and the added value that the advanced functionality included within the Kestrel TSCM ® Professional Software, can offer the professional Technical Security Specialist (TSS) ™ that other manufacturers simply cannot, or will not deliver with generations of outdated and obsolete concepts, resources and training.

The Kestrel TSCM ® Professional Software is explicitly designed for maximized operator versatility, scalability and flexibility requiring an advanced understanding of applied RF signal propagation, RF signal analysis and analytics, and an appreciation of Near-Field (NF) signal characterization, to gain the maximum benefit and best possible outcome.

The Kestrel TSCM ® Professional Software is not designed as a simple spectrum analyzer or collection platform, but rather, it engages and brings the professional technical operator back into the equation with innovative, and many never before included standard features and functionality.

The technical operator has full and unrestricted control of the deployment session and can combine his or her direct personal experience with the ever-changing dynamics of the complex signal and threat environment.

Critical mission deployment is enhanced by the exceptional integration of multiple layered feature sets that advantage the very best in detection, identification and localization principles across the application.

It is like have a dozen resources that can be utilized separately or in combination to achieve mission critical results.

TIP: Understanding the intent and function of each technical operator control input dialog, is absolutely critical in achieving a satisfactory end result or outcome during deployment of any advanced software application. Many of the software control groups are intuitively duplicated on various menus and tool bars to permit improved operator centric workflow and unprecedented convenience. The use of low-level artificial intelligence (AI), dynamic control linking and predictive logic are all fully supported within the Kestrel TSCM ® Professional Software application.

Utilizing incorrect, and / or sub-optimal control settings can result in friendly signals being flagged as threats and hostile (or potentially hostile) signal events being displayed, dismissed, or missed altogether during the detection and analysis process.

It is the responsibility of the technical operator to ensure that all deployment settings are optimal for any unique mission requirements and this is a easy task within the software as it is designed to remove erroneous control and configuration options based on the operator defined deployment mode.

Recommended default control settings have been implemented within the software for most common deployment scenarios and are based on real-world and reference lab-based analytics of hundreds of live and simulated | Technical Surveillance Devices (TSD) | and the combined-shared experience of professional technical operators working at all operational threat levels worldwide.

TIP: We strongly recommend that all end-users attend the Kestrel TSCM ® Professional Software, Certified Technical Operator (CTO) TM or Certified Government Technical Operator (CGTO) TM training to gain better insight and an understanding of the capabilities and limitations of the various search receivers and spectrum analyzer hardware options supported within the Kestrel TSCM ® Professional Software features and functionality. Professional Development TSCM Group Inc. has developed specific deployment methods and techniques to better harness and maximizes the capabilities of select search receivers and analyzer hardware under the umbrella of a modern moving target threat model. The Kestrel TSCM ® Professional Software requires that the technical operator apply a new and developing methodology that simply cannot be fully described or explored within the | Software Programming and Operation Manual (SPOM) | entirely on its own.

The Kestrel TSCM ® Professional Software includes numerous advanced threat detection, signal identification, and analytical concepts that are firmly based on a modern moving target threat model, which at first will be unfamiliar to the technical operator until some practical field experience and training are attained.

The specifications and default settings are subject to change as both new hardware and software development progresses and new features and functionality are implemented and field tested.

Existing features and functionality continue to be improved and new features and options are scheduled for long-term developed and implemented at both the hardware and software level.

We work closely with various hardware manufacturers to bring innovative and cutting-edge solutions to the commercial Technical Security (TSEC) industry worldwide.

Our | Technical Research and Standards Group (TRSG) TM | and | Software Development Group (SDG) TM | continue to add additional new technology TSCM specific features, work-flow tools, advanced functionality, bug fixes, security patches and minor updates and enhancements with the release of each subsequent version of the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) TM application.

Professional Development TSCM Group Inc., provides excellent documentation for the TSCM ® Professional Software at the technical support level.

The Software Programming and Operation Manual (SPOM) TM is located within the password protected area of the Kestrel TSCM ® Professional Software, Technical Support Group (TSG) Resource Centre website.

Our Software Programming and Operation Manual (SPOM) TM is a lot more than a typical user manual, it is a powerful knowledge base resource that provides theoretical and practical deployment considerations for use in a modern moving target threat model.

The online Technical Support Group (TSG) Resource Centre is a powerful knowledge base resource that is available only to licensed authorized Kestrel TSCM ® Professional Software users and authorized technical operators and is not a public domain document.

We encourage technical operators of the Kestrel TSCM ® Professional Software to report any bugs, stability issues, behaviour observations, development ideas and other input regarding potential product improvement, such as new features and functionality, potential work-flow enhancements or anything else you would like to see added in subsequent versions of the Kestrel TSCM ® Professional Software application.

We are interested in technical operator input and are fully engaged, committed and dedicated to the advancement of the Kestrel TSCM ® Professional Software as a function of real-world technical operator critical mission requirements.

The Kestrel TSCM ® Professional Software is the first total system integration package, supporting a wide range of search receivers and professional level spectrum analyzers ever developed for the commercial, government and military sectors.

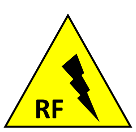
The experience and real-world needs of professional technical operators like you drive the future of the Kestrel TSCM ® Professional Software development.

Electro Static Discharge (ESD) | Warning!

The Software Defined Radio (SDR) receivers and analyzers supported for use with the Kestrel TSCM ® Professional Software are sophisticated, precision and highly sensitive RF based test and measurement instruments that can be damaged by Electro-Static Discharge (ESD), if handled improperly.

The technical operator must take the appropriate precautions during setup and deployment when connecting or disconnecting, cables and connectors, antennas and other accessories to the radio hardware, to avoid potentially damaging the device due to inadvertent Electro-Static Discharge (ESD) conditions.

Radio Frequency (RF) Radiation | Warning



It is essential that host computer controlled SDR radio hardware and analyzers, antennas and other accessories be placed with consideration given to protecting the devices from high-power Near-Field (RF) radiation.

The maximum allowable signal level at the RF front-end input will differ depending on the radio hardware or analyzer utilized and it is essential that an appropriate value internal attenuator settings and in some cases an external attenuator be utilized whenever the technical operator suspects that the signal level at the input connector may exceed the maximum input level for the radio hardware utilized.

It is recommended that technical operators include an inline (SMA to SMA) DC Block, +10 dB Attenuator pad and a +20 dB Attenuator pad in the sweep kit, in the event that these are required when deploying in strong ambient RF signal environments and also to assist in signal source localization, by preventing saturation of the radio front end during walk-about direction-finding.

The use of a | Low Noise Amplifier (LNA) | is typically not required or recommended for use with the modern SDR hardware supported by the Kestrel TSCM ® Professional Software unless significant coaxial antenna cable and connector losses are anticipated.

When a distant coaxial antenna cable run is required during deployment, an LNA may be utilized to compensate for cable loss attenuation and should be placed on the antenna side, not the radio side.

The use of an in-line external attenuator pad can prevent receiver saturation and the potential for damage to the radio when the device is utilized in a walk-about fashion in search of the strongest Signal of Interest (SOI) event.

SDR devices also include a variety of technical operator selectable internal attenuators, which are useful for signal source localization, however, internal attenuators are not necessarily a substitute for an appropriate value, external attenuator pad, to limit the actual input level to below the maximum allowable input signal level.

It should also be understood that switching attenuator settings during deployment of Location Differential Signal Analysis (LDSA) ™ is not recommended when comparative energy must later be analyzed.

Maximum Allowable Input Signal Level (Supported SDR Hardware)

Receiver | Analyzer	Frequency Range	Level	Support Level
Signal Hound ™ USB-SA44B	1Hz to 4.4 GHz 240 kHz IFBW	+20 dBm	Kestrel TSCM ® Professional Software
Signal Hound ™ USB-SA124B	100 kHz to 12.4 GHz 240 kHz IFBW	+20 dBm	Kestrel TSCM ® Professional Software
Signal Hound ™ BB60A	9 kHz to 6.0 GHz 20 MHz IFBW	+20 dBm	Kestrel TSCM ® Professional Software
Signal Hound ™ BB60C | 24 GHz/Sec (10 kHz RBW)	9 kHz to 6.0 GHz 27 MHz IFBW	+20 dBm	Kestrel TSCM ® Professional Software
Signal Hound ™ SM200A/B/C | 1 THz/Sec (30 kHz RBW)	100 kHz to 20 GHz 160 MHz IFBW	+20 dBm	Kestrel TSCM ® Professional Software
Anritsu | Spectrum Master (C Series) MS272xC [1] **Anritsu | Spectrum Master (T Series)** MS272xT [2] **Anritsu | Field Master (Pro Series)** MS2090A [3]	9 kHz to 9 GHz [1] [2] [3] 9 kHz to 13 GHz [1] [2] 9 kHz to 14 GHz [3] 9 kHz to 20 GHz [1] [2] 9 kHz to 26.5 GHz [3] 9 kHz to 32 GHz [1] [2] [3] 9 kHz to 43 GHz [1] [2] [3] 9 kHz to 43.5 GHz [3] 9 kHz to 54 GHz [3]	+30 dBm	Kestrel TSCM ® Professional Software [1] [2] IQ Playback Support [3]
Rohde and Schwarz EM100 Compact Receiver PR100 Portable Receiver	9 kHz to 3.5 GHz 9 kHz to 7.5 GHz	+20 dBm	Kestrel TSCM ® Professional Software
Tektronix Canada RSA306-USB	9 kHz to 6.2 GHz	+20 dBm	Kestrel TSCM ® Professional
ThinkRF Corporation R5500-408 R5500-418 R5500-427 R5750-427	9 kHz to 8 GHz 9 kHz to 18 GHz 9 kHz to 27 GHz	-10 dBm	Kestrel TSCM ® Professional Software
Shearwater TSCM Merlin MK3	100 kHz to 30 GHz		Kestrel TSCM ® Professional Software
CRFS RFeye Node	10 MHz to 6 GHz	+15 dBm	Kestrel TSCM ® Professional Software
Keysight FieldFox | Microwave Spectrum Analyzers	100 kHz to 14 GHz 100 kHz to 18 GHz 100 kHz to 26.5 GHz 100 kHz to 32 GHz 100 kHz to 44 GHz 100 kHz to 50 GHz		Kestrel TSCM ® Professional Software
SDRPlay RSP2pro	1 Hz to 2 GHz 8 MHz IFBW		Kestrel TSCM ® Professional Software

Maximum Input Level | v1.40xx

Kestrel-net ™ Tactical Workstation Series (TSW) (TMW) (TCW) (TGW)			
General Specifications | Customization Note: Specifications and Available Options are Subject to Change without Notice.	**Frequency Range | Real-Time IF Bandwidth**	**Kestrel-net ™** **Tactical Workstation Series | Configuration**	**TSCM | SIGINT | ELINT | RSSM ™** **Software Support Level**
Tactical Spectrum Workstation (TSW) ™ 10.1" 1280 x 800 resolution resistive touchscreen display, Intel i9 core processor, 64 GB DDR4 RAM, dual (internal) 1 TB SSD Storage Media, Windows 10 Professional OS. 4G Broadband network, Kestrel Lighting Fiber-Optic Remote (KLR). Supports Dual internal Signal Hound BB60C Spectrum Analyzers and RF Recorders Multiple Receiver Operation (MRO) ™.	1Hz to 50 GHz (SDR Specific) 240 kHz to 160 MHz IFBW (SDR Specific)		Kestrel TSCM ® Professional Software Automatic Export Control (AEC) ™ | OPT AEC Command Line Programming (CLP) ™ | OPT CLP Tap Capture Plot (TCP) ™ | OPT TCP Dynamic Trace Autonomous Platform (DTAP-GPS) ™ Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS
Tactical Mobile Workstation (TMW) ™ 17.3" 1920 x 1080 resolution display, Intel i7 core processor, 32 GB DDR4 RAM, (dual) 1 TB SSD Storage Media, Window 10 Professional OS, 4G Broadband network, Kestrel Lighting Fiber-Optic Remote (KLR). Dual hot swap (95-Watt Hour) Lithium Ion (95-Watt Hour) batteries. Supports Multiple Receiver Operation (MRO) ™.	1Hz to 50 GHz (SDR Specific) 240 kHz to 160 MHz IFBW (SDR Specific)		Kestrel TSCM ® Professional Software Automatic Export Control (AEC) ™ | OPT AEC Command Line Programming (CLP) ™ | OPT CLP Dynamic Trace Autonomous Platform (DTAP-GPS) ™ Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS
Tactical Command Workstation (TCW) ™ 23.8" (dual) 1920 x 1080 resolution displays, Intel i7 core processor, 32 GB DDR4 RAM, (dual) 1 TB SSD Storage Media, Window 10 Professional OS, 4G Broadband network, Kestrel Lightning Fiber-Optic Remote (KLR). Supports Multiple Receiver Operation (MRO) ™.	1Hz to 50 GHz (SDR Specific) 240 kHz to 160 MHz IFBW (SDR Specific)		Kestrel TSCM ® Professional Software Automatic Export Control (AEC) ™ | OPT AEC Command Line Programming (CLP) ™ | OPT CLP Tap Capture Plot (TCP) ™ | OPT TCP Dynamic Trace Autonomous Platform (DTAP-GPS) ™ Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS
Tactical Geo-Location Workstation (TGW) ™ Professional level tablet computer mobile workstation with the latest Intel i7 processor. Dedicated GPU, 4G/LTE Broadband Wireless, Detachable Keyboard, 14-inch Daylight Viewable Display.	1Hz to 50 GHz (SDR Specific) 240 kHz to 160 MHz IFBW (SDR Specific)		Kestrel TSCM ® Professional Software Automatic Export Control (AEC) ™ | OPT AEC Command Line Programming (CLP) ™ | OPT CLP Tap Capture Plot (TCP) ™ | OPT TCP Dynamic Trace Autonomous Platform (DTAP-GPS) ™ Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS

RF Antenna Switch Support | Mini-Circuits (MC) Hardware			
Model	**Ports**	**Range**	**Connectivity Support**
RC-1SP4T-A18	4-Ports	DC to 18 GHz	USB 2.0
RC-1SPDT-A18	2-Ports	DC to 18 GHz	USB 2.0
RC-1SP6T-A12	6-Ports	DC to 12 GHz	USB 2.0

RF Switch Support | v1.40xx

Exceeding the maximum input signal level can damage the receiver or analyzers input attenuator and other (RF) front-end components.

Do <u>not</u> connect high-level signals such as those directly from transmitters or other signal sources, including cable television or RF Signal Generators, directly to the receiver or analyzer RF input without the use of a proper internal and external RF attenuation to limit the RF signal to below the maximum allowable signal level for your connected SDR device.

The Kestrel TSCM ® Professional Software is designed to automatically sweep the ambient RF spectrum, utilizing the full or partial search receiver or spectrum analyzer Range of Interest (ROI), based on a set of highly flexible and operationally intuitive, technical operator defined programming and setup parameters.

The Kestrel TSCM ® Professional Software application is specifically designed by the our | Technical Research and Standards Group (TRSG) ™ | and | Software Development Group (SDG) ™ | as a specialized and dedicated TSCM specific signal capture, logging, threat identification and signal analysis application that is specific to observing, capturing, documenting, analyzing and demodulating analog and digital Signals of Interest (SOI) within both the Near-Field and Far-Field ambient RF spectral environment.

The Kestrel TSCM ® Professional Software also has the ability to generate customized automatic PDF formatted reports at any time during an active runtime session or during post analysis review.

The | Session Report Generator (SRG) ™ | and | Advanced Report Generator (ARG) ™ | provide total mission-oriented report output not only for the RF phase of the inspection, but for the entire inspection from beginning to end.

Statement of Capability and Limitation

The Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™ is designed to replace or eliminate the need or requirement to utilize additional TSCM based RF equipment resources at any given threat level encountered, allowing the technical operator to continue working within a familiar equipment-oriented environment.

Our professional approach (training and operationally during the past 40 years) has always been and always will be, to utilize the widest possible range of dedicated TSCM specific and professional level Test and Measurement and Analytical equipment resources available, as may be required for any given known or developing technological threat encountered in practice.

The Kestrel TSCM ® Professional Software is simply one (1) of the highly specialized and technologically sophisticated resources that is available to professionally qualified technical operators.

When the Kestrel TSCM ® Professional Software is deployed correctly, taking into account all capabilities and limitations, including the actual or perceived operational target area threat level, the Kestrel ® TSCM Software is a very powerful cutting edge professional level equipment resource.

As is typically the case with virtually every search receiver and spectrum analyzer on the market, there are going to be a number of limiting factors that dictate the overall performance and effectiveness of any particular radio, for any given deployment application or circumstance.

The search receiver or spectrum analyzer design is often the primary consideration when sensitivity, selectivity, dynamic range, bandwidth, out of band images, spurious signals and other mixing artefacts affect the overall performance, and these must be taken into consideration to achieve the desired outcome and will dictate the suitability of any given hardware for the mission defined parameters.

Display Configuration

"Kestrel Soars when Deployed in a Multiple Monitor Configuration…"

The Kestrel TSCM ® Professional Software is specifically designed to operate effectively in a single display monitor configuration, or across multiple display monitors to realize maximum deployment benefits and efficiency.

Single, dual and multiple receiver operation, as well as the unique ability to deploy any number of active or standby spectral band allocations or Ranges of Interest (ROI), is fully supported across any combination of multiple receivers, or spectrum analyzers, and allows all display functions and associated control elements to be transferred to a variety of additional display monitors for outstanding situational awareness.

Multiple display operation is a direct function and capability of the host computer graphics hardware support and may be enhanced utilizing external USB 3.0 supported graphics adapters to allow for additional HDMI (recommended) display monitors such as large format flat screen televisions, all at their respective native display resolutions, including computer monitors, flat screen televisions and LCD data projectors.

The use of recently available USB 3.0 powered LED display monitors supported by Windows 10 is an excellent way to enhance operator situational awareness and achieve multiple monitor operation during travel assignments.

It is possible to take advantage of the many high-definition wireless display options that are available to extend the overall operational capability during deployment, protective operations and special events, however, the use of wireless devices within the target area, or the facility wireless policy can be problematic. This includes wireless remote capability within some spectrum monitoring resources.

The ability to deploy the Kestrel TSCM ® Professional Software in a command and control setting, is fully supported across multiple search receivers, display monitors and active spectrum band allocations.

A laptop computer and dual USB 3.0 powered LED display monitors are relatively light weight, travel friendly, and excellent for demanding deployment of the Kestrel TSCM ® Professional Software.

Powerful desktop, micro PC technology and rack mount computers, are an excellent choice for permanent installation and long-term operational deployment of the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™ within facility security command posts, or for permanent managed Remote Spectrum Surveillance and Monitoring (RSSM) ™, as well as for temporary deployment within a variety of electronically enhanced RF security related applications in a protective role for executive residences, hotel rooms, meeting and conference facilities.

All-In-One computers offer portability, significant computing power and are an excellent choice for temporary installation of the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™ for deployment in a variety of monitoring related applications.

Many of the “All-In-One” computers support touch screen input, permitting additional navigational and set-up options during active deployment.

Laptop and tablet computers are an excellent choice for fixed and mobile deployment of the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™ within facility security command posts or during temporary deployment for a variety of RF monitoring related applications in a protective role for executive residences, hotel rooms or meeting and conference facilities.

Laptop and tablet computers are an excellent choice for travel related deployment as the entire system can easily be carried in a standard carry-on laptop bag.

In-fact, an entire dual receiver, Signals Intelligence Support System (SISS) ™ can easily be packed to meet airline travel weight and size limitations for carry-on luggage in a standard laptop computer bag, with lots of room to spare for accessories.

Dynamic Range

The | Dynamic Range | of a receiver or spectrum analyzer is the ratio of the highest signal level to the lowest signal level, usually equal to the | Ambient Noise Floor (ANF) | that the search receiver or analyzer can effectively process and display as a signal event, expressed in (dBm).

Modern TSCM | SIGINT resources must display good dynamic range to handle the many high-power signals and still detect and display weak signals in the presence of the strong adjacent signals within the displayed Range of Interest (ROI).

The fact is that the high-end range is a factor of input overload and the low end is a factor of sensitivity.

Spurious Free Dynamic Range (SFDR)

The | Spurious Free Dynamic Range (SFDR) | is the frequency spectrum of interest (Dynamic Range), free from unwanted fundamental frequency anomalies, components, or other mixing artefacts present across all super-heterodyne receivers.

The SFDR is the relationship between the amplitude of the fundamental frequency and the amplitude of the most prominent harmonic event.

Basically, the dynamic range is the relationship and ability of the receiver to display the strongest signal and weakest signal for operator interpretation.

Due to noise and non-linear elements of various components, all transmitter and receiver local oscillators, particularly in near-field applications, will generate what can be described as undesirable frequency artefacts at harmonic and spurious levels of the fundamental frequency of interest.

The dynamic range between the fundamental frequency and the strongest amplitude spur is referred to as the Spurious-Free Dynamic Range (SFDR).

The SFDR is the measure of the ratio between the fundamental frequency of interest and the largest harmonic, or non-harmonic related spur.

In modern wide band radio applications, it is not uncommon for the technical operator to realize an Ambient Noise Floor (ANF), typically in the (-90 dBm to -105 dBm) range, with various modern SDR hardware.

However, as new generations of industry disruptive SDR radios achieve lower and lower noise floors (-110 dBm down to -160 dBm), these spurious artifacts become more pronounced, as the noise floor is lowered, exposing more undesirable spurious components that previously were simply not visible.

There is a trade-off between the benefits of a lower noise floor and spurious artifacts and when the technical operator learns to interpret spurious response, the benefit of a lower noise floor will be better appreciated.

Unfortunately, there are many RF products utilized within a TSCM role that mask the spurious artifacts by means of a calibration table or other spectrum leveling tricks, which in-turn can prevent adequate signal detection.

It is therefore important the technical operator be presented with a true spectrum and not just a spectrum that looks good.

TIP: Look carefully at manufacturer specifications, as the truth lies in as much as what is provided vs what is not provided. The act of not providing measurable specifications is simply a lie by omission.

Understanding (Near-Field) Detection

Technical Surveillance Countermeasures (TSCM) is generally considered to be a "Near-Field" search, detection and collection application and therefore, it is not as critical for the technical operator to utilize an extremely sensitive receiver as is necessary for more distant, so-called “Far-Field” reception of potentially weak Signals of Interest (SOI) in a Signals Intelligence (SIGINT) role.

Likewise, the antenna technology can be simplified and still be extremely effective for the intended purpose.

Obviously, the technical operator needs to carefully look at receiver sensitivity, however, sensitivity is not the single most important issue for “Near-Field” TSCM search, detection and collection related applications.

In-fact, a slightly less sensitive “Near-Field” SDR radio is often required and is ideal for deployment in strong ambient signal environments to help prevent receiver or spectrum analyzer overload, saturating the receiver RF front-end, and associated mixer components such as the ADC circuit, causing gaps in the collection process as might be the case in an RF flooding attack.

When the receiver mixer becomes saturated, the result is a significant increase in the displayed noise, spurious signal levels, inter-modulation, out of band images and there will be an overall increase in the Ambient Noise Floor (ANF) observed.

There will also be a corresponding decrease in the technical operator’s ability to obtain accurate signal levels and bandwidth measurements.

Utilizing a Low Noise Amplifier (LNA) and even a small amount of attenuation can significantly enhance the ability to minimize undesirable effects when working in a strong RF ambient signal environment.

Adjusting the IF Gain (sensitivity) can also have a positive outcome and help to minimize the undesirable spectral characteristics that may be observed during collection and analysis, as will a pre-selector when working wide bandwidths.

TIP: The use of | AUTO | gain and attenuation settings is discouraged for TSCM purposes as the technical operator never knows what the hardware, firmware, or software is doing, or what the actual signals are in these modes. The spectrum warrior takes the time to determine the appropriate settings and not let the equipment resource make hidden changes across the target area that have the ability to weaken the overall effectiveness.

It is always best to set the desired gain and attenuation levels manually and utilize consistent settings across the assignment.

The concept of radio sensitivity also applies to the type and resonant characteristics (design range) of the antenna selected for "Near-Field" applications and for basic indoor RF propagation related Direction Finding, as is often the case in Technical Surveillance Countermeasures (TSCM) from a signal detection and emitter source localization perspective.

Most simple design wideband receive only antennas will prove to be extremely effective in the "Near-Field" ambient signal environment common to TSCM deployment and the operator does not need to invest in complex antenna technology.

Portability and simplicity are key to success within a modern moving target threat model.

In reality, more than one (1) wideband antenna will be required to effectively cover the entire extended frequency most modern SIGINT / TSCM based wideband radio and spectrum analyzers.

However, there are a number of considerations that need to be understood, with respect to antenna technology selection, expensive antennas do not necessarily perform better that simple antennas in near-field applications such as TSCM.

A simple paperclip fashioned into an antenna, can outperform an expensive wideband antenna on a number of levels when deployed side by side in a TSCM related application.

The ability to manually or automatically switch antennas associated with various, Ranges of Interest (ROI) is certainly <u>not</u> a requirement across wideband radios, in receive only wide band applications, operating in "Near-Field" given the variations in gain and displayed spectrum, which many manufacturers will average for visual consistency, or make use of calibration tricks to make the spectrum look good.

TIP: Consider the size of the Operator Defined Target Area (ODTA) ™ and the extended Functional Target Area (FTA) ™ region and then determine the Antenna Placement Distance (APD) ™ for the threat level and facility occupancy load and you will be assured of adequate signal detection across the Range of Interest (ROI) as a function of the TSB 2000 (Technical) Standard ™.

Antenna Considerations

There is a requirement to include both Omni-directional and Directional antenna options.

Log-Periodic antennas are technically neither omni-directional or directional, however, it does exhibit both properties and is ideal for TSCM work.

In an omni-directional role the Log-Periodic antenna can be tripod mounted pointing upward to achieve a modified omni-directional capability.

In this configuration there will be nulls off of the edges of the antenna in this configuration, however, they are only negatable in impact and unimportant when working in near-field applications.

The null can actually be useful in nulling out the impact of high-power signals sources such as near by wireless towers and even facility level WIFI access points and cellular pico cell technology.

The Log-periodic antenna option is ideal for both initial signal detection and ultimately the localization of potentially hostile signal sources, or used to verify the directional origin of friendly signals, relative to the Operator Defined Target Area (ODTA) ™.

TIP: It is essential that the technical operator not be fooled by the shape of a log-periodic antenna, as it is not directional subject to the Signal of Interest (SOI) frequency being received, which can be more sensitive, not at the antenna point, but rather further down along the antenna elements. In many cases the actual direction an be 15 to 30 degrees off the point of the antenna. The reason the antenna has a point, is strictly due to the engineering design as the tip of the antenna is more sensitive to higher frequencies and the base of the antenna is more sensitive to lower frequencies. Mounting a laser pointer on a log-periodic antenna is total nonsense and a warning to prospective buyers to move on to another product.

Most high-quality broadband sectional whips are effective in the upper HF and across the VHF and UHF frequency bands and may be easily tuned for resonance simply by adjusting the overall length of the antenna for better pin-pointing the emitter once detected and identified, as a Signal of Interest (SOI).

Changing the antenna polarization from vertical to horizontal or anywhere in between can also provide excellent results in improving the overall signal quality during the search, and in a direction-finding role as we never know the antenna position of a hostile transmitter until it is located.

Band specific antennas are not as effective for TSCM applications and should be avoided for the most part in favour of multiple band and wide band receiving antennas, unless the technical operator is interested in a specific frequency, or a very narrow collection Range of Interest (ROI).

Yagi antennas are an example of typically single frequency or narrow range antennas that are generally too bulking for must deployment scenarios unless hunting in the great outdoors over several kilometers.

Many technical operators spend more time selecting a suitable search receiver or spectrum analyzer, and not enough time selecting an adequate antenna system, or do not fully understand the capabilities and limitations of the many antenna designs.

The KestrelPod I ™ (ceiling mount), and the KestrelPod II ™ (portable) Ultra-Wide Band Surveillance Antennas are low cost TSCM optimized antennas with excellent "Near-Field" characteristics.

The Kestrel Log Periodic (KLP) ™ antenna kit provides a single antenna solution for both operator assisted fixed TSCM collection, and for walk-about direction-finding (DF), signal localization and the kit includes a quad shielded RF extension cable, and our Kestrel Vision Antenna (KVA) ™ for common wireless band applications across the 698 MHz to 2700 MHz.

Antenna Couplers | Power Dividers

Combining more than one (1) passive or active antenna elements utilizing a suitable antenna power divider, combiner or coupler can significantly enhance the overall collection process, and can have a positive effect on lowering the overall | Ambient Noise Floor (ANF) | in regions of the spectrum that are normally outside of the engineering design range of a single antenna element.

When a passive antenna coupler is deployed there will be a small insertion loss realized, and often a | Low Noise Amplifier (LNA) | will be utilized to create an active antenna system.

The direct benefit will be a significant improvement in spectral efficiency over a wide operational Range of Interest (ROI).

It is possible to feed multiple search receivers or analyzers utilizing one (1) antenna, and a suitable coupler with multiple output port, or feed a single search receiver or analyzer with multiple antennas.

Port isolation is an important specification to consider when a coupler is utilized to combine multiple antennas.

Understanding Signal Strength | RSSI

There are four (4) commonly utilized units of measurement that represent RF signal strength within a TSCM role, including, mW (milliwatts), dBm (dB milliwatts), RSSI (Receive Signal Strength Indicator) and percentage (%) measurements.

Each of these common measurement standards is directly related to the others, although some are more closely related than others, and some offer more meaningful analytical detail than others.

TSCM related equipment resources will often utilize various combinations of these values to enhance the technical operator's situational awareness and the display type will generally be selected to represent the best possible data display for the intended visual effect or other purpose.

It is generally possible to convert from one (1) unit to another with varying degrees of conversion accuracy and meaning, but it is not always possible in the extreme limits of any given test and measurement range or scenario, and in reality, there is no real TSCM requirement or need to convert signal strength values with any degree of precision, or accuracy.

The technical operator is more focused on detection, identification and localization.

When RF energy is measured in milliwatts (mW), the signal level is the actual amount of energy present at the antenna, not necessarily the radio.

Signal strength does not fade in a linear manner, but rather, inversely as the square of the distance between the transmitter antenna and the radio antenna in a clear Line-of-Sight (LOS) free of all propagation anomalies.

This means that if you are a particular distance from the transmitter antenna and you measure the signal level and then move twice the distance from the transmitter antenna, the signal will decrease by a factor of four (4) times, assuming all the stars align, and polarization is consistent and LOS is achieved.

However, all this is text book theory and not necessarily field producible, based on many typical propagation and other factors, such as reflections, multipath, blocked signals, ground wave effect, and even signal type and power level.

The dBm (dB milliwatts) is a logarithmic measurement of signal strength and dBm values can be directly converted to and from mW values.

Each time the actual mW power level becomes half of the previous level, the dBm measurement goes down by (roughly) 3 dB.

As a general guideline, it is essential to remember that a decrease of 3 dB yields roughly half the original value and, conversely, an increase of 3 dB yields roughly twice the original value.

TIP: Receive Signal Strength Indicator (RSSI) is an electronic circuit that is utilized to measure the strength of an incoming signals level. The basic circuit is designed to receive RF signals and in turn; generate an output equivalent to the received signals strength. The ability of the receiver to pick the weakest of signals is referred to as receiver sensitivity. The higher the receiver sensitivity, the better the receiver's ability will be to detect weak signals. The RSSI circuit measures the signal strength based on the output voltage. If the signal strength is good the output voltage is higher and if the output voltage is lower, the corresponding signal strength indication is also going to be lower.

Inverse Square Law

The | Inverse Square Law | defines how an RF signal would be affected in power by either increasing or decreasing the distance from the transmitter's antenna.

The reality is that the ISL is less relevant in practical terms when working in close to a signal at the room level as is typical in many TSCM applications, so forget the math and follow the signal.

It is essential that the technical operator be aware of, and understand the principles of the ISL by the numbers in an ideal text book signal search sort of way that will likely never happen in a practical sense, with the exception of organized training scenarios.

There are many additional factors including, signal attenuation, reflected power, multi-path effect, ground wave absorption, reflections near the transmitter, reflections near the receiver, blocked direct signals, and polarization, etc., that can affect the technical operator's ability to hear, see, detect and even localize the emitter.

The | Inverse Square Law | will likely have the most dramatic impact, based on the actual distance from the transmitter antenna, and is key to understanding the fine art of near-field signal characterization.

When signal strength measurements are taken at a distance greater than approximately one (1) or two (2) wavelengths from the transmitter, these additional Inverse Square law influences the energy level of the radiated carrier, become relatively insignificant and can generally be ignored, however, this is not always the case and the technical operator needs to be able to identify and resolve any propagation factors that might affect the ability to hear and visualize the Signal of Interest (SOI) and then locate the transmitter in a typically complex real world ambient signal environment.

When a transmitter is radiating a signal at for example 100 mW, it is generally understood that 100 mW is present at the last point in the transmitter circuit before the signal enters the radiating antenna element and the electrical energy becomes a free space radio frequency signal.

The transmitter antenna will often introduce and exhibit some level of gain (or loss) and what is actually measured will be assumed to be the actual power level at the antenna as a result of any exhibited gain (or loss) factors.

Additional RF Applications

Other possible uses of the Kestrel TSCM ® Professional Software include basic RF emanation testing and signal level analytics with the use of appropriate EMC antenna probes, as well as a wide range of Remote Spectrum Surveillance and Monitoring (RSSM) ™ assignments, basic interference detection and analysis, radio direction-finding applications, spectrum review and utilization verification, channel occupancy analysis, traffic analysis, spectrum event logging, transmitter output monitoring and testing, occupied channel utilization, and many other scientific and educational purposes.

Remote spectrum surveillance and monitoring (RSSM) ™ is fully supported utilizing Remote Desktop Software (RDS).

TIP: Signal Hound ™ receivers are delivered with an excellent spectrum analyzer software application. The Spike software when utilized in conjunction with the Kestrel TSCM ® Professional Software represents a powerful TSCM | SIGINT platform. The Kestrel TSCM ® Professional Software is a separate and independently developed in Canada application that is designed specifically for the Technical Surveillance Countermeasures (TSCM) function and includes advanced features and functionality.

A Software Defined Radio (SDR) receiver, and a suitable PC, or laptop computer loaded with the Kestrel TSCM ® Professional Software eliminates the need for carrying bulky and obsolete analog spectrum analyzers into the target area and facilitates ease of transport during travel related deployment, all but eliminating most travel security related concerns.

The ability to carry the system as a simple computer peripheral that qualifies as a standard airline carry-on item alongside a PC based laptop or tablet computer, provides security, and a low-profile travel Rapid Deployment Kit (RDK).

The Kestrel TSCM ® Professional Software makes it possible to travel with one (1), or more advanced Software Defined Radio (SDR) standalone radios, providing a dedicated and extremely powerful dual receiver Technical Surveillance Countermeasures (TSCM) specific, RF spectrum analysis tool kit.

The Kestrel TSCM ® Professional Software consists of a straight forward, easy to setup and navigate, User Interface (UI) that offers considerable flexibility for the professional Technical Security Specialist (TSS) ™ [1] as to how the system is deployed during mission critical scenarios and can be utilized at any given operational threat level within a modern moving target threat model environment.

The combination of a technologically advanced Software Defined Radio (SDR) receiver, Kestrel TSCM ® Professional Software application, and a Technical Security Branch (TSB) certified, well trained and experienced Technical Security Specialist (TSS) ™, are powerful tools and skill sets that contribute significantly to the timely detection, identification, location and neutralization of the vast array of highly sophisticated and constantly developing (RF) technological threats.

[1] A TSB (Certified) Technical Security Specialist (TSS) ™ is a graduate in good standing of the Professional Development TSCM Group Inc., Technical Security Branch (TSB) 14-Day resident based Technical Security Specialist (TSS) Designate Certification program. Certification is based on the TSB 2000 (Technical) Standard ™ and the TSCM Operational Standard - Policy and Procedure Guideline (OS-PPG) ™.

Measurement | RF Reference

There are many complex measurement units directly and indirectly associated with RF spectrum analysis and electronics in general.

Common Values | Reference Chart					
Prefix	**Symbol**	**Value**	**Prefix**	**Symbol**	**Value**
Tera	T	10^{12}	**pico**	p	10^{-12}
Giga	G	10^{9}	**nano**	n	10^{-9}
Mega	M	10^{6}	**micro**	u	10^{-6}
kilo	k	10^{3}	**milli**	m	10^{-3}

RF Values Reference Chart | v1.40xx

Software Customization

If the end-user requires a specific software-based feature or functionality for deployment as a technical operator, our Technical Research and Standards Group (TRSG) ™ and Software Development Group (SDG) ™ may be able to assist in the development and implementation of the appropriate software level integration.

Our Software Development Group (SDG) ™ at Professional Development TSCM Group Inc., can develop and implement a customized add-on feature based on the end-users specific technical specifications at a very reasonable development cost.

Our Software Development Group (SDG) ™ will expertly design, craft, implement, and integrate your custom feature seamlessly into the Kestrel TSCM ® Professional Software application and provide the appropriate level of supporting documentation, technical support, backward compatibility, and optional technical operator certification training.

The customization process begins by submitting an outline of the feature or functionality desired, along with a detailed technical description of the desired operation and functionality to our Technical Support Group (TSG) ™ at support@pdtg.ca for initial evaluation and review.

Professional Development TSCM Group Inc., will provide a firm costing of the proposed functionality, based on a projected (hourly development rate) and the anticipated development timeline required to schedule and complete the custom project.

The development project will only be accepted for implementation if it is 100% possible and within the supported search receiver or spectrum analyzer capability, so there is no financial risk involved for the end-user.

The project, feature or functionality will only be considered by the Technical Security Branch (TSB) ™, providing the implementation of the feature or functionality does not violate any laws with respect to the intercept, reception and / or processing of radio communication signals, resources for authorized entities are exempt.

TIP: Exemptions may apply for authorized end-users under the Radio Telecommunication Act, Federal Statues of Canada as well as other relevant Canadian and international law. Custom features outside of COTS capability are not included in the commercial version of the software.

Telecommunications Act (1993)

The Canadian Telecommunications Act (1993) identifies the significance of telecommunications in maintaining Canada's identity and sovereignty.

It defines telecommunications as "the emission, transmission or reception of intelligence by any wire, cable, radio, optical or other electromagnetic system, or by any similar technical system."

It is essential that the technical operator be familiar with the various laws effecting the interception, processing, and dissemination of RF communication related signals.

Although, domestic and international law varies, the capture and decoding of digital signals, may be a violation of law.

TIP: Professional Development TSCM Group Inc. offers a full range of advanced Technical Security Specialist (TSS) ™ Designate Certification program and product specific training for the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™, and equipment resources from most other manufacturers worldwide.

Legal Notice

The Kestrel TSCM ® Professional Software is an advanced, commercially available, professional level TSCM | SIGINT specific software application that is actively deployed by technical operators or TSB certified, Technical Security Specialists (TSS) ™, corporate security entities, law enforcement, government, security apparatus, military entities, and others worldwide, who are tasked with a wide range of technical security related responsibilities at the national security level.

The Kestrel TSCM ® Professional Software contains a variety of specialized features and functionality that are essential to the professional technical operator but have the potential to be utilized by person's unknown, for questionable or even illegal purposes.

It is solely the responsibility of the end-user entity, or technical operator to deploy the Kestrel TSCM ® Professional Software in a legal manner that is in full compliance with the laws and regulations of the country, or geographical region of intended operational deployment that might vary significantly from country to country.

There are a number of features, specifically developed for "authorized" end-user entities only, for specialized deployment situations.

Under no circumstances shall an authorized end-user or entity, in possession of restricted custom software features, sell, loan, or otherwise transfer the software to any third-party without the express written consent of Professional Development TSCM Group Inc., under the strict terms of the End-User License Agreement (EULA), or other applicable laws.

These are restricted features that do not appear within the COTS software version and generally require additional licensing and an End-User Certificate (EUC), with specific provisions and compliance verification.

It is strongly recommended that the technical operator seek the appropriate legal counsel and fully understand the laws governing the interception, monitoring, processing, decoding and recording wireless signals, prior to deploying the software in countries where it might be illegal to do so.

The software can be deployed against a wide range of threats and utilized for unique spectrum challenges and purposes.

It is the end-user's responsibility to determine the appropriateness of the software role for any mission, assignment, or purpose.

RF Propagation | General Characteristics

It is essential that the technical operator fully understand the complexities of indoor and outdoor **RF** signal propagation characteristics.

VHF / UHF / SHF Signals of Interest (SOI) are generally considered to be Line-of-Sight (LOS) transmissions with predictable Near-Field characteristics.

The Signal of Interest (SOI) will always be stronger near the source of the emitter; however, there may be any number of RF Hot Spots encountered due to localized propagation effects.

The apparent rate-of-change in amplitude (RSSI) will increase at a significantly faster rate, the closer the distance to the emitter, based on the Inverse Square Law.

Reflections, blocked signals, multipath, ground effect, absorption, building occupancy and many other propagation factors can affect the technical operator's ability to easily locate the source of the emission and indoor signal propagation can be significantly affected by structural building elements, furnishings; occupancy and infrastructure.

The position of the Technical Surveillance Device (TSD) antenna (Horizontal or Vertical Polarization) is an important factor to consider and the possibility of a highly directional (Horn) or (Directional Patch) antenna pointed away from the target area can make both detection and localization a significant challenge for the technical operator.

Lab research conducted by the Technical Research and Standards Group (TSRG) ™ and the detailed technical analysis of hundreds of the hostile and friendly radio frequency devices, clearly indicate that the antennas found on most typical Technical Surveillance Devices (TSD) are not electrically resonant and will often be installed in a less than optimal configuration or orientation, which in-turn, has significant impact on signal propagation characteristics.

The technical operator cannot locate an emitter by standing in one (1) place and becoming fixated at any one (1) location, or by randomly wandering the target area (except maybe by accident), will not result in the timely localization of a well-placed low power Technical Surveillance Device (TSD).

It is essential that a systematic and methodical approach be taken to move about the target area, adjacent to, above and below the target area, to identify the highest amplitude locations or RF Hot Spots in a three (3) dimensional search pattern.

The ability to deploy advanced geo-location heat mapping technology can help to resolve ambiguity and identify many emitters that otherwise might go undetected or identified.

Fixating on any one (1) point within the target area when an RF Hot Spot is identified, does not mean that is the strongest RSSI level within the target area, nor does it mean that that is the location of the emitter, it is essential that the technical operator carefully review the entire target area before fixating on any particular RF Hot Spot identified.

The technical operator must learn to visualize RF signal propagation characteristics in real-time during search to more efficiently localize the emitter in a timely fashion by understanding the dynamic effect and impact of the target area.

The Kestrel TSCM ® Professional Software includes a powerful RF Visualizer (RFV) ™ that allows the technical operator to visualize RF propagation modeling as part of the optional | Tap Capture Plot (TCP) ™ | and | Dynamic Trace Autonomous Platform (DTAP-GPS) ™ | features.

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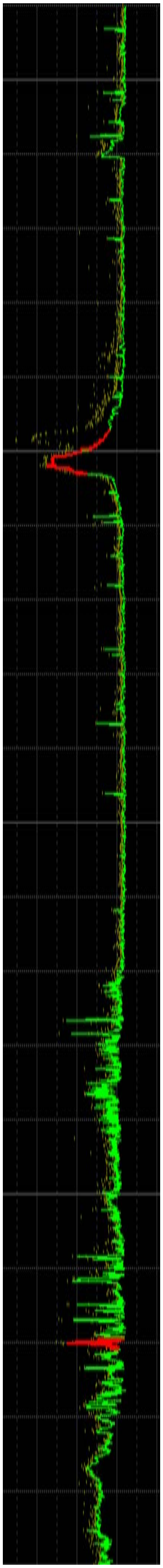
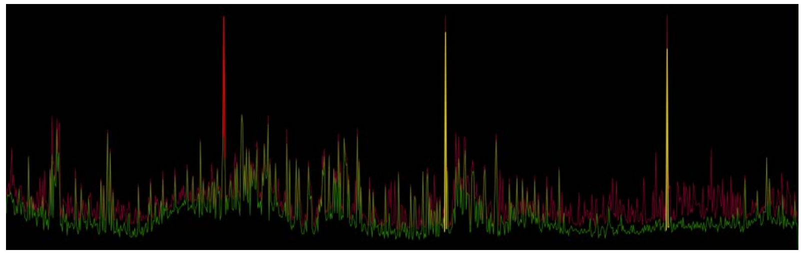


Chapter 2



Software Installation

Innovation is Simply the Beginning...

Review and Revision: 2020-04-05

Software Installation

The Kestrel TSCM ® Professional Software is easy to install on a PC based Laptop, tablet and / or desktop computer with a recommended mid-level gaming performance capability for typical technical security deployment scenarios.

TIP: The key to success in operating the Kestrel TSCM Professional Software for operator assisted and autonomous deployment is to ensure that the host computer hardware is not over-looked as an integral component of the surveillance platform.

System Requirements

The Kestrel TSCM ® Professional Software and drivers for all support SDR receivers are compatible with the Windows 10 (OS) 64 Bit Version.

Depending on the radio specifications, a direct connection to a single dedicated high-speed USB 2.0, USB 3.0, Gigabit LAN, or SFP+ Fiber-Optic port is required on the host computer.

TIP: It is essential to understand that all or most of the actual data is processed by the host computer; not by the search receiver. Therefore; selecting a suitable high-performance host computer is essential to achieving proper operation for use in professional deployment applications.

Kestrel TSCM ® Professional Software

Given the significant processing demands and extensive memory utilization required by the Kestrel TSCM ® Professional Software and associated SDR hardware processes, such as capturing, transferring and processing large project files at high-speeds, on-going file storage requirements and continuous computer processing demands a large capacity SSD storage drive.

A minimum of 16 GB of RAM (32 GB or 64 GB) is recommended and a quad core Intel i7 or higher processor is required for optimal results.

The Kestrel TSCM ® Professional Software is a complex and sophisticated software application that has been specifically designed to take full advantage of quad core processors, such as the Intel i7 ™ (8th | 9th generation).

TIP: It stands to reason that professional TSCM technical operators that tend to push the limits of equipment resources will need to utilize a more powerful portable laptop computer. The Kestrel TSCM ® Professional Software will run on a Tablet computer as a walk-about search tool, however, the RF Spectral Display (RSD) and Waterfall Display (WFD) can be operated for extended periods of time and as such will create large historical data project files and this in-turn, places greater demands on memory utilization, processing resources and storage space. Tablet computers should only be utilized for walk-about RSSI search applications and are not recommended for long-term collection or demodulation scenarios.

The recommended host computer configuration and specifications assume Dual Receiver Operation (DRO) ™ or a single search receiver with a second standby demodulation hand-off receiver.

If you plan on running more than one (1) search receiver or spectrum analyzer as part of the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™, the host computer processor and memory required may need to be increased proportionally from the minimum recommended standard.

Host Computer Configuration

It is strongly recommended that the technical operator configure and disable any power management features and screen savers on the host computer as well as any automatic update applications that might automatically restart the host computer during critical deployment, when a network connection is available.

However, it is absolutely essential the host computer be updated regularly to ensure that the latest drivers and other software components are the most current configurations available.

Utilizing a dedicated host computer with only essential operational programs installed is considered best practice and maximizes the amount of available memory and storage space, and minimizes the potential for unnecessary memory resident programs running in the background.

Default power management features often reduce or terminate power on USB 3.0 port connections when enabled and can affect the operation of the storage drive, display and other system resources required for the uninterrupted operation and communication of the search receiver hardware with the host computer.

Power Management (Recommended Settings)

During the installation process the Kestrel TSCM ® Professional Software installs and configures the advanced power management settings in the Windows 10 OS to reflect the Kestrel Power Profile, which automatically configures the recommended settings.

Unfortunately, some of the Windows 10 updates override the Kestrel Power Profile and reset the settings back to the defaults.

It is recommended that the technical operator review the power profile to ensure the Kestrel Power Profile is enabled.

If it is not, simply run the installer to restore the Kestrel Power Profile settings.

The recommended power management settings can also be manually configured as required.

Our Technical Research and Standards Group (TRSG) ™ have conducted extensive research relating to USB port operation for PC based computers.

There are a number of recommended adjustments that are required to get the best performance from the host computer whether it is a laptop, or desktop system.

The default power management profile can selectively reduce the performance and power consumed by the USB port controller depending on the default settings of the operating system and power management profile.

The following background and recommended actions are strongly recommended in preparation for the use of the Kestrel TSCM ® Professional Software, Multiple Receiver Operation (MRO) ™ and Dual Receiver Operation (DRO) ™ utilizing USB connected search receiver hardware.

When all or some USB ports are being utilized, particularly when running on battery only, the operating system may automatically reduce power and performance resources to one or more other USB ports.

It is essential that the operator disable all power-management features and run the host computer in a high-performance power configuration.

Certain SDR devices will require USB 2.0 (or higher) for proper operation, other SDR hardware will require USB 3.0 ports.

Some older systems might have only USB 2.0 or a mix of USB 2.0 and USB 3.0 ports and are not recommended.

It is also possible that USB ports remain powered after the computer is shut-down to provide a convenient powered port for charging.

It is recommended that such ports not be utilized for the primary connection of high-performance SDR devices, as these ports may prevent power cycling during the initialization process.

The following are examples of recommended power management setting for achieving the best possible performance.

In addition to the following recommended PC power management configuration, certain externally connected devices may require that the Windows power management be disabled at the USB driver level within the Device Manager.

Power Management (Win 10)

Navigate to | WINDOWS SETTINGS | and click on | SYSTEM | POWER and SLEEP | and set the screen to | NEVER | and sleep to | NEVER |.

Next select | Additional Power Settings | and set (or create) the power plan for | HIGH PREFORMANCE | or click on |CHANGE PLAN SETTINGS |.

Please note that later versions of the software automatically create a | Kestrel ® Power Profile |, to make most of the necessary power management changes.

However, not all recommended changes are under control of the installer modifications and may require operator enhancement.

When the plan is to deploy the Kestrel TSCM ® Professional Software for long term collection, set the | TURN OFF THE DISPLAY = NEVER | and | PUT THE COMPUTER TO SLEEP = NEVER |.

Click on the | CHANGE ADVANCED POWER SETTINGS | and compete the following changes as desired for best uninterrupted performance:

Hard Disks

TURN OFF HARD DISK AFTER = NEVER

Sleep

SLEEP AFTER (SETTING = NEVER)

HIBERNATE AFTER (SETTING = NEVER)

USB Settings

USB SELECTIVE SUSPEND SETTING (SETTING = DISABLED)

Processor Power Management

MINIMUM PROCESSOR STATE (ON BATTERY = 100%) (PLUGGED IN = 100%)

Display

TURN OFF DISPLAY AFTER (SETTING = NEVER)

Once all the settings are adjusted, the technical operator must SAVE CAHNGES and EXIT DIALOG window, SAVE CAHNGES and EXIT CONTROL POWER PLAN window.

Device Manager Settings | USB Controllers

It is strongly recommended that the operator regularly check the device management settings for the Universal Serial Bus (USB) drivers.

WINDOWS POWER MANAGEMENT: (UNCHECK) POWER MANAGEMENT

USB HUB DRIVERS: (UNCHECK) POWER MANAGEMENT

SDR HARDWARE SPECIFIC DRIVERS: (UNCHECK) POWER MANAGEMENT

View Hidden Files and Directories

By default, Windows OS hides certain system files and directories that are normally associates with critical operating system functionality.

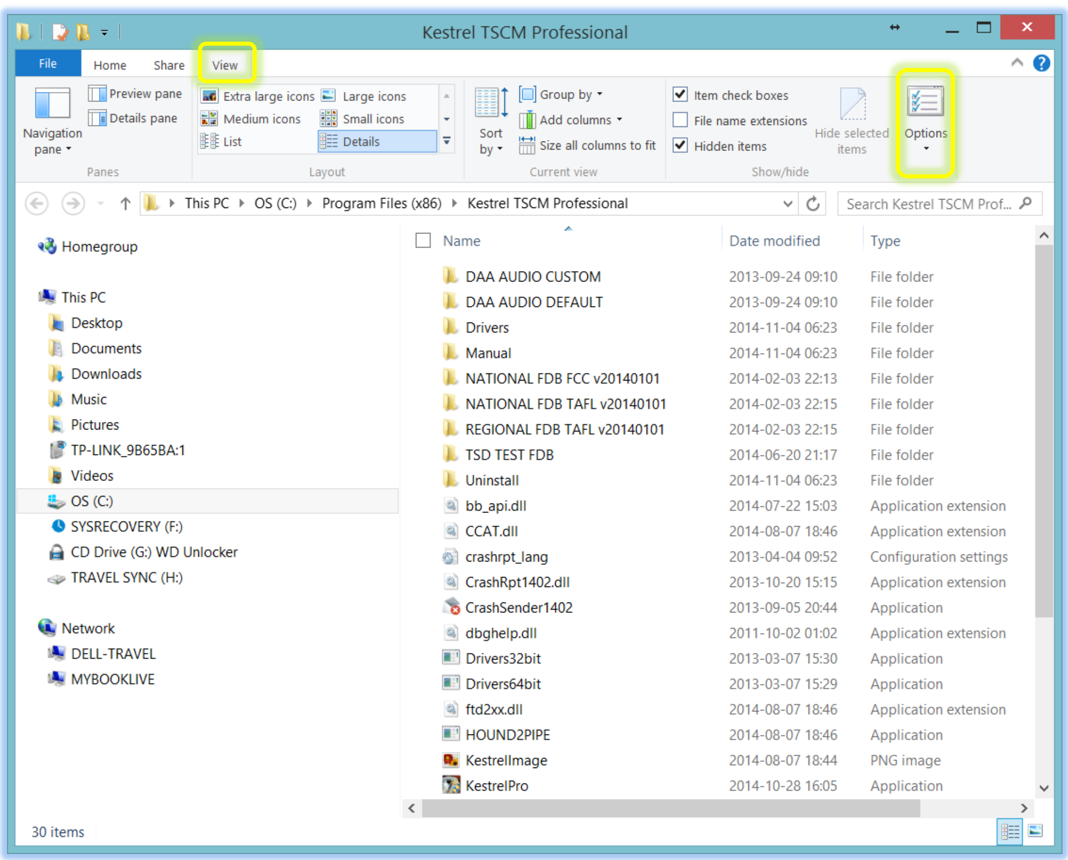
However, some important Kestrel TSCM ® Professional Software application files and directories fall into this category, and are as a result, hidden by default.

These include some of the file extensions associated with the Kestrel ® software and the default DATA and SETTINGS directories, utilized by the application.

It is strongly recommended that the host computer be configured to display hidden files and directories, as well as set to display the file extensions, which again are hidden by the Windows OS default settings.

Open windows file explorer in a new window.

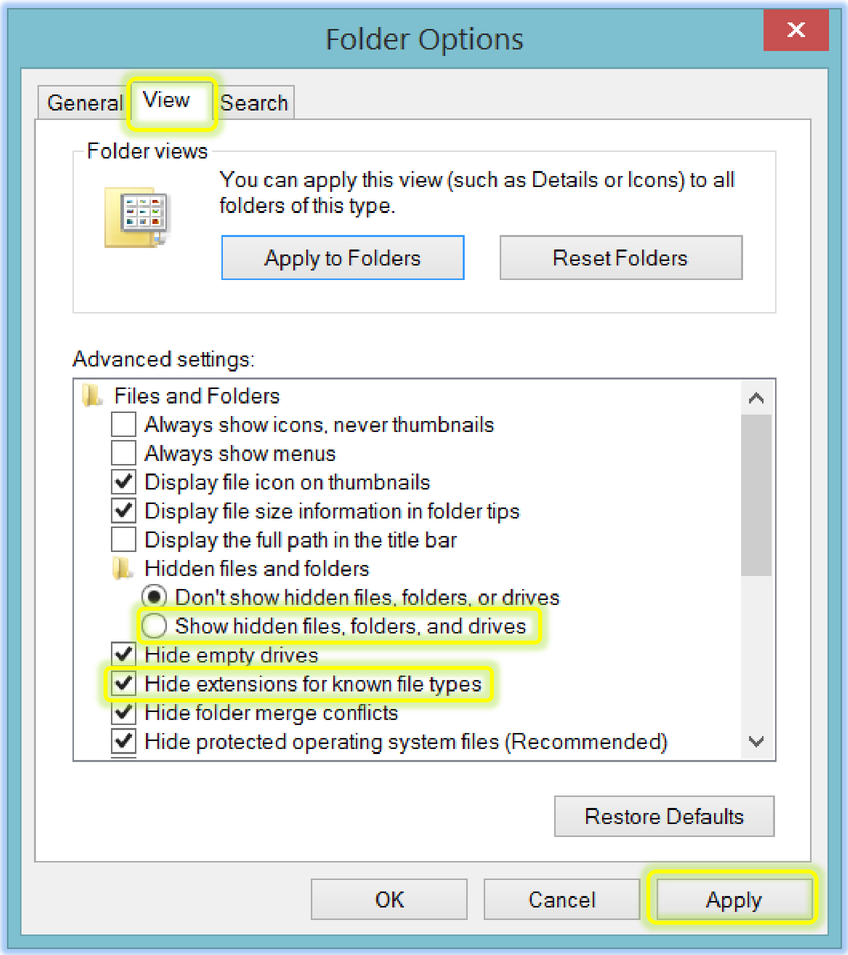
Select the | VIEW | tab from the menu tool bar.



Windows File Explorer | v1.40xx

Next select the | OPTIONS | menu to display the | FOLDER OPTIONS | dialog window.

Select the | VIEW | tab to view the default settings.



Windows Folder Options | v1.39xx

Next, select the | SHOW HIDDEN FILES, FOLDERS, OR DRIVES | option, and uncheck the | HIDE EXTENSIONS FOR KNOWN FILE TYPES | press the |APPLY | and | OK | buttons.

You will now be able to view and create individual desktop shortcuts to the Kestrel | DATA | and | SETTINGS | directories.

DATA DIRECTORY | C:\Users\Paul D Turner\AppData\Roaming\PDTG\data

SETTINGS DIRECTORY | C:\Users\Paul D Turner\AppData\Roaming\PDTG\settings

Restart Computer

In addition to the above, it is strongly recommended that any active screen saver program be disabled.

It is strongly recommended that the technical operator first install and verify correct operation of the manufacturer's software, prior to installing the Kestrel TSCM ® Professional Software.

This allows the technical operator to verify that the USB port drivers are properly installed.

TIP: It is recommended that the technical operator first install the Signal Hound ™ Spike software that is included with the Signal Hound ™ Receiver and verify correct operation of the search receiver hardware, prior to the installation of the Kestrel TSCM ® Professional Software. You must restart the computer before opening the Spike software for the first time after installation. For technical support of the Signal Hound ™ receiver and Spike software, please contact support@signalhound.com directly, for technical support of the Kestrel TSCM ® Professional Software, please contact support@pdtg.ca or visit www.kestreltscm.com for additional technical support and troubleshooting information.

It is strongly recommended that the technical operator ensure that the host computer power supply is connected and powered during operation of the Kestrel TSCM ® Professional Software and USB powered search receivers on portable computers such as laptops.

TIP: It is recommended that the technical operator utilize an RF / EMI Surge Protector to help filter out additional power line related noise. It is also recommended that the technical operator position the Laptops switching power supply as far away from the search receiver and / or antenna as possible to help minimize any undesirable noise artefacts. The use of noise suppression USB certified cables will also help minimize noise related artefacts.

The published battery times for laptop computers will be significantly reduced since the Signal Hound ™ Receiver is directly powered by the host computer.

Various host computer power and energy power management protocols may adversely affect operation, as noted above.

Laptop Computer Reboots

When utilizing the Kestrel TSCM ® Professional Software for extended periods of deployment time, it is essential that the technical operator disable any software updating applications that may automatically reboot the host computer.

This is of particular concern during unattended operation.

TIP: Windows 10 users may have notice that the auto update feature can no longer be disabled. Automatic restarts may be delayed; however, this is a significant problem for network active systems during Remote Spectrum Surveillance and Monitoring (RSSM) deployment.

Applications such as the operating system, anti-virus programs and other periodic program updates can automatically reboot the host computer and interrupt the data collection process.

If reboots occur during the "auto save" process, the project file may be corrupted as a result and even if the computer reboots successfully, the established sweep session and any unsaved data may be lost.

Generally, only the last minute of data will be affected, however, this totally depends the timing of the unscheduled restart.

For unattended deployment and operation, it is essential to disable all programs that may reboot the computer automatically.

Collected data is automatically saved and the technical operator does not need to save the project file prior to closing the Kestrel TSCM ® Professional Software application.

An easy way to ensure that host computer reboots do not occur during long term deployment is to ensure that no network or Internet connections are active, preventing host computer updates during critical operation.

Kestrel TSCM ® Professional | Installer

The latest release of the Kestrel TSCM ® Professional Software is always available from the | Technical Support Group (TSG) ™ Resource Centre | website for authorized technical operators.

The Kestrel TSCM ® Professional Software installation file is delivered as a standard Windows ™ based (.EXE) installer.

Software Installation Procedure

You must follow the next steps precisely to successfully prepare and install the Kestrel TSCM ® Professional Software on your computer.

Host Computer

The role and importance of the host computer specifications must not be under-estimated when the Kestrel TSCM ® Professional Software is utilized for professional applications, including long term unattended deployment and managed Remote Spectrum Surveillance and Monitoring (RSSM) ™.

The host computer makes all the difference in the technical operator's ability to collect, process and view, large project files from both a storage and operator Live View Analysis (LVA) ™ point of view.

The Kestrel TSCM ® Professional Software places moderate demands on the host computer and it is essential that the technical operator ensure that the host computer hardware meets the minimum specifications and is up to the task of the specific demands that the technical operator plans to place on the system.

Preparing the Host Computer

The Kestrel TSCM ® Professional Software is a cutting edge and technologically sophisticated software application that relies on the processing ability of a suitable mid-range gaming computer.

It is strongly recommended that the following steps be implemented prior to the installation and activation the Kestrel TSCM ® Professional Software application on the host computer.

It is our experience that many computer users rarely update their systems with what can be described as almost daily patches, fixes, updates and new versions of sometimes critical software and maintenance utilities.

Regardless of the current host computer automatic update settings, it is essential that the host computer operating system and productivity software be updated to the most currently available versions.

Running the Microsoft ™ update tool is a simple process and will quite often suggest optional updates that do not necessarily automatically install even when the computer is set to accept automatic updates.

As we strongly recommend (best practice) that all automatic update functionality be disabled when the Kestrel TSCM ® Professional Software is to be actively deployed in unattended long-term collection role, or when a network connection is active for monitoring purposes, it is critical that the technical operator periodically manually update the operating system and any productivity software.

Complete a general clean-up and update of critical operating system and productivity programs prior to installing the Kestrel TSCM ® Professional Software application.

Once the host computer is updated, the following steps will ensure that the software is correctly installed on the host computer.

Please note that the actual installation process may differ depending on the actual operating system platform utilized.

The following installation instructions assume that the Windows Operating System (OS) is utilized (recommended).

There may be differences in the installation process for various operating systems.

It is strongly recommended that the technical operator first install any receiver or analyzer software and confirm that the hardware is functioning correctly with the software, as this verifies that the drivers are properly installed.

Please ensure that an active Internet connection is present during the installation process, but do not connect the receiver until after the software is successfully installed and the computer has been restarted, as driver installation can take several minutes to install the first time they are connected.

Kestrel TSCM ® Professional Installer

After successfully rebooting the host computer and verifying that the radio is functioning correctly, the technical operator is ready to install the Kestrel TSCM ® Professional Software application on the host computer.

Warning: Do not run the installer from removable media.

Always download and run the installer from the desktop local storage media.

Step 1

The first step is to fully uninstall any previous versions of the Kestrel TSCM ® Professional Software from the host computer.

Close all other applications and any unsaved files that are currently open on your desktop, and ensure that all search receivers are disconnected from the host computer.

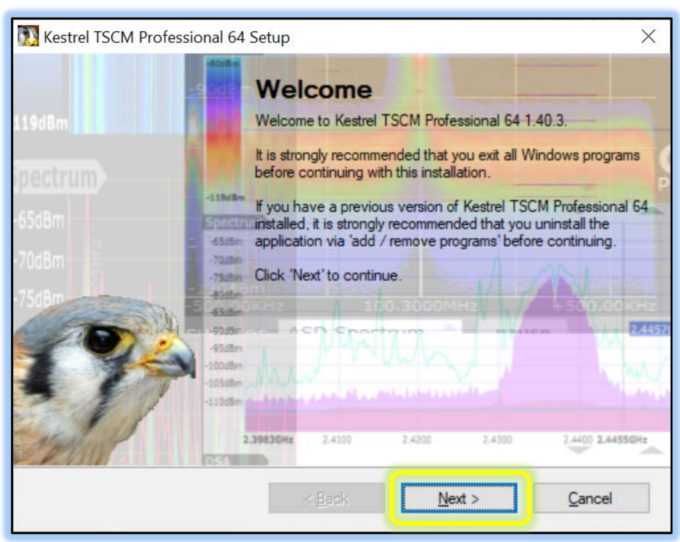
Double click on the (.exe) installer program and follow the on-screen prompts to successfully install the Kestrel TSCM ® Professional Software and pay particular attention to the End-User Licence Agreement (EULA), as you have a legal obligation to agree to all provisions of the EULA without exception or modification.

The installer will take less than a minute to complete the installation of the Kestrel TSCM ® Professional Software application and all associated support drivers and when you are prompted to do so, click on | Finish | to complete the installation process and restart the host computer.

TIP: It is recommended that you restart the target computer to complete the installation process of any hardware related software and drivers prior to running the Kestrel TSCM ® Professional Software installer, and again once the Kestrel TSCM ® Professional Software has completed the installation process.

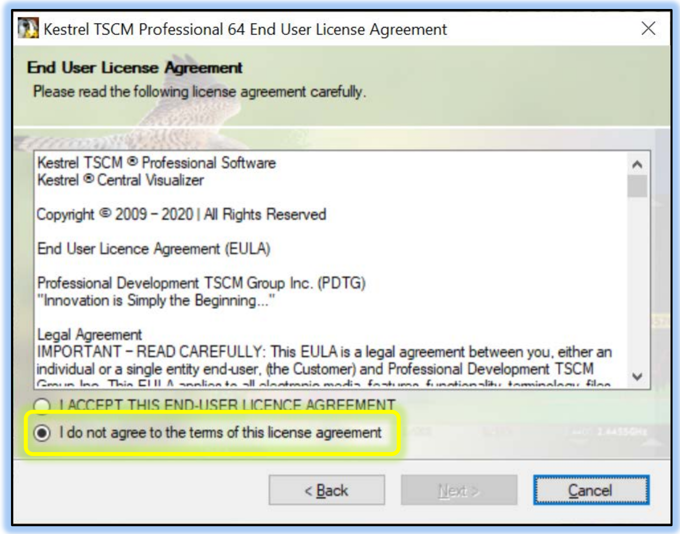
Installation Progress | 64-Bit

The following images illustrate the typical installation progress through the various installer dialog windows.



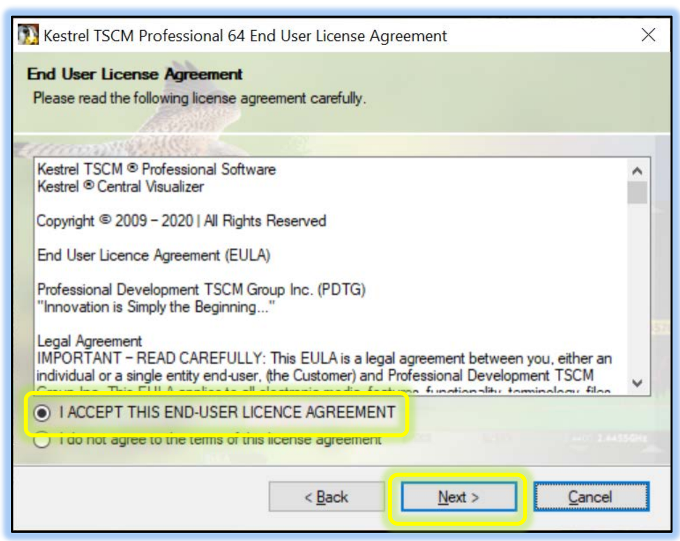
Welcome | v1.40xx

When ready to begin, press NEXT to continue.



EULA | v1.40xx

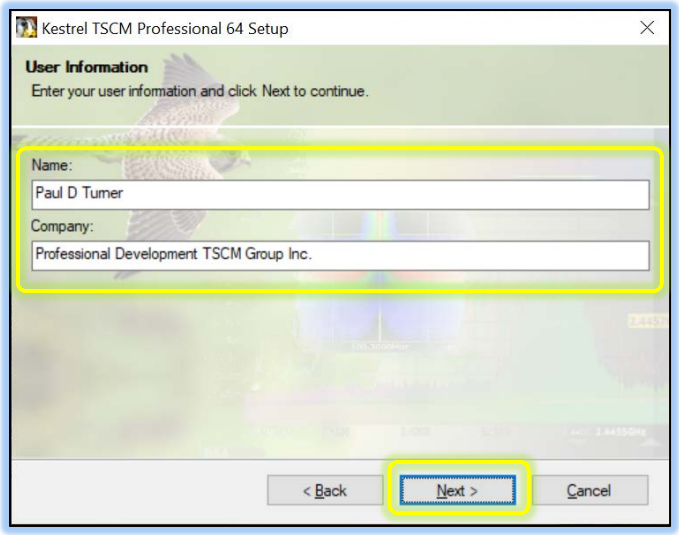
Carefully read and click on the | I Accept this End User License Agreement (EULA) | check box.



EULA | v1.40xx

If you agree to all provisions of the EULA without modification select, I ACCEPT THIS END-USER LICENCE AGREEMENT.

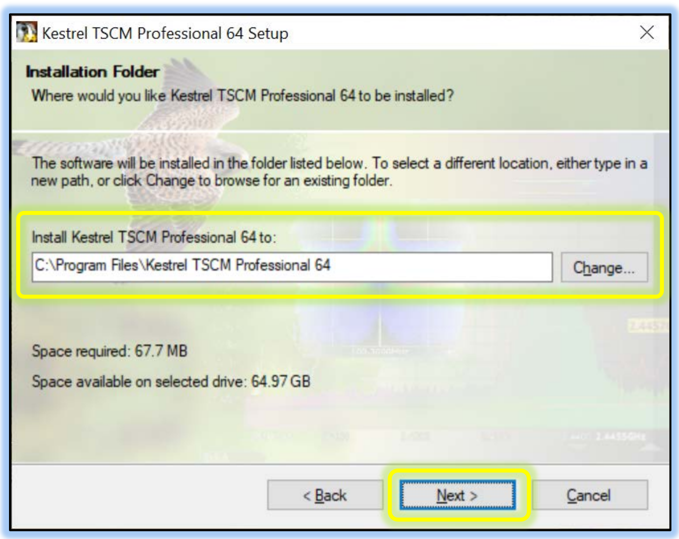
When you are ready to proceed, press NEXT to continue.



User Information | v1.40xx

Enter a name (mandatory field) reference and company (optional field), if applicable.

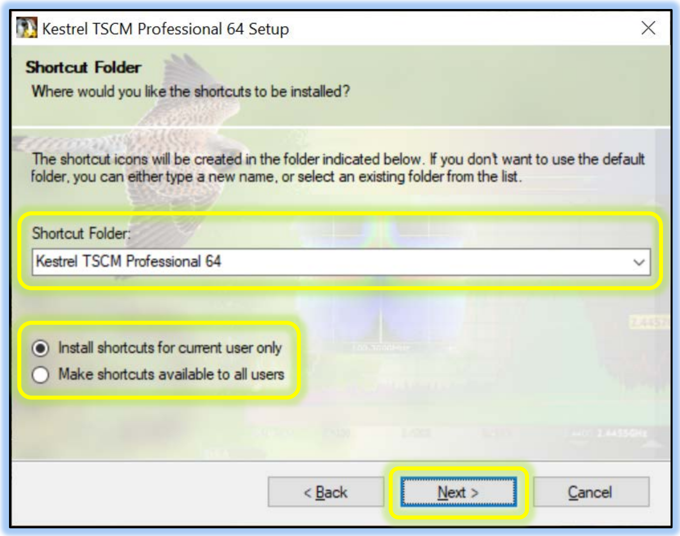
When you are ready to proceed, press NEXT to continue.



Default Installation Directory | v1.40xx

It is recommended that the default installation directory be utilized without modification.

Press the NEXT button when you are ready to continue.

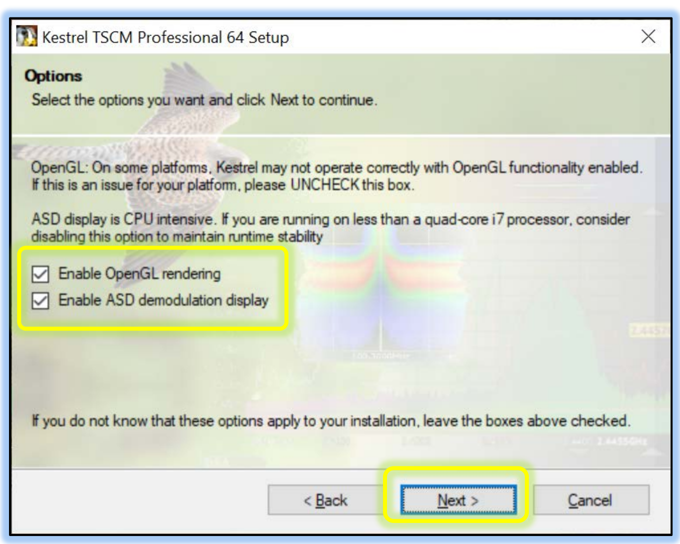


Shortcut Folder | v1.40xx

Accept or edit the Shortcut Folder name and select whether the installation should be available only to the current user or all users on the computer.

For security reasons, it is recommended that the program only be made available to the current user, unless separate users share use of the application with separate login credentials. Separate Activation Security Keys (ASK) ™ are required for each user.

When you are ready to continue, press the NEXT button.



OpenGL | ASD Display | v1.40xx

Not all host computers support OpenGL graphics rendering and some computers may support OpenGL, but lack the systems resources to advantage the capability.

It is recommended that all operators ensure that the host computers video drivers are up to date.

It is strongly recommended that drivers be updated directly using the following website resource.

https://www.intel.com/content/www/us/en/support/intel-driver-support-assistant.html

When Kestrel ® is installed on a computer without OpenGL support, the symptoms may include graphics rendering that will be distorted or not displayed as expected, if OpenGL is supported, but the system lacks the system resources or performance, operation may be impaired, particularly, with the Demodulation Visualizer active.

The best advice is to properly configure the host computer prior to installing Kestrel ® and try different installation parameters and combinations of OpenGL and the | Audio Spectral Density (ASD) | installation features, if difficulties are encountered.

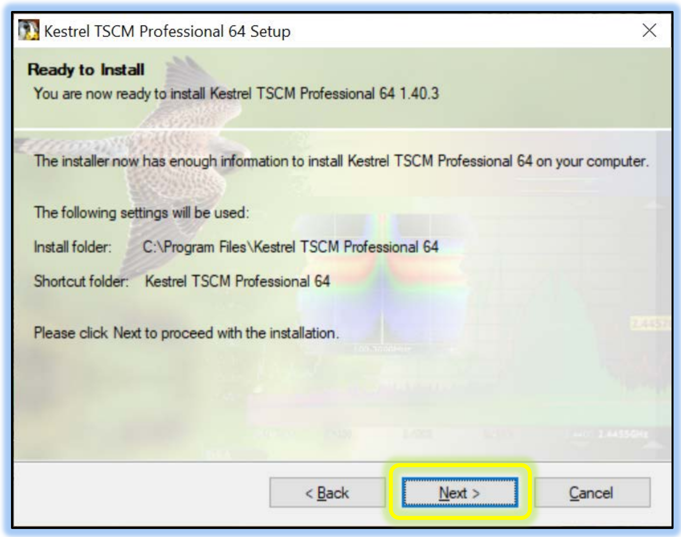
Leave the OpenGL option checked, unless otherwise required for correct operation.

If the above described symptoms exist after default installation, simply run the installer a second time with the OpenGL option unchecked.

Computers that do not have an Intel Quad-Core i7 HQ (or higher) Processor, may not have the system resources to process the FFT intensive, Audio Spectral Density (ASD) display, and audio demodulation integrity.

If this is determined to be an issue for the computer, simply run the installer with the ASD Demodulation Display option unchecked.

Leave this option checked, unless otherwise required for correct operation.

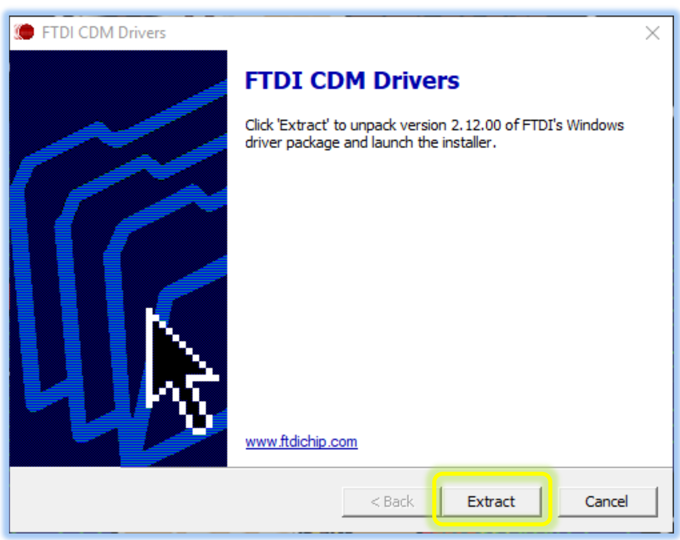


Installation Summary | v1.40xx

The installation process should now have all the information required to complete the installation.

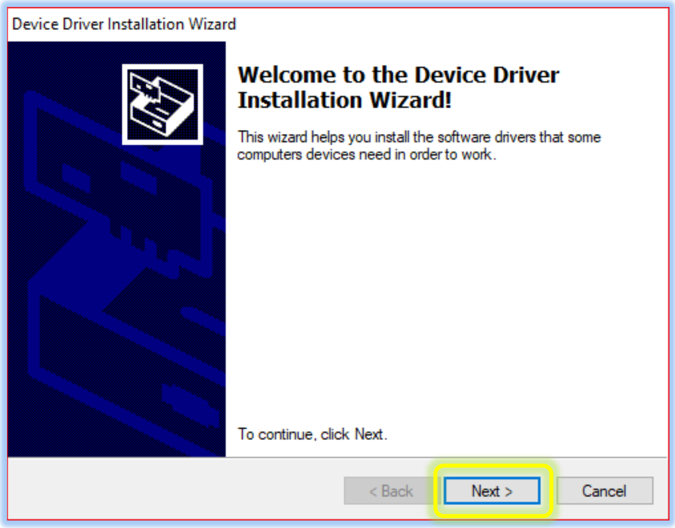
Confirm that all the displayed details are correct before pressing the | NEXT | button to complete the installation process.

The installer will also install the latest USB 3.0 drivers, even if the drivers are already found on the machine during the installation process.



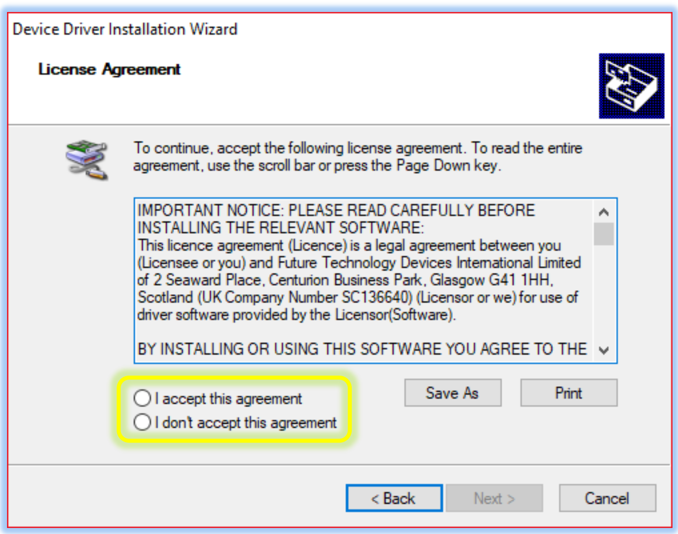
FTDI CDM Driver Package | v1.40xx

The driver package will extract during the installation process.

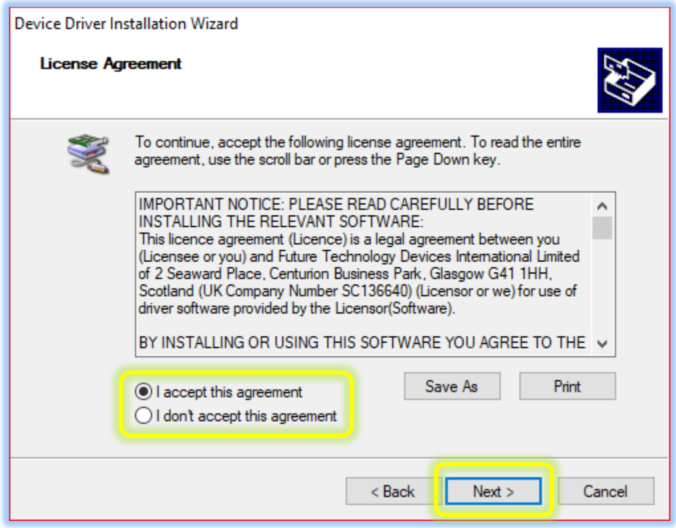


FTDI CDM Driver | v1.40xx

Press next to initiate the FTDI CDM installation process.

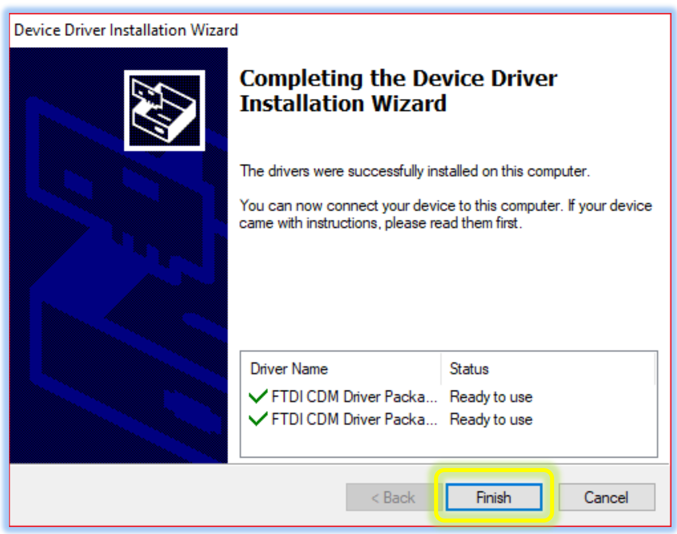


FTDI CDM Driver Agreement | v1.40xx



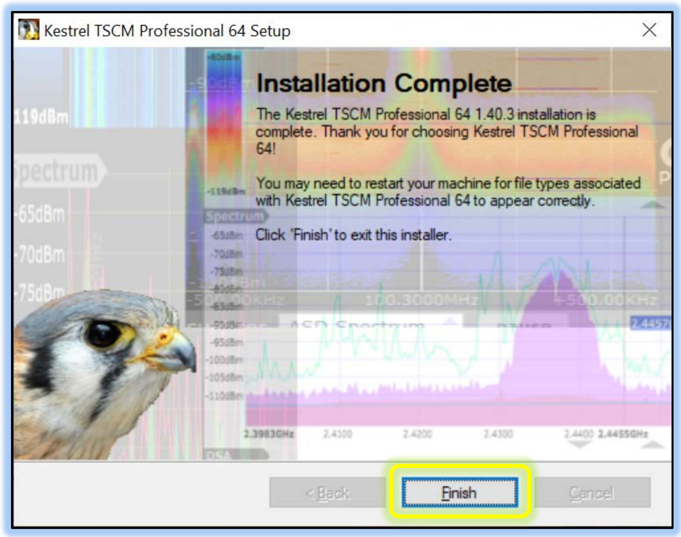
FTDI CDM Driver Agreement | v1.40xx

The installer process will complete the driver installation and display the installation result.



FTDI CDM Driver Ready | v1.40xx

Once the driver package has installed the application installation complete window will appear confirming the process has completed successfully.



Installation Complete | v1.40xx

The software installation is now complete.

Press the | FINISH | button to close the installer program.

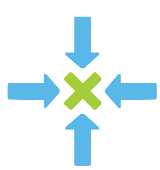
It is strongly recommended that you reboot the host computer to complete the installation of the drivers and to establish file associations.

The SDR hardware can now be connected to complete the process.

Beta (Drop-In) Files

Between official full installer releases, there may be a number of Beta drop-in (.EXE) files, to resolve discovered bugs, application instability, or to add a new feature prior to the next scheduled full release installer.

These files can be downloaded from the Technical Support Group (TSG) Resource Centre website, along with the latest full installer release.



TIP: To utilize the Beta release updates, when available as a Drop-In (EXE) file, you MUST have the most current full installer application running on your system.

If you wish to take advantage of the Drop-In (.EXE) Beta release (recommended), it is important to understand the intent and purpose, as well as the proper drop-in installation method and desktop shortcut setup method.

The first step is to download the Beta file from the TSG, which is co-located with the latest full installer application.

Next, unzip the file and place it in the default Kestrel ® installation directory.

C:\Program Files \ Kestrel TSCM Professional 64.

Within this directory, navigate to the (.EXE) file.

You will note that there will be a file named KestrelPro.exe, this is the current release of the full installer running on your system and will still be available for use from the desktop shortcut.

The Beta (.EXE) file, might be called KestrelPro_1.40-56DEV.exe for example.

Use a right mouse click on the file and navigate to | SEND TO | DESKTOP CREATE SHORTCUT | to send a shortcut ICON to the desktop.

You can rename the desktop shortcut to represent the new Beta release.

You will now have two (2) desktop shortcuts representing the latest full installer application and the Beta release and either version can be run on the system.

Critical Driver Installation Tasks

Installing the Kestrel TSCM ® Professional Software is generally not an issue on most host computer installations.

However, once the host computer has been rebooted following the installation of the software and the technical operator is ready to connect multiple search receivers or analyzers for the first time, it is recommended that an active Internet connection be present.

The Internet connection will permit windows to search for and install USB driver updates, if required.

It is essential that new search receivers be connected one (1) at a time and allowed to complete the USB Port Driver installation, prior to connecting the next additional search receiver or analyzer for the first time.

Connecting multiple search receivers during driver installation is not recommended and may result in unexpected driver installation errors.

The host computer will generally display a message indicating the progress and successful completion of the driver installation process.

Once the driver installation process is successfully completed for each new search receiver or analyzer, the technical operator is advised to reboot the host computer before proceeding to the first run of the software, receiver initialization and activation steps.

Running the Kestrel TSCM ® Professional Software for the first time will initialize all physically connected (found) search receivers and analyzers and provide a table of all found devices.

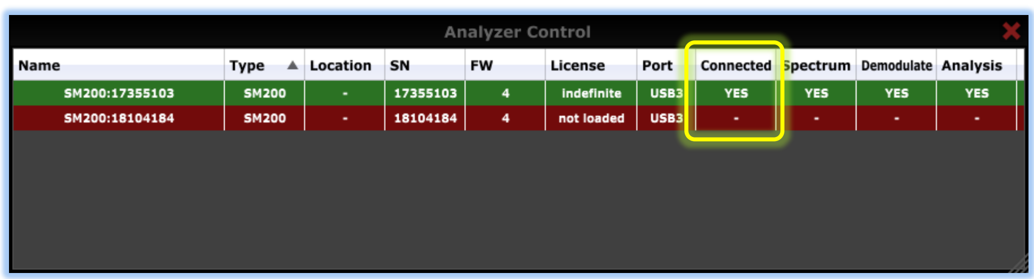
The Analyzer Control window will display along with the UI during the start-up process.

It must also be understood that additional setup for Gigabit LAN SDR devices will be required by adding the TCP/IP address in to the Network Addresses dialog window.

The software needs to be closed and opened to initialize LAN connected hardware for the first run.

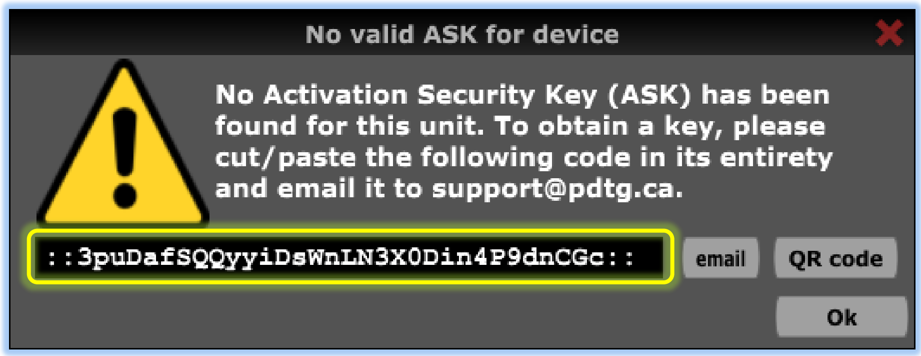
Assuming that no valid Activation Security Key (ASK) is found for one (1) or more search receivers or analyzers, devices will display with a RED background indicating they are present, but not connected.

The image below illustrates that Two (2) radios were detected during the initialization process, with one (1) receiver without an Activation Security Keys (ASK) present.



Analyzer Control | v1.40xx

Clicking on the “Connected” tab for the unlicensed radio, results in the display of the “No Valid ASK for Device” dialog window illustrated below.



Challenge and Response Code | v1.40xx

Processing the ASK request for each new radio will be required prior to using the hardware with the software for the first time.

Firmware Version Warning

During the receiver initialization process, the software verifies and displays the current firmware version installed on each receiver or analyzer.

When the firmware is found to be current, no message dialog window will appear during the initialization process and the receiver firmware version will display within the | ANALYZER CONTROL | dialog window as a reference.

The following | Firmware Version Warning | dialog window will display if the receiver or analyzer's firmware is out of date.

This applies only to the Signal Hound BB60C Spectrum Analyzer and RF Recorder.

It is strongly recommended that the technical operator visit the manufacturer's website to download and install the current firmware.

Please note that the device may need to be returned to the manufacturer for factory updates.

Firmware Warning | v1.40xx

Activation Security Key (ASK)

During the first run of each connected search receiver, you will be required to request from the Technical Support Group (TSG) ™ a valid | Activation Security Key (ASK) ™ |, based on a Challenge and Response Code (CRC) ™ provided to the TSG ™ by the end-user.

The ASK ™ will be emailed to the address provided within the original request as sent to support@pdtg.ca once received, authenticated and processed.

Each individual search receiver or analyzer must be properly licensed for use with the Kestrel TSCM ® Professional Software.

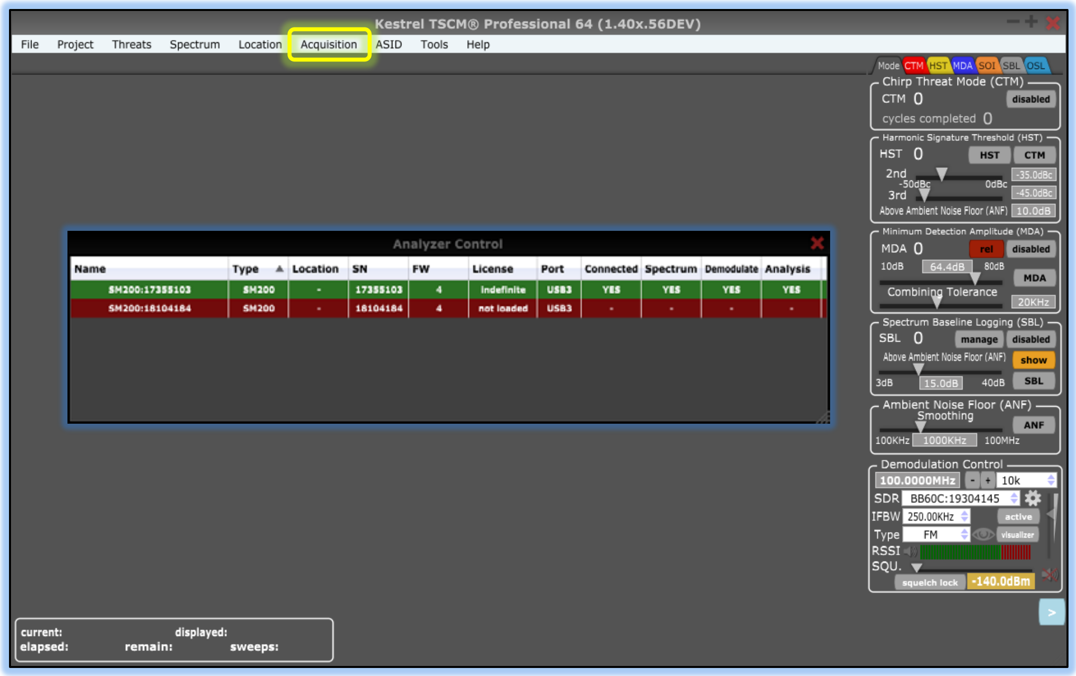
Each software license purchased supports and is permitted to utilize two (2) supported radios for Dual Receiver Operation (DRO) ™.

Connect one (1) or more supported search receivers or analyzers to the host computer and start the application.

When the application is started for the first time, the User-Interface (UI) and the spectrum work space is displayed along with the | ANALYZER CONTROL | dialog window.

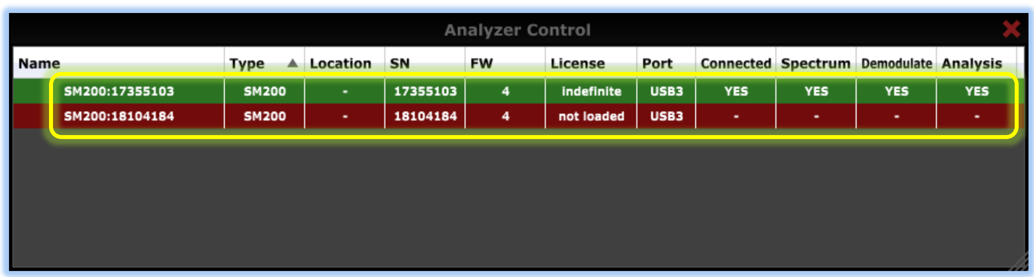
It is also possible to access the Analyzer Control at any time on the main toolbar menu by selecting |ACQUISITION | ANALYZER CONTROL | to display an active list of search receivers and analyzers, and the status and settings that have been detected and identified during the application start-up and initialization process.

Always review and confirm the hardware settings in the | Analyzer Control |during setup as an important first step in programming the software, and assigning receiver control priorities for the intended deployment.



UI Workspace | v1.40

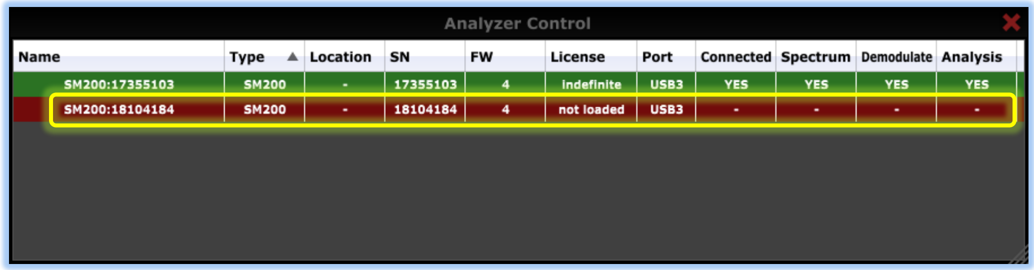
The | ANALYZER CONTROL | dialog window displays the status of each connected search receiver or analyzer detected by the software during the application start up and initialization process.



Analyzer Control Window | v1.40xx

There are a number of SDR radio specific settings that by default need to be adjusted the first-time new hardware is connected, and once set will hold the settings for future deployment until changed by the technical operator.

The following example illustrates two (2) radios detected during the start-up and initialization process, no Activation Security Key (ASK) ™ was found for one (1) of these devices.



Analyzer Control Window | v1.40xx

There are a number of configuration settings that are deployment specific and will need to be reviewed and / or modified for specific collection and radio hand-off requirements each time the software is deployed.

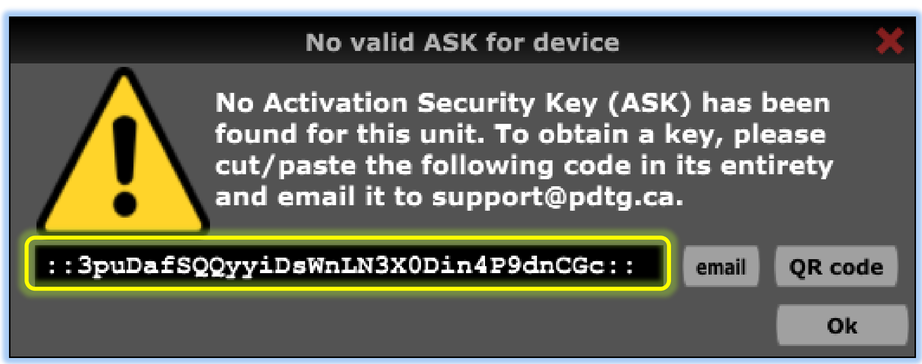
Once the User-Interface (UI) is open, it is recommended that the technical operator immediately review the | ANALYZER CONTROL | window to verify or modify configuration settings, as may be required.

If the connected search receiver or analyzer has already been associated with an Activation Security Key (ASK) ™, the license status will display | CONNECTED | for each properly licensed receiver.

The first time a new search receiver is detected and identified during the application start-up process, the | LICENSE | and | CONNECTED | status boxes will not be populated.

The technical operator utilizes a left mouse click on the | CONNECTED | window for each individual search receiver or analyzer that is not licensed or connected, to display the Challenge and Response (CRC) ™ string dialog window.

In the event that this is the first time that a new search receiver or analyzer is connected, or when a valid | ASK ™ | is not found, or a previously issued | ASK ™ | has expired, been corrupted, the following dialog box will be presented.



Challenge and Response Code | v1.40xx

The | No Valid ASK for Device | warning box will generate an encrypted | Challenge and Response Code (CRC) ™ | that is unique each search receiver or analyzer generated request and the host computer installation.

The system generated CRC string must be submitted to the Technical Support Group (TSG) ™ so that an | Activation Security Key (ASK) ™ | can be generated for each search receiver or analyzer and again for each machine you intend to install the software under the provisions of the End User License Agreement (EULA).

Activation Security Keys (ASK) ™ are not transferable or reusable and can not be sold or provided to any third-party.

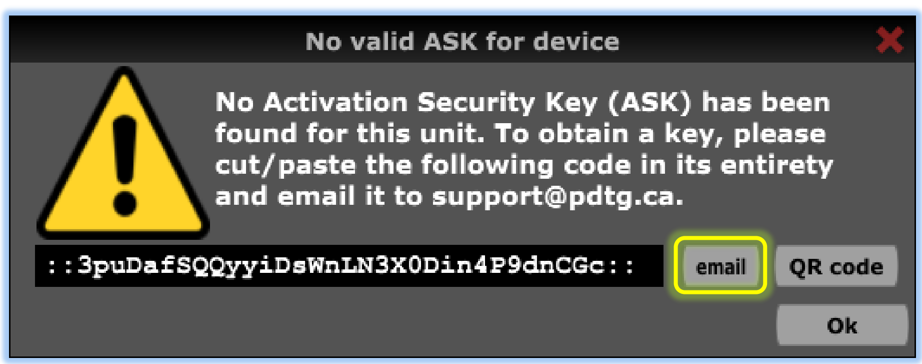
The Kestrel TSCM ® Professional Software | Activation Security Keys (ASK) ™ | are search | HARDWARE | and | HOST COMPUTER | (machine) specific.

The technical operator can email the CRC string directly from the target machine, by pressing the email button, or the CRC string can be "Cut and Paste" directly into a new email message and sent to support@pdtg.ca for processing.

Pressing the | EMAIL | button dynamically populates the host computers default email client (if configured) such as Microsoft Outlook ™, and submits the email to support@pdtg.ca for authentication and a return Activation Security Key (ASK) ™.

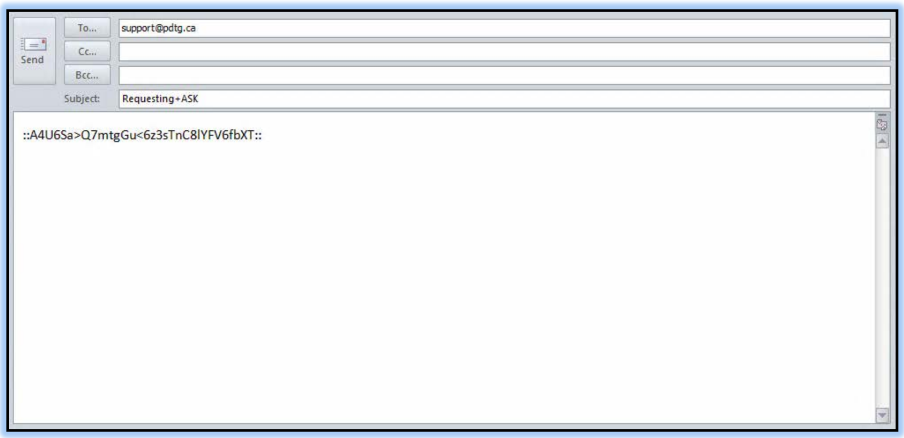
Do not manually type the | Challenge and Response Code (CRC) ™ | into an email, the coding will be corrupted and the Technical Support Group (TSG) ™ will be unable to generate a valid Activation Security Key (ASK) ™ for the host computer installation.

TIP: Do not alter the encrypted Challenge and Response Code (CRC) ™ string in any way, or the TSG ™ will not be able to generate a valid ASK ™ for your specific installation.



Challenge and Response Code | v1.38xx

If the host computer is connected to the Internet, and an email client is configured on the host computer, simply press the email button and the CRC ™ string and TSG ™ email address will be dynamically populated, as illustrated in the following Microsoft Outlook ™ email client example below.



Challenge and Response Code Email | v1.40xx

Sending an email request for a Security Activation Key (ASK) ™ is not an immediate or automated process and requires the manual interpretation and validation by the Technical Support Group (TSG) ™.

All requests received for Security Activation Keys (ASK) ™ will be processed at the earliest opportunity by the Technical Support Group (TSG) ™, but this process can take up to 24 hours, depending on our travel and other operational commitments.

The TSG ™ response to ASK ™ requests, will normally be processed within the same business day that the request is received; however, some exceptions and delays may occur.

Once the CRC ™ string has been "Cut and Paste", or otherwise sent to the Technical Support Group (TSG) ™ by email, press the "OK" button to close the dialog box.

CRC SDR Warning | v1.40xx

A warning dialog window will serve as notice that the attempt to connect to the search receiver or analyzer has failed, since no Activation Security Key (ASK) ™ was found during the initialization process.

The technical operator can now close the Kestrel TSCM ® Professional Software UI and will not be able to utilize the software until the Technical Support Group (TSG) ™ generates an Activation Security Key (ASK) ™ specifically for the hardware and / or the host computer installation.

Please note that the software can still be used to open and view historical Kestrel Project Files (KPF) ™ even without a valid hardware license.

The Technical Support Group (TSG) ™ will return the Activation Security Key (ASK) ™ by reply email, often within a few hours, or the same business day after receiving the email request, in most cases.

Depending on a number of software licensing factors, individual Activation Security Keys (ASK) ™ may be issued for a specific period of time, or may be implemented for specific hardware options, optional software features and functionality, or specific to the host computer installation.

A sophisticated "Key Management" strategy adds an important security layer to the process of preventing unauthorized user access to the Kestrel TSCM ® Professional Software technology when it is to be deployed in potentially hostile working environments.

The TSG ™ will reply by email with the necessary ASK details displayed in the following text-based format for the hardware and any options purchased;

BB60C | 18147092 | AEC ™ | CLP ™ | AMCS ™ | TCP ™ | DTAP-GPS ™ |

License prepared for pdturner@pdtg.ca (Technical Security Branch) at email pdturner@pdtg.ca on 2017-07-03 17:14:01

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::h3PVC7aRztO8UrBA4R2D>QgWOO>h8pBSSnCobogT0xGiod0B3bK6kUJJYFLjJtCgXtn@NmSBcgt Rw1eEnaTF9K3ua>JldXyOFmah648baEvrv7xfGdgGHsWtAiUpJKrCokpoVy>0gb9MZy7udYooXqV NLRufPGOKidjzuh#DBLxr<URLu4uayT5ys2oVkdX43qIos2fpeE>TdGeKUQBp1<w6YnHHij3pArxt4 BpNO?UnX<YjUJrciRB85zsY1ajOA5L::

--

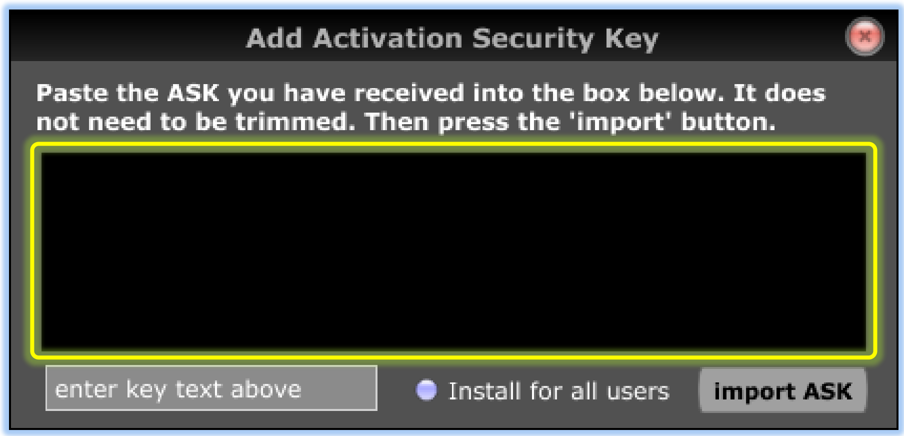
Expires at midnight on 2023-04-06 00:00:01 | or | Indefinite |

To activate a specific radio or analyzer for use with the Kestrel TSCM ® Professional Software, it will be necessary for the technical operator to "Cut and Paste" the entire body of the email message (recommended) exactly as provided by the Technical Support Group (TSG) ™ and as indicated in the example ASK ™ structure above or trim the ASK to include only the actual code string beginning with "::" and ending with "::".

Add "ASK" String

Assuming that the application is currently closed, open the Kestrel TSCM ® Professional Software application and access the | ACQUISITION | ADD ASK | dialog window.

The | Add Activation Security Key | dialog window will open and the technical operator can "Cut and Paste" the ASK ™ code directly into the dialog box.



Activation Security Key (ASK) | v1.38xx

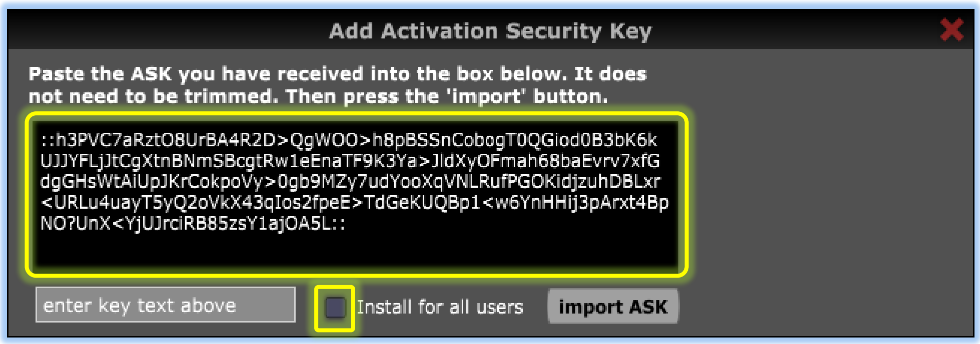
The entire text message may be entered into the window; it is not necessary to trim the ASK ™ string during the “cut and paste” process.

In the event that the host PC has more than a single user profile, selecting the | INSTALL FOR ALL USERS | will install the Activation Security Key (ASK) ™ for all user instances on the host PC automatically.

It is acceptable to trim the ASK ™ code string (not recommended) but, essential that the technical operator not alter in any way, the actual ASK ™ code string.

**::h3PVC7aRztO8UrBA4R2D>QgWOO>h8pBSSnCobogT0QGiod0B3bK6kUJJYFLjJtCgXtnBNmSBcgt
Rw1eEnaTF9K3Ya>JldXyOFmah68baEvrv7xfGdgGHsWtAiUpJKrCokpoVy>0gb9MZy7udYooXqVN
LRufPGOKidjzuhDBLxr<URLu4uayT5yQ2oVkX43qIos2fpeE>TdGeKUQBp1<w6YnHHij3pArxt4BpN
O?UnX<YjUJrciRB85zsY1ajOA5L::**

If the technical operator trims the code before entering the ASK ™ code string, it is essential that the entire code including the leading "::" and "::" at the end of the code string be included.



Activation Security Key |v1.40xx

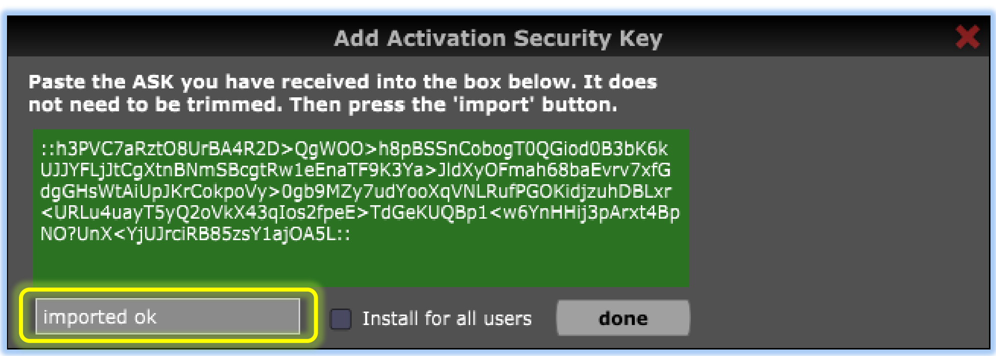
Press the | IMPORT ASK | button once to set the Activation Security Key (ASK) ™ to the Kestrel TSCM ® Professional Software encryption security key management database structure.

The background will turn | GREEN |, when the key is set, however, this action does not indicate that the ASK ™ entered is valid and only indicates that the ASK ™ is set to the authentication database structure.

ASK ™ verification is performed and confirmed the next time that the Kestrel TSCM ® Professional Software is run and every time a new session is generated.

It is also essential to return to the | ANALYZER CONTROL | and activate the hardware for which the license was installed, by clicking on the | CONNECT | box for the receiver or analyzer.

Press the | DONE | button to close the "Add Activation Security Key" dialog input box and close the Kestrel TSCM ® Professional Software application.



Activation Security Key | v1.40xx

This process will only occur the first time you run the software, initialization and start-up will be instantaneous and you will not normally be required to enter the Activation Security Key (ASK) ™ again in the future.

The ASK ™ is a one time, machine specific, and is not transferable or movable to another host computer, you will need to submit another CRC ™ that has been specifically generated on another computer as per the terms of the EULA.

The Activation Security Key (ASK) ™ must be obtained by contacting the Technical Support Group (TSG) at support@pdtg.ca in the event that the Activation Security Key (ASK) ™ lost, or corrupted due to a computer malfunction.

This can occur when new hardware, or when the OS is refreshed changing the machine ID and / or registry.

The Technical Support Group (SRG) ™ will determine eligibility to receive an additional ASK ™ for your various installations under the terms of the EULA.

Authorized technical operators will be provided with one (1) or more Activation Security Keys (ASK) ™ for use with one (1) or more supported search receivers or analyzers for each licensed copy of the Kestrel TSCM ® Professional Software, or for (optionally) licensed software modules purchased.

Currently, there are five (5) optional software modules;

Automatic Export Control (AEC) ™ | OPT AEC

Command Line Programming (CLP) ™ | OPT CLP

Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS

Tap Capture Plot (TCP) ™ | OPT TCP

Dynamic Trace Autonomous Platform (DTAP-GPS) ™ | OPT DTAP-GPS

In the event that optional software modules are purchased at the same time as the Kestrel TSCM ® Professional Software, the initial provided Activation Security Key (ASK) ™ will contain all required activation of the base software and purchased options.

However, when optional modules are purchased separately, a one or more new Activation Security Keys (ASK) ™ will be required to activate the optional software.

You may install the Kestrel TSCM ® Professional Software on a second host computer to provide a backup system.

However, you can only use the software with the search receiver or analyzer for which the Activation Security Key (ASK) ™ was issued and you will require an additional ASK ™ for each receiver on the second host computer installation.

It is essential that the Challenge and Response Code (CRC) ™ string be generated on the new host computer that you will utilize with the search receiver or analyzer hardware.

Under the terms of the EULA, we permit dual receiver, with the same two (2) receivers licensed across two (2) computers.

TIP: The Activation Security Key (ASK) ™ will work only with a single, search receiver or analyzer. Additional software licenses are required for each individual search receiver or analyzer. It is possible to use the Kestrel TSCM ® Professional Software with two (2) or more search receivers or analyzers, by entering the ASK ™ for the second search receiver or analyzer during the initialization process. The Kestrel TSCM ® Professional Software fully supports multiple Activation Security Key (ASK) ™ management.

The EULA permits simultaneous installation on no more than two (2) host computer platforms, unless additional sub-license Activate Security Keys (ASK) ™ are purchased from the Technical Support Group (TSG) ™.

This licensing method allows a single receiver, or two receivers referred to as Dual Receiver Operation (DRO) ™ to be utilized in the field on a portable Laptop computer operationally and on a second host computer system at the office in support of post analysis review and report generation for example.

Our licensing infrastructure permits the Kestrel TSCM ® Professional Software to support multiple search receivers and analyzers and multiple search receiver and analyzer types, providing that additional Activation Security Key (ASK) ™ licenses are obtained for each additional search receiver or spectrum analyzer.

QR Code Generator | Classified Computers

In support of secure working environments, and for classified computers that are not permitted any outside network or storage media connectivity, such as the use of email clients, or the connection of external storage media to accomplish licensing requests, we have implemented the ability to process the | CRC ™ | string via a mobile device, supporting two (2) different methods.

The technical operator can press the | QR CODE | button to invoke and display a | QR CODE | containing the | CRC ™ | string information as a standard QR code image.

Challenge and Response Code | QR Code | v1.40xx

Pressing the | QR CODE | button results in the display of a | ASK REQUEST QR CODE | window displayed on the UI.

CRC | QR Code | v1.40xx

The technical operator has two (2) options in processing and sending the | QR CODE | containing the | CRC ™ | string to support@pdtg.ca for processing.

| OPTION 1 | The technical operator can simply take a picture of the QR code window and email the image from a mobile device, such as a smart phone to support@pdtg.ca for processing.

| OPTION 2 | If the operator has a | QR Code Reader Application | installed on a mobile device, the displayed | QR CODE | can be captured and decoded to text and emailed from within the | QR Code Reader Application |, on a mobile device, assuming there is email support within the APP (or a cut and paste function, directly to support@pdtg.ca for processing.

Utilizing either | OPTION 1 | or | OPTION 2 | provides a means of | AIR GAP | isolation by processing the | CRC ™ | string without the need of a network connection on the target classified machine and does not require that the technical operator utilize external storage media to transfer the | CRC ™ | string, nor does the operator need to manually type the | CRC ™ | string (not recommended).

Run Software | First Time

The next time that the Kestrel TSCM ® Professional Software is opened, all connected search receivers with a valid ASK ™ installed will automatically initialize during the application start-up process.

The splash screen will display the status of the initialization process for all supported hardware.

The technical operator can | LEFT | mouse click on the | CONNECTED | table cell for each of the new receivers to activate the license for newly added hardware.

Once this is completed for each new receiver or analyzer, the receiver or analyzer will display | GREEN | during each subsequent initialization of the software and the activation process will not need to be repeated.

Software Updates

In order to install any Kestrel TSCM ® Professional Software update and / or new maintenance release version of the application, you must uninstall the previous version of the application and restart the host computer.

Once a new version of the Kestrel TSCM ® Professional Software is installed, restart your computer again and wait for the initialization process to complete once you have started your new software for the first time with a receiver or analyzer connected.

The ASK ™ should not be required to be entered again when an old installation is removed and new release is installed, providing a valid ASK ™ has been previously entered and remains valid in all other respects.

The ASK ™ is not part of the uninstaller process.

TIP: Warning | Make sure that you have backed-up, moved or transferred all your user data prior to uninstalling and reinstalling the program, or implementing new maintenance versions of the Kestrel TSCM ® Professional Software as a precaution. User data is not uninstalled or moved during the process, but it is always wise to maintain a separate backup of critical files, including any custom system related files.

Occasionally, Beta drop files in an | EXE | format may be available for download, adding additional features, functionality and bug fixes.

These Beta files are not installers and simply need to be placed in the Kestrel ® TSCM Professional Software main installation directory.

Once placed, the technical operator can create a desktop shortcut.

This allows the operator to maintain more than one software release version, consisting of the official installer and multiple Beta releases.

All Beta release code is included in the next official installer release and can be removed from the installation directory, once the next installer is available.

It is strongly recommended that the technical operator not store working project files or custom system file settings within the default installation directory, unless this is the installer default for a particular file type.

The Kestrel TSCM ® Professional Software provides an advanced directory and file management feature that provides the technical operator full and unrestricted ability to change the default file location and settings directory as desired.

Please note that this not a recommended practice for other than advanced users or as directed by technical support consultation.

Never change the directory locations to external storage media.

The technical operator can access this feature from within the program once the UI is displayed on the host computer and is located by selecting | MENU | SETTINGS DIRECTORY | and |MENU | PROJECT ROOT | options.

File management is an essential component of our unique workflow management-based approach.

Kestrel Crash Reporter (KCR)

Kestrel has a built-in error capture and reporting module.

This module can capture most, but not all Kestrel TSCM ® Professional Software specific, and some of the common API and DLL file crashes, or instability, associated with third-party receiver hardware connectivity.

The Kestrel Crash Reporter (KCR), packages several source files and logs, associated with the crash condition that may provide the Software Development Group (SDG) with valuable clues as to the origin of the crash, so that the necessary bug fixes, defensive code, or operational enhancements can be implemented in future releases of the software.

When a crash occurs within the software, or a third-party file, the KCR ™ may initialize, and capture several files related to the event, and generate and display a dialog window, indicating that the error conditions have been captured.

It is strongly recommended that the error reports be submitted to the Technical Support Group (TSG) ™.

It generally only requires the press of a button on the open dialog window in most cases.

There are a number of technical operator responses possible;

The operator can simply close the window resulting in no error report being sent to the Technical Support Group (TSG) ™, and resume normal operation of the software, after a restart of the application (Not Recommended).

The operator may simply press the | SEND REPORT | button, assuming there is a network connection present, and this will result in a generic report being sent, without any identifying elements, directly from your affected computer, however, this relies on a configured mail client.

The operator can click on the | PROVIDE ADDITIONAL INFO | link and enter a brief explanation of what you were doing leading up to the crash, and perhaps your name and email address, so technical support may contact you, if necessary.

This added information provides the SDG ™ with valuable information in knowing where to begin searching for the trouble reported (Recommended).

If no Internet connection is present, click on | WHAT DOES THIS REPORT CONTAIN |, and select | EXPORT REPORT |.

This will prompt the technical operator to save the error report to the computer for sending via email at another time, or from another computer when network access becomes available.

If the computer is currently connected to a network, the technical operator can simply send the report without adding any comments or identifying information, however, adding a name and email address is always greatly appreciated and allows us to provide a higher level of technical support, than we are able to from an anonymous error report.

Crash Report Submission

The error report code level programming, automatically sends the error report to Paul D Turner, TSS TSI at support@pdtg.ca, and is reviewed at this level, as the first step in the process and the information collected is not provided to any other third-party beyond the lead software engineer.

The error report content is then forwarded to our | Software Development Group (SDG) ™ | for formal analysis and review.

Once the review is complete, any software bugs or fixes, associated with the Kestrel TSCM ® Professional Software, are corrected as soon as practical and a new interim (Beta) drop-in (EXE) file release is often made available in short order, or the fix may be scheduled for release with the next available installer.

If the error is generated within a third-party API or DLL file, the manufacturer of the product is immediately notified, and in most cases, they will provide a patch file or fix for the identified issue, to the | Software Development Group (SDG) ™ | for inclusion in the next installer release of the Kestrel TSCM ® Professional Software.

If the error is generated by the host computer or other unrelated software, firmware, or setup, we may not be able to provide a direct patch or fix.

In this event, the best we can do is point you in the right direction and assist if possible, with whatever technical information we have available.

Unfortunately, third-party manufacturers are not under our direct control, and the release of patches and fixes are not always implemented as quickly as the Kestrel TSCM ® Professional Software | Software Development Group (SDG) ™ |, is normally able to accomplish.

Technical Operator Responsibility

It is understandable that many technical operators do not want to deal with bugs and instability within any software program.

However, they are unfortunately, a part of virtually all computing, and taking a few moments to assist us in understanding how you use the software and what you were doing at the time of the crash, can help us build a more robust product over time.

We also understand that there are many variables in the crash process, including the specific computer hardware, other software interaction, third-party software and firmware, and of course our own software issues, all of which we diligently, work hard to eliminate, or at least minimize.

You can assist by participating in the | Kestrel Crash Reporter (KCR) ™ | submission process when crashes occur.

We thank you in advance for your assistance!

Classified Computer (Red / Black) Separation

The installation of the Kestrel TSCM ® Professional Software on a plain text sensitive or classified computer platform, or computers that are not permitted to be connected to a network is easily accomplished utilizing RED / BLACK separation criteria to filter and accomplish the | CRC ™ | ASK ™ | licensing activation process.

Download the Kestrel TSCM ® Professional Software from the Technical Support Group (TSG) Resource Centre website onto a normal unsecured, non-classified (BLACK) machine and perform any agency filtering or vetting protocol, as required.

Transfer the Kestrel TSCM ® Professional Software application installer onto the sensitive or classified (RED) machine and complete the software installation process.

Run the Kestrel TSCM ® Professional Software for the first time on the sensitive or classified (RED) machine to generate the | Challenge and Response (CRC) ™ | code string generation process.

TIP: The licensing process generates a CRC ™ code string specific to each host computer and does not collect any data or personal information during the process. The CRC ™ code is encrypted and does not in any way compromise the host computer or collect any information during the process.

When the Kestrel TSCM ® Professional Software application starts and displays the GUI workspace and | ANALYZER CONTROL | window, select and click on the | CONNECTED | table cell for the receiver or analyzer of interest to generate the Challenge and Response (CRC) code string dialog window.

Cut and paste the Challenge and Response (CRC) code string from the CRC dialog window and copy to a text editor file and transfer the file to a normal unsecured, non-classified (BLACK) machine.

TIP: Do not edit, retype, or alter the CRC code string in any way during the process. Any editing or alteration of the CRC code string will prevent the Technical Support Group (TSG) from generating the Activation Security Key (ASK) for the receiver or analyzer.

Email the text file containing the CRC code string to support@pdtg.ca from the non-classified (BLACK) machine or cut and paste the CRC code string into the body of an email on the normally unsecured, non-classified (BLACK) machine.

Once the Technical Support Group (TSG) processes the CRC Code request, the Activation Security Key (ASK) will be sent to the provided email address associated with the normally unsecure, non-classified (BLACK) machine.

Once the Activation Security Key (ASK) is received from the Technical Support Group (TSG) by return email on the normally unsecure, non-classified (BLACK) machine and the appropriate filtering has been performed as required, transfer the Activation Security Key (ASK) to the sensitive or classified (RED) machine on which the CRC code string was originally generated.

Run the Kestrel TSCM ® Professional Software on the sensitive or classified (RED) machine and select the | ACQUISTION | ADD ASK | menu and cut and paste the ASK code string into the dialog window and press the | IMPORT ASK | button.

Click on the |CONNECTED | table cell of the specific search receiver or analyzer in the | ANALYZER CONFIGURATION | dialog window to complete the activation for the receiver or analyzer.

It will be necessary to repeat the RED / BLACK separation process for each individual search receiver or analyzer and for each plaintext, sensitive or classified (RED) computer.

It is essential the technical operator comply with all agency policy, procedure and protocols relative to the filtering of software and file transfer between RED / BLACK machines.

This process will often require processing through an intermediary (sanitization and filtering) machine.

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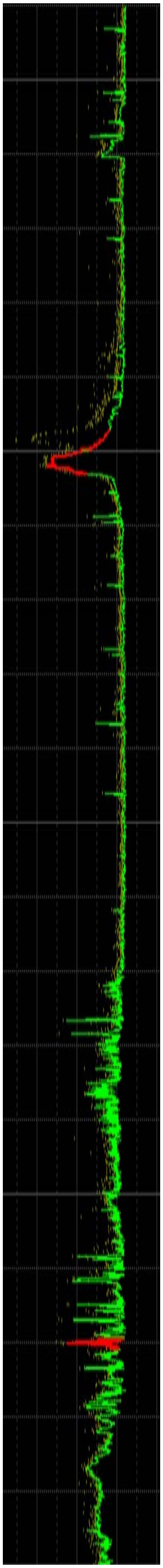
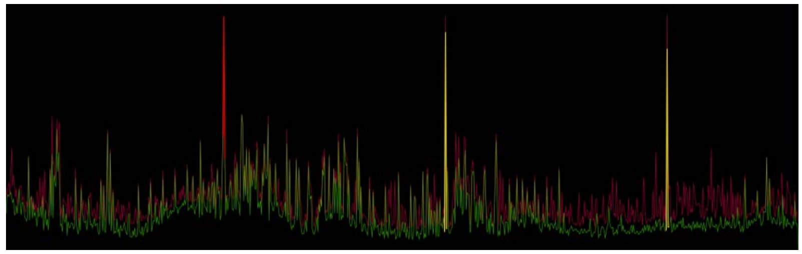


Chapter 3

Receiver Initialization | Setup

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Receiver Selection | Initialization

There are several important elements that the technical operator will need to determine and / or define, relative to the set-up and programming the Kestrel TSCM ® Professional Software, for active deployment.

The technical operator must take into account the actual and / or perceived operational threat level, complexity of ambient RF signal environment, target area signal propagation characteristics, training and experience of the technical operator, and many other factors that can and will, affect the Probability of Intercept (POI) and Probability of Detection (POD) of potentially hostile signals, when utilizing the Kestrel TSCM ® Professional Software in the field.

Probability of Detection (POD) is the single most common misconception among technical operators, in believing that a limited time-on-target sweep meets an acceptable level of due-diligence if the equipment is seen as having a high POD. This is a dangerous perception, and it is essential that the technical operator take into account many factors, including understanding the Probability of Detection (POD) by the numbers, as outlined within the TSB 2000 (Technical) Standard ™.

As an example, it would <u>not</u> be advisable to utilize the Kestrel TSCM ® Professional Software, active Chirp Threat Mode (CTM) ™ within a currently occupied work environment during normal business hours as this action would prove disruptive for employees working within the target area.

Utilizing the active CTM ™ feature outside of normal business hours would not likely be a problem and adds an additional level of active detection.

Setup parameters will depend on whether the Kestrel TSCM ® Professional Software is being utilized for Discrete Signal Search (DSS), or Discrete Signal Analysis (DSA).

Discrete Signal Search (DSS)

By definition, a Discrete Signal Search (DSS) generally includes specifically defined frequency bands, or active spectral ranges, referred to as Ranges of Interest (ROI), involving partial, or even the full receiver range capture of the specified spectra.

The DSS concept is most often utilized for continuous unattended operation over an extended period of time and / or during real time spectrum monitoring applications, when large RF spectral ranges must be captured, documented, and later analyzed.

Discrete Signal Analysis (DSA)

The process of Discrete Signal Analysis (DSA) is most often used by the technical operator to analyze individual “discrete” Signals of Interest (SOI), when such signals are captured and recorded by the Kestrel TSCM ® Professional Software, and it is desirable for the operator to manually review these potentially hostile Signals of Interest (SOI), or otherwise dismiss the SOI as a confirmed friendly signal.

Runtime User Interface (UI)

When the Kestrel TSCM ® Professional Software desktop icon  or start menu, shortcut is selected, the Kestrel TSCM ® Professional Software splash screen appears briefly on the UI, displaying the “current software release version”, “build reference”, “date and time of release” and “copyright” related information.

Splash Screen | v1.37xx

During the application start-up process, a short audio confirmation tone will be heard from the host computer speakers, unless previously disabled.

This confirms that the computer audio is currently active, and capable of processing audio on demand, including alerts, alarms, and demodulation functionality.

If the confirmation audio tone is not heard during the software initialization and start-up process, the technical operator will be unable to utilize the Chirp Threat Mode (CTM) ™ or the Audio Demodulation functionality, unless the technical operator has disabled the start-up audio by unchecking the | ENABLE SPLASH AUDIO | checkbox previously.

There is also an additional audio setup control group within the Kestrel TSCM ® Professional Software.

The technical operator may need to review and adjust the host computer audio control settings, and / or access the | HELP | AUDIO SETTINGS | control group at the application level.

In the event that no audio exists, the technical operator will need to check the host computer audio capability.

On some tablet computers, plugging in headphones, for use with demodulation, may not cut-off the speaker audio, due to audio sub-system conflicts between the host computer and the Kestrel application.

Accessing the | HELP | AUDIO SETTINGS | control group, permits the technical operator to manually select the appropriate audio source.

Optimal Range of Interest (ROI)

Determining the optimal Range of Interest (ROI) is always a challenge for the technical operator, since we rarely know for certain, what specifically we are looking for, and where within the ambient RF spectrum, we should be looking.

The TSB 2000 (Technical) Standard ™, recommends that the technical operator, should always include the maximum capability of the SDR hardware.

Spectra that is not reviewed, is a missed opportunity at best, and impacts the Probability of Detection (POD).

A hostile emission might be located virtually anywhere in the ambient RF spectrum environment, and can take on many different forms, from a direct fundamental frequency, harmonic, or intermodulation artifact.

All signal events must be investigated and confirmed friendly.

See Chapter 11

Threat Detection Algorithm (TDA)

The Kestrel TSCM ® Professional Software contains an active Threat Detection Algorithm (TDA) ™ that is capable of identifying the fundamental frequencies, and the 2nd / 3rd / 4th / 5th / 6th / 7th / 8th / 9th harmonic, and (1 / h) sub-harmonic, events of analog based audio transmitters.

Harmonic Signature Threshold (HST) ™, detection sensitivity control is provided for both the 2nd / 3rd harmonic events in dBc.

It is essential that the technical operator consider and select the possible active detection Range of Interest (ROI) to include the possibility of at least capturing the 2nd / 3rd harmonic events when deciding the active search ROI.

For example; if the primary concern might be a commonly manufactured UHF transmitter in the 433 MHz range, the technical operator might normally only focus on the spectrum below 750 MHz.

Expanding the Range of Interest (ROI) to 2000 MHz provides the technical operator with the opportunity to not only detect the fundamental frequency, but also the 2nd Harmonic (866 MHz) and 3rd Harmonic (1299 MHz) events as part of the active threat detection strategy.

This equates to significantly improving the Probability of Detection (POD) by presenting three (3) signal events for detection purposes, rather just the anticipated fundamental frequency.

Extending the Range of Interest (ROI) to say 3000 MHz provides the technical operator with the opportunity to not only detect the fundamental frequency and the 2nd Harmonic (866 MHz) and 3rd Harmonic (1299 MHz) events as part of the active threat detection strategy, but also the 4th Harmonic (1732 MHz), 5th Harmonic (2165 MHz) and 6th Harmonic (2598 MHz) events, as well.

During qualification testing; the Kestrel TSCM ® Professional Software successfully demonstrated the ability to detect the fundamental and associated harmonics up to the 9th Harmonic event.

Approximate Sweep Time (USB-SA44B)

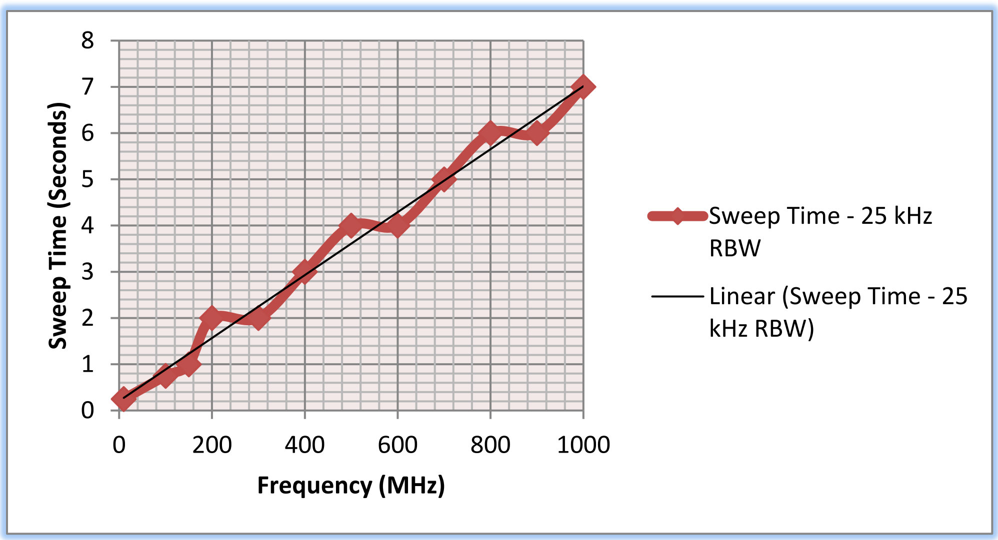
The following graphs indicate the approximate sweep time at various search ranges of the Kestrel TSCM ® Professional Software utilizing the Signal Hound ™ (USB-SA44B) search receiver hardware.

The sweep times were demonstrated based on a Resolution Bandwidth (RBW) of 26 kHz, with very little difference in actual sweep time at 51 kHz (RBW).

The actual sweep time will remain fairly consistent; however, as the software analyzes individual Signals of Interest (SOI) against the operator selected threat criteria setting, the apparent sweep time will vary based on the threat analysis environment and number of signals that need to be analyzed.

The following example chart indicates the average sweep times at 100 MHz, 150 MHz, 200 MHz, 300 MHz, 400 MHz, 500 MHz, 600 MHz, 700 MHz, 800 MHz, 900 MHz and 1000 MHz.

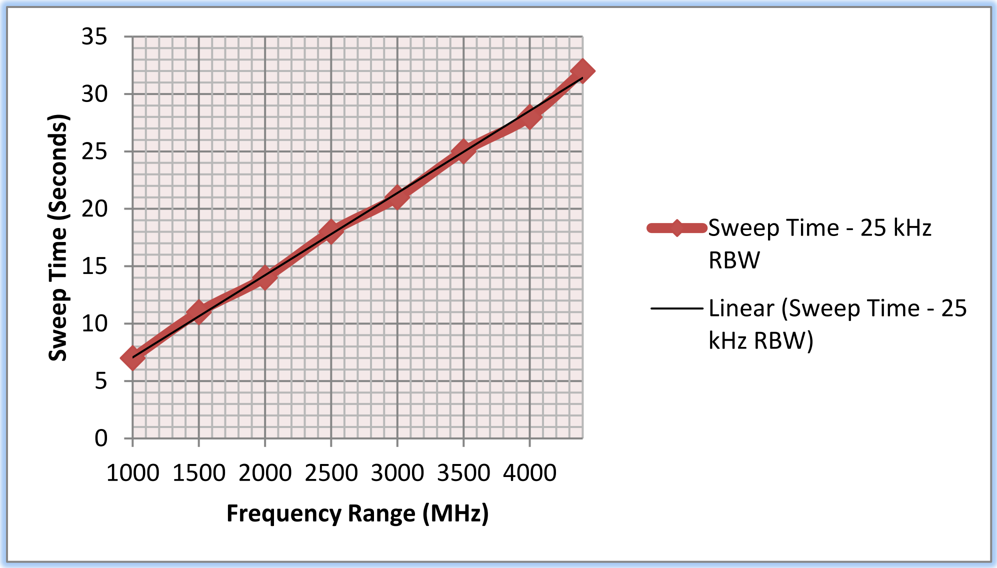
We have determined that the free running time is approximately 150 MHz per second for the USB-SA44B search receiver.



Sweep Time Graph | v1.39

The approximate Sweep Time at 51 kHz (RBW) is on average approximately 150 MHz per second, and it takes approximately (7) seconds to sweep a (1 GHz) range when configured for either Minimum Detection Amplitude (MDA) or Spectrum Baseline Logging (SBL) only.

The following example chart indicates the average sweep times at 1000 MHz, 1500 MHz, 2000 MHz, 2500 MHz, 3000 MHz, 3500 MHz, 4000 MHz and 4500 MHz.



Sweep Time Graph | v1.39

A full spectrum receiver range (1 Hz to 4400 MHz) sweep will take approximately 30 seconds to complete, when configured for either Minimum Detection Amplitude (MDA) or Spectrum Baseline Logging (SBL) only, without active threat detection.

Approximate Sweep Time (USB-SA124B)

The following chart illustrates the approximate sweep time characteristics for the Signal Hound ™ (USB-SA124B) search receiver.

Only legal (SPAN Vs RBW) values are included for common Range of Interest (ROI) settings in 1 GHz spans, as well as the 12.4 GHz full span.

Host computer limitations, limits the number of data points that can be processed for display purposes.

The Kestrel TSCM ® Professional Software has built in protection to prevent illegal Resolution Bandwidth (RBW) values from selection during runtime.

For example; the following formula illustrates the approximate number of data points;

Number of Data Points = 2.5 x [SPAN (MHz)] / [RBW (MHz)]

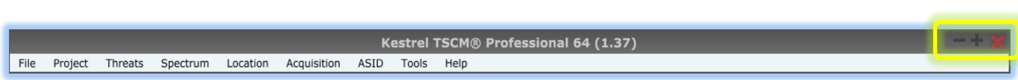
2.5 x 10 GHz SPAN (10000 MHz) / 26 kHz RBW (0.026 MHz) = 961,539 Data Points

Signal Hound (USB-SA124B) Approximate Sweep Time (RBW = FAST Mode)					
SPAN Vs RBW	**6.4 kHz (FAST)**	**13 kHz (FAST)**	**26 kHz (FAST)**	**51 kHz (FAST)**	**102 kHz (FAST)**
1.0 GHz	9.2 Sec	8.7 Sec	8.4 Sec	8.3 Sec	8.3 Sec
2.0 GHz	---	---	15.5 Sec	15.3 Sec	15.2 Sec
3.0 GHz	---	---	22.7 Sec	22.3 Sec	22.1 Sec
4.0 GHz	---	---	29.8 Sec	29.3 Sec	29.1 Sec
5.0 GHz	---	---	36.9 Sec	36.3 Sec	36.0 Sec
6.0 GHz	---	---	44.1 Sec	43.4 Sec	43.0 Sec
7.0 GHz	---	---	51.2 Sec	50.4 Sec	50.0 Sec
8.0 GHz	---	---	58.4 Sec	57.4 Sec	57.0 Sec
9.0 GHz	---	---	65.6 Sec	64.6 Sec	64.0 Sec
10.0 GHz	---	---	72.7 Sec	71.6 Sec	71.0 Sec
11.0 GHz	---	---	---	---	77.9 Sec
12.0 GHz	---	---	---	---	84.9 Sec
12.4 GHz	---	---	---	---	87.7 Sec

Sweep Time Chart | v1.37xx

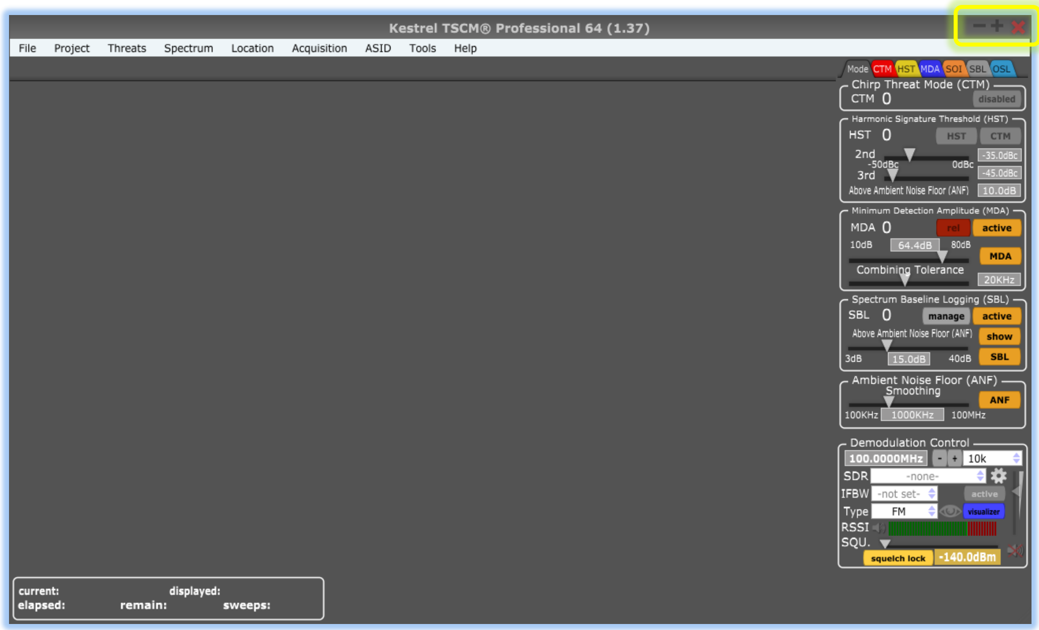
User Interface (UI)

The Human Operator | User Interface (UI) immediately opens (full screen) adjusting to the host computer screen resolution and will display an empty "New Project" workspace.

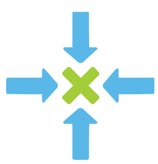


UI Main Menu Control Group - v1.38xx

There are three (3) familiar buttons located on the UI header that allow the technical operator access to the Minimize | - | Button, Window | + | Button and Close | X | Button.



Project Workspace | v1.37xx



TIP: It is recommended that the Windows (Auto Hide Taskbar) feature be activated to provide additional work space for the UI.

The Kestrel TSCM ® Professional Software will display all controls and status dialog boxes correctly (windowed or full screen) at a minimum (absolute) display resolution of 1048 x 800 (or higher) for use on Laptop and Tablet computers and are ideal computing platforms for walk-around direction finding, as precision RF signal source locators.

See Chapter 12

Differential Signal Analysis (DSA)

The Kestrel Prey III ™ RF Locator is a unique and very powerful, first of its kind, ruggedized pre-configured tablet computing platform that permits the technical operator to utilize the Signal Hound ™ (USB-SA44B, USB-SA124B, BB60A, and BB60C) search receivers as a full featured walk-around RF locator and advanced signal analysis resource.

This advanced computing platform was selected and customized for use with the Kestrel Prey III ™ RF Locator and provides excellent portability with a high definition display, and powerful Intel i7 HQ Processor.

It is recommended that for both Laptop and Desktop installations, the technical operator utilize a minimum display resolution of 1280 x 800, or higher depending on the actual display size available, for example, a 1920 x 1080 resolution is idea for larger display monitors.

However, a wide range of screen resolutions may also be utilized as to enhance technical operator situational awareness.

Some of the features may not be completely visible at (windowed or full screen) resolutions of below 1048 x 800 pixels.

The technical operator is advised to experiment and determine the best display resolutions for the host computer and display utilized.

The Kestrel TSCM ® Professional Software fully supports PC based Touch Screen Display technology.

Recommended (Windowed and Full Screen) Display Resolutions			
Screen Resolution	**Window (Default)**	**Full Screen**	**Recommended**
1920 x 1080	✓	✓	Excellent
1680 x 1050	✓	✓	Excellent
1600 x 1024	✓	✓	Excellent
1600 x 900	✓	✓	Excellent
1440 x 900	✓	✓	Excellent
1400 x 1050	✓	✓	Excellent
1366 x 768	Not Supported	✓	Good
1360 x 768	Not Supported	✓	Good
1280 x 1024	✓	✓	Excellent
1280 x 960	✓	✓	Excellent
1280 x 800	✓	✓	Excellent
1280 x 768	Not Supported	✓	Excellent
1280 x 720	Not Supported	Not Supported	Not Supported
1152 x 864	Not Supported	✓	Good
1024 x 768	Not Supported	Not Supported	Not Supported
800 x 600	Not Supported	Not Supported	Not Supported

Display Resolution Chart | v1.38xx

Signal Hound | Hardware Setup

The following component items are included with the Signal Hound ™ Receiver kit.

There are a number of additional component items that are necessary to achieve the full potential of the system.

Digital Receiver (1 Hz to 4400 MHz) – Included
High Speed (USB 2.0) 6-foot Cable – Included
SAMR Software CD-ROM – Included
Wideband Omni-Directional Antenna – Required
Noise Suppressed High Speed USB 2.0 Cable – Recommended
25-foot High Speed USB 2.0 Certified Cable – Optional

Connecting the Hardware

The first step in connecting the Signal Hound ™ Receiver hardware, once the SAMR software is properly installed and the host computer has been rebooted, is to connect the high-speed USB 2.0 Cable between the host computer and the Signal Hound ™ receiver hardware.

The USB 2.0 Device Drivers will automatically install for the connected receiver.

Once the driver installation process completes successfully for the first time; the computer should be rebooted, after the restart has completed, the receiver Status LED will be GREEN indicating that the receiver is ready for use.

The technical operator will need to attach a suitable antenna to the RF Input SMA (F) connector located on the front of the receiver.

Connecting the antenna directly on the front of the receiver is not recommended, it is better to utilize a short RF cable as a stand-off to maintain a small distance between the receiver and the antenna.

TIP: Do not over tighten or force the RF input (SMA) connector; to prevent possible damage to the connector threads or other structural components. SMA connectors provide superior (RF) performance; but may be easily damaged by over tightening the cable or antenna connector.

Operational Considerations

When selecting a suitable antenna, it is important to understand that TSCM work in general is based on Near-Field (NF) detection, reception and signal analysis.

Virtually any wideband sectional whip antenna will be effective for most search receiver applications at the individual room level of the target area.

For consistency, it is essential that the technical operator ensure that the antenna orientation is the same for each collection location when the Differential Signal Analysis (DSA) feature is deployed.

This attention to detail in practice will permit the technical operator to establish meaningful comparative data when utilizing the Differential Signal Analysis (DSA) functionality over a period of time.

It is essential to locate the actual receiver antenna in the center of the target area or room consistent with the recommended Antenna Placement Distance (APD), as defined in the TSB 2000 (Technical) Standard ™ and described in the TSCM Operational Standard - Policy and Procedure Guideline (OS-PPG) ™, development by Professional Development TSCM Group Inc., under the operational umbrella of the Technical Security Branch (TSB).

Anritsu (Spectrum Master) | C Series | T Series

Full operational support is available for the Anritsu Spectrum Master "C" Series and "T" Series Spectrum Analyzers.

The Kestrel TSCM ® Professional Software provides full support for the 9 GHz, 13 GHz, 20 GHz, 32 GHz and 43 GHz spectrum analyzers.

Connecting the Hardware

The first step in connecting the Anritsu ™ Spectrum Master hardware is to first install the Anritsu Master Software Tools (MST) provided with the analyzer on CD-ROM or as a website download.

Once the MST software and required the driver installation process completes successfully, the computer should be rebooted.

Connect a High-Speed USB 2.0 Cable or a CAT 5e LAN patch cable between the Anritsu ™ Spectrum Master and the host computer hardware.

The technical operator will need to attach a suitable antenna to the RF Input N (F) connector located on the top of the Anritsu analyzer.

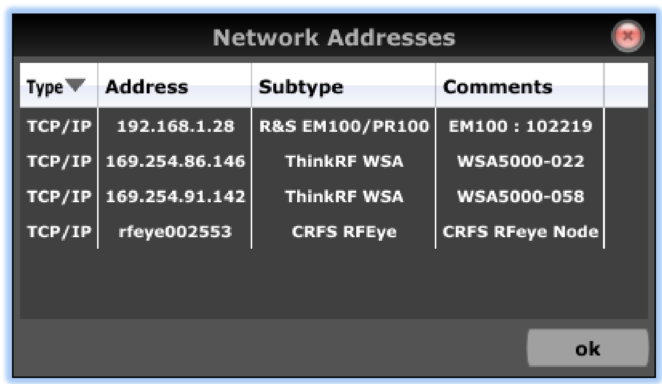
Start the Anritsu ™ Spectrum Master and host computer in preparation for use with the Kestrel TSCM ® Professional Software.

When the High-Speed USB 2.0 cable option is utilized; the technical operator can initialize the analyzer by navigating to the | ACQUISITION | ANALYZER CONTROL | menu option.

It will be necessary to enter a valid Dynamic IP Address when the host computer is connected to the analyzer utilizing a CAT 5e LAN cable.

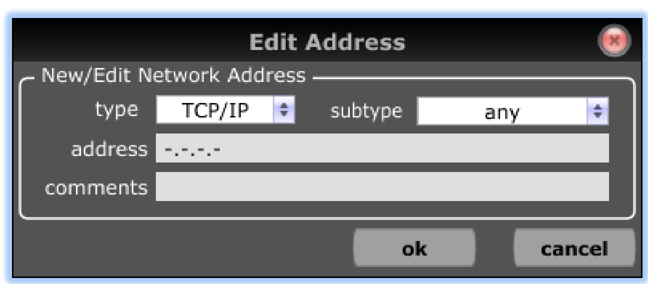
The analyzer will normally assign a Dynamic IP Address during the start-up process and may be accessed under the system sub-menu structure (consult the Anritsu user manual).

It will be necessary to enter the appropriate Dynamic IP Address into the | ACQUISITION | NETWORK ADDRESSES | EDIT ADDRESS | menu dialog box, prior to initializing the analyzer.



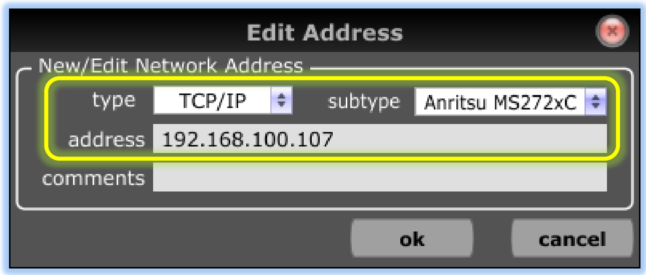
Network Addresses | v1.37xx

The | EDIT ADDRESS | input dialog box is accessed by either a left or right mouse click on the | NETWORK ADDRESSES | dialog window.



Edit Address | v1.37xx

Select TCP / IP and enter the appropriate IP Address as assigned by the Anritsu analyzer.

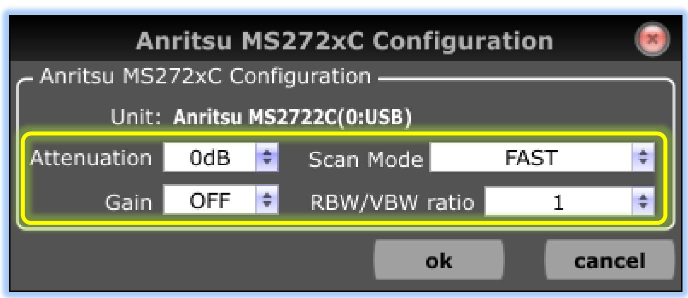


Edit Address | v1.37xx

Once the Dynamic IP Address is entered, press the | OK | button and proceed to the | FILE | NEW PROJECT | menu and select the analyzer for initialization.

Anritsu (MS272xC) Configuration

For the Anritsu Spectrum Master ("C" Series) analyzers there are four (4) optional settings that need to be accepted as default or adjusted by the technical operator during the setup process.



Anritsu Configuration | v1.37xx

The Default settings are highlighted in the following Anritsu (MS272xC) Configuration Chart.

Anritsu (MS272xC) Configuration Chart			
Attenuation Level (dB)	***Gain***	***Scan Mode***	***RBW / VBW Ratio***
0 dB	***Off***	***Fast***	***1***
5 dB	On	Performance	3
10 dB		NO FFT	10
15 dB			30
20 dB			100
25 dB			300
30 dB			1000
35 dB			3000
40 dB			10000
45 dB			30000
50 dB			100000
55 dB			300000
60 dB			1000000
65 dB			

Rohde & Schwarz (RS) | EM100 | PR100 |

Full operational support is available for both the Rohde & Schwarz (RS) EM100 and PR100 compact search receivers.

The Kestrel TSCM ® Professional Software provides full support for the base level unit from 9 kHz to 3.5 GHz and for the 9 kHz to 7.5 GHz and other support depending on the installed options and configuration of the receiver.

Connecting the Hardware

The following procedure and information assume that the appropriate options and configurations are available on the Rohde & Schwarz (RS) (EM00 / PR100) compact receiver hardware.

The first step is to connect a CAT 5e (or higher) LAN (Straight) or (Cross-Over) cable between the EM100 / PR100 and the host computer Ethernet port.

The IPv4 properties will need to be setup as a Static IP address on the same Subnet utilizing a different IP address from the device. You will need to know the IP address of the device (consult the EM100 / PR100 documentation).

Rohde & Schwarz (R&S) EM100 / PR100 (Direct LAN Connection) Example		
R&S EM100 / PR100	Direct Connection	Desktop / Laptop PC
Device IP Address 192.168.1.28	Ethernet Local Area Network (LAN) Connection utilizing a Cat 5e or higher (straight or cross-over cable)	Static IPv4 IP Address 192.168.1.35
Subnet Mask 255.255.255.0		Subnet Mask 255.255.255.0

R&S EM100 Connection (Direct) | v1.37xx

Alternatively, connecting the EM100 / PR100 to a Network work group switch is also supported and easily configured.

However, the IPv4 properties will still need to be setup as a Static IP address on the same network Subnet.

It is essential that access be allowed through Windows Firewall, should a warning dialog window appear during the setup or start-up of the Kestrel TSCM ® Professional Software application.

<table>
<tr><th colspan="3">Rohde & Schwarz (R&S) EM100 / PR100 (Network Workgroup Switch)</th></tr>
<tr><td>R&S EM100 / PR100</td><td rowspan="3">Network Switch Connection

Local Area Network (LAN) across a Network Workgroup Switch between Device and PC</td><td>Desktop / Laptop PC</td></tr>
<tr><td>Device IP Address
192.168.1.28</td><td>Static IPv4 IP Address
192.168.1.35</td></tr>
<tr><td>Subnet Mask
255.255.255.0</td><td>Subnet Mask
255.255.255.0</td></tr>
</table>

R&S EM100 Connection (Workgroup Switch) | v1.37xx

TIP: Additional network configuration on the host computer may be required, or a cross-over cable and router may be necessary as the EM100 / PR100 do not support Auto Sense on the LAN port.

The technical operator will need to attach a suitable antenna to the RF Input supported by an N (F) type connector located on the back of the EM100 receiver or the top of the PR100 receiver.

Power the EM100 / PR100 and host computer in preparation for use with the Kestrel TSCM ® Professional Software.

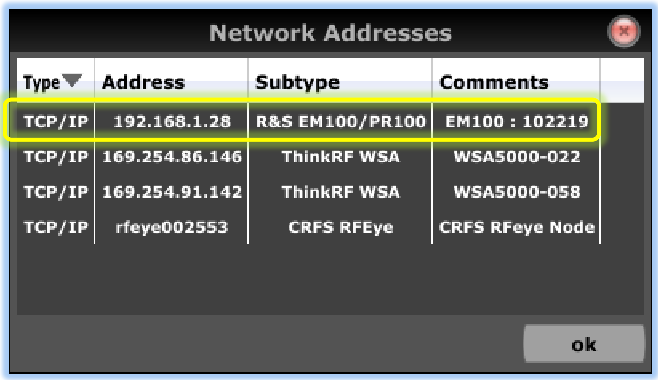
It will be necessary to enter a valid Static IPv4 Address that is different from the EM100 / PR100.

The receiver will not assign a Dynamic IP Address during the start-up process and must be assigned a manual Static IPv4 address on the same Subnet Mask.

After starting the Kestrel TSCM ® Professional Software application, it will be necessary to enter a valid network IP address of the device, by navigating and accessing the | ACQUISITION | NETWORK ADDRESSES | EDIT ADDRESS | menu dialog window.

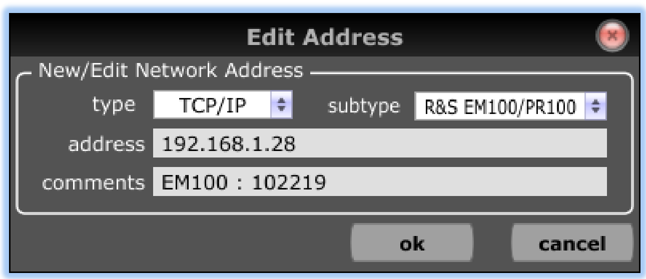
The | TYPE | needs to be set to TCP / IP and the IP address must be the IP address of the EM100 / PR100 compact receiver.

It is also possible to add a comment such as the receiver or analyzer model number and serial number for easier identification in the future, or when multiple devices are utilized.



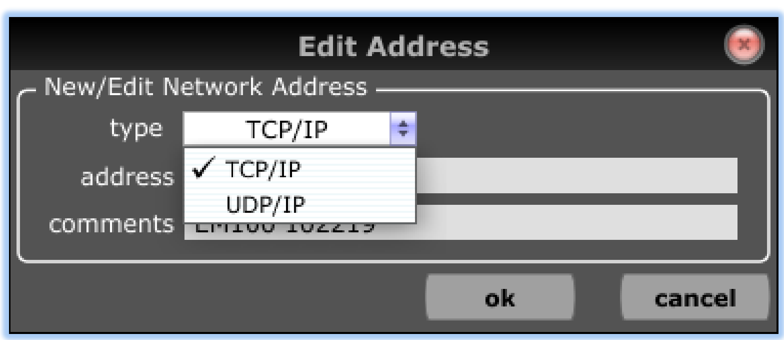
Network Addresses | v1.37xx

The | EDIT ADDRESS | input dialog box is accessed by either a left or right mouse click on the | NETWORK ADDRESS | dialog window.



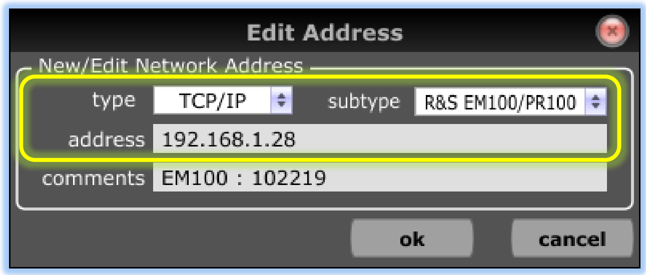
Edit Address | v1.37xx

Options include TCP / IP and UDP / IP and are dependent on the receiver or analyzer communication protocol and method utilized.



Edit Address | v1.37xx

Select TCP / IP setting and enter the appropriate IP Address as assigned for the EM100 / PR100 Compact Receiver.



Edit Address | v1.37xx

Once the IP Address is entered, the technical operator may also add descriptive comment to describe the device, which is useful when multiple receivers are utilized.

To complete the connection process, press the | OK | button and proceed to the | FILE | NEW PROJECT | menu and select the receiver or analyzer for initialization.

Configuring the Computer Network Connection

To configure the host computer network connection to communicate with the EM100 / PR100 compact search receiver, navigate to the desktop | NETWORK ICON |and selecting the | OPEN NETWORK AND SHARING CENTER | CHANGE ADAPTER SETTINGS | and then select the properties for the | LOCAL AREA CONNECTION | and under the | NETWORKING | tab, highlight | INTERNET PROTOCOL (TCP / IPv4) | and click on the | PROPERTIES | button.

Under the | GENERAL | tab, select | USE THE FOLLOWING IP ADDRESS | option and enter a unique IP address, different from the EM100 / PR100 compact receiver (Device) IP address and other IP addresses on your network to avoid possible network IP conflicts.

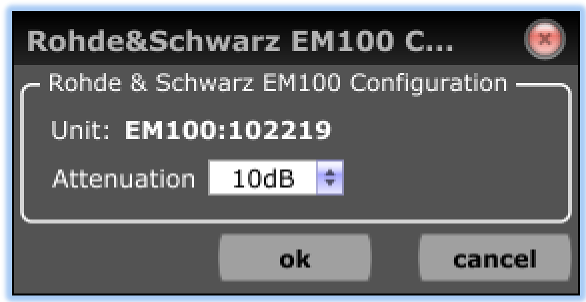
Ensure that the EM100 / PR100 and computer are using the same Subnet Mask.

Rohde & Schwarz (EM100 / PR100) Configuration Chart		
Example - Static IP Configuration (Direct Connection)		
EM100	192.168.1.28	255.255.255.0
Computer	192.168.1.35	255.255.255.0

Configuration Dialog | v1.37xx

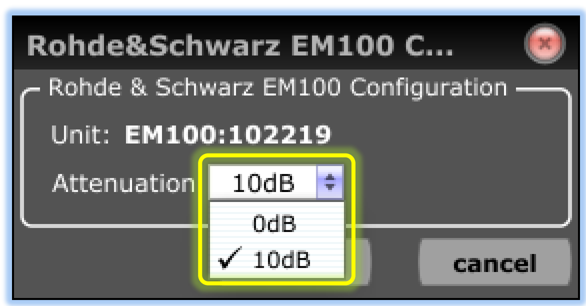
Rohde & Schwarz (EM100 / PR100) Configuration

For the Rohde & Schwarz (EM100) Compact Receiver there is only one (1) optional setting that needs to be accepted as default or adjusted by the technical operator during the setup process.



EM100 / PR100 Configuration | v1.37xx

Adjust the Attenuation level as operationally required, based on the ambient RF (0 dB or 10 dB) for the ambient RF spectrum environment.



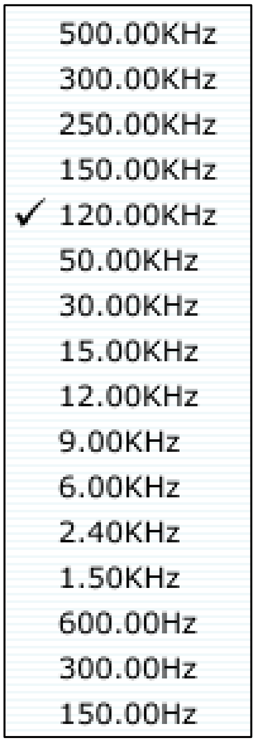
EM100 / PR100 Configuration | v1.37xx

The default setting is highlighted in the following R&S (EM100 / PR100) Configuration Chart.

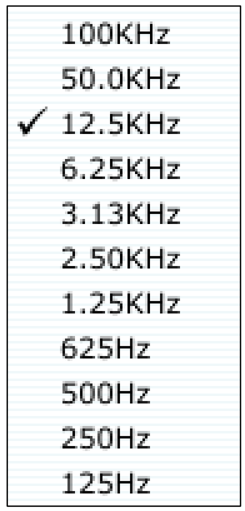
Rohde & Schwarz (EM100 / PR100) Configuration Chart	
Attenuation Level (dB)	
0 dB	
10 dB	***Default***

Configuration Dialog | v1.37xx

The following Intermediate Frequency Bandwidth (IFBW) and Resolution Bandwidth (RBW) are available for the EM100 / PR100 compact receivers within the Kestrel TSCM ® Professional Software application.



IFBW | v1.37xx



RBW | v1.37xx

EM100 | Resolution Bandwidth (RBW) Availability Chart

RBW	ROI	7.5 GHz	6 GHz	5 GHz	4 GHz	3 GHz	2 GHz	1 GHz
100 kHz		✓	✓	✓	✓	✓	✓	✓
50 kHz		✓	✓	✓	✓	✓	✓	✓
12.5 kHz		---	✓	✓	✓	✓	✓	✓
6.25 kHz		---	---	---	✓	✓	✓	✓
3.13 kHz		---	---	---	---	---	✓	✓
2.5 kHz		---	---	---	---	---	---	✓

EM100 RBW Chart | v1.37xx

EM100 | Resolution Bandwidth (RBW) Availability Chart							
RBW	**ROI**	**500 MHz**	**250 MHz**	**100 MHz**	**50 MHz**	**25 MHz**	**10 MHz**
100 kHz		✓	✓	✓	✓	✓	✓
50 kHz		✓	✓	✓	✓	✓	✓
12.5 kHz		✓	✓	✓	✓	✓	✓
6.25 kHz		✓	✓	✓	✓	✓	✓
3.13 kHz		✓	✓	✓	✓	✓	✓
2.5 kHz		✓	✓	✓	✓	✓	✓
1.25 kHz		✓	✓	✓	✓	✓	✓
625 Hz		---	✓	✓	✓	✓	✓
500 Hz		---	---	✓	✓	✓	✓
250 Hz		---	---	---	---	✓	✓
125 Hz		---	---	---	---	---	✓

EM100 RBW Chart | v1.37xx

The Rohde & Schwarz (RS) EM100 compact receiver includes a headphone output that is active momentarily between sweeps.

Whenever the Kestrel TSCM ® Professional Software demodulation control group is active, or sweep is paused, the headphone output on the EM100 is active.

Signal Hound (BB60A) Real-Time Spectrum Analyzer Configuration

The BB60A is the next generation high-speed broadband search receiver sweeping at up to 24 GHz per second at a Resolution Bandwidth of 10 kHz.

The BB60A requires very specific computer hardware for proper operation with the Kestrel TSCM ® Professional Software.

Base computing requirements include, a gaming level laptop running an Intel i7 4770HQ (or higher) processor with 16 GB RAM (32 GB Recommended) and at least 1 TB SSD / HDD storage.

The BB60C requires two (2) adjacent (co-located) USB 3.0 SuperSpeed ports for receiver communication and power requirements.

Windows 7 Professional (or higher) 64-Bit operating system is required.

The BB60A is a high speed (real-time) spectrum analyzer communicating with your PC over a USB 3.0 Super Speed link.

The BB60A has 20 MHz of real-time bandwidth, tunes from 9 kHz to 6 GHz, collects 80 million samples per second and streams data to your computer for processing and storage at approximately 140 MB / second.

The BB60A is a hybrid super heterodyne FFT spectrum analyzer and combination of swept-tuned and FFT based analyzer.

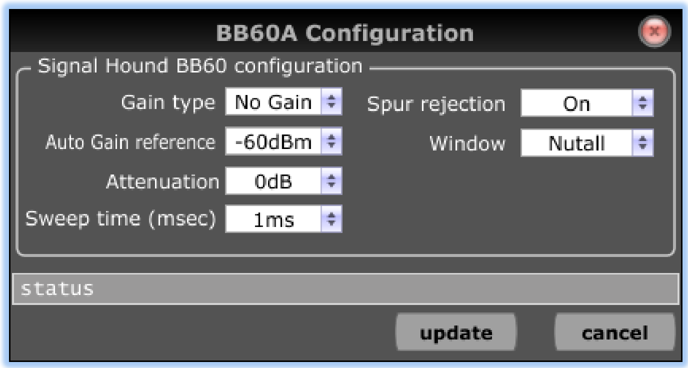
The BB60A uses an oscillator and band-pass filter to down-convert a portion of the input spectrum into an intermediate frequency (IF).

The intermediate frequency is then sent from the device to the host PC where it undergoes FFT spectrum analysis transforming the input IF into a frequency spectrum.

BB60A Configuration

The Kestrel TSCM ® Professional Software includes a receiver level configuration dialog window that supports the initial setup runtime configuration of unique features and functionality of each individually supported receiver or analyzer.

The following describes the various Signal Hound (BB60A) configuration options available to the technical operator during the initialization and setup process of the receiver and supports dynamic adjustment during runtime.



BB60A Configuration Defaults | v1.37xxx

Gain Type

The Signal Hound BB60A "Gain Type" options include | AUTO | NO GAIN | LOW GAIN | MEDIUM GAIN | HIGH GAIN |.

When | AUTO | is selected, the API utilizes the "Auto Gain Reference" level to select the optimal gain setting for an input signal with amplitude equal to the reference level.

After the RF input attenuator (0, 10, 20, 30 dB), the RF signal path contains an additional amplifier stage following band filtering, which is selected for | MEDIUM | or | HIGH | and bypassed for | LOW | or | NO GAIN | and the Intermediate Frequency (IF) has an amplifier which is bypassed for | NO GAIN | and additional amplification in the Analog Digital Convertor (ADC) stage is utilized for the | HIGH GAIN | setting.

If a gain other than | AUTO | is selected, the reference level parameter is ignored.

Default = NO GAIN

Auto Gain Reference

The BB60A "Auto Gain Reference" options include | 0 dBm | -10 dBm | -20 dBm | -30 dBm | -40 dBm | -50 dBm | -60 dBm | -70 dBm | -80 dBm |.

Default = -60 dBm

Attenuation

The BB60A attenuation options include | AUTO | 10 dB | 20 dB | 30 dB |.

The RF attenuator is the first front end gain control device encountered by the input signal.

Attenuation is adjustable in 10 dB steps.

If | AUTO | is selected, the optimal attenuation setting is selected automatically as a function of (X = dB).

Default = 0 dBm

Sweep Time (mSec)

The BB60A "Sweep Time" options include | 1 mSec | 2 mSec | 5 mSec | 10 mSec | 20 mSec | 50 mSec | 100 mSec |.

In "Sweep Mode", the | SWEEP TIME (mSec) | selected determines how long the BB60A receiver collects data before it begins processing.

In "Real-Time Mode", the | SWEEP TIME (mSec) | represents the length of time data is collected and compounded before returning a sweep.

Selected values for "Real-Time" operation should be between (16 mSec and 100 mSec) for optimal viewing.

Default = 1 mSec

Spurious Rejection

The BB60A "Spurious Rejection" options include | NONE | ON |.

The spurious rejection control can be utilized to optimize certain aspects of the signal display characteristics.

Ideally, the | SPURIOUS REJECTION | control should be set to | NONE | for discrete signal level review and analysis and | ON | in a typical TSCM role when a wide Range of Interest (ROI) is utilized.

Spurious Rejection | NONE | = 24 GHz / Second [4 fps]

Spurious Rejection | ON | = 12 GHz / Second [2 fps]

If you have a steady Continuous Wave (CW) or slowly changing signal event and need to minimize image and spurious responses from the BB60A, the use of the | ON | setting is recommended.

Default = ON

Window Type

The BB60A "Window" options include | NUTALL | BLACKMAN | HAMMING | FLAT TOP | FLAT TOP (EMC 9 kHz) | FLAT TOP (EMC 120 kHz) |.

It is possible to change the windowing that is applied to the spectrum data before any actual signal processing is performed.

In real-time mode, the windowing parameter is permanently set to | NUTALL | and cannot be changed.

The windowing type can only be changed when utilizing native Resolution Bandwidth (RBW) as found within the Kestrel TSCM ® Professional Software.

Default Windowing Type = NUTALL

The recommended (optional) setting for the Technical Security (TSEC) function is the | HAMMING | window providing a slightly lower Ambient Noise Floor (ANF).

ADC Overflow

An | ADC | warning annunciator message is displayed on the Graticule when the Analog Digital Convertor (ADC) detects clipping of the input signal.

This condition will occur when the maximum voltage level has been reached periodically or continuously during runtime and results in measurement inaccuracy and significant trace and signal errors.

Signal analysis and reconstruction accuracy become major issues when signal level clipping is allowed to occur during runtime.

The trace display may momentarily freeze when the ADC Overload indicator is active continuously, or periodically during runtime.

To prevent ADC overload, the technical operator must utilize a combination of either increasing the attenuation level (dB), decreasing the gain, or increasing the reference level (when gain is set to automatic) to allow for additional signal level headroom.

Receiver Saturation Vs ADC Overflow

Technical operators often wonder why they see an | ADC | overflow warning on displayed on the Graticule.

An ADC overflow annunciator is displayed when the received signal is not digitized properly, which usually causes spectral distortion and trace display issues.

ADC overflow is a "digital" measure for "too large of a signal level" and can only be detected when the signal is sampled, while acquiring data.

ADC overflow should be regarded as a serious issue and requires an adjustment of the receiver | GAIN | and / or | ATTENUATION | level.

Digital Signal Processing (DSP) | ADC Overflow

Understanding the effects of DSP related errors that are introduced by using improper ADC settings is an essential skill every technical operator must develop.

The Analog to Digital Conversion (ADC) process is a primary source of data capture errors and once errors are introduced, can result in inaccurate or distorted measurements and erroneous spectrum display elements.

The technical operator can take steps to minimize the resulting errors, only once recognized.

The Kestrel TSCM ® Professional Software will display the annotation “ADC Overflow” flag on the Graticule should an ADC overload condition exist during runtime.

ADC Overflow might otherwise be difficult to detect unless the technical operator has a valid set of measurement data parameters for direct comparative analysis.

In the event of ADC Overflow, the input signal may exceed the dynamic range of the current ADC settings.

If the dynamic range is 70 dB and the signal is greater than 70 dB, ADC overflow will occur resulting in measurement errors.

However, another concern for the technical operator is the effect of too small a signal level at the ADC input.

It this case a signal might be within the noise floor and not properly detected or displayed.

The signal may reside within the noise floor making it indistinguishable from the extensive noise present within the ambient spectrum environment.

It is essential that the technical operator recognize and understand the effects of improper ADC settings.

As can be seen, the ADC setting can have a positive or negative effect on the quality of the measurement and therefore, the Probability of Detection (POD).

From the technical operator’s standpoint, these ADC related errors are not always easy to identify.

There is a cause and effect since errors at the ADC input carry through the rest of the Digital Signal Processing (DSP) path and the amount of the error is directly proportional to the signal level present at the ADC input based on the ADC gain and attenuation settings.

Resolution Bandwidth (RBW)

The Signal Hound (BB60C) legal value Resolution bandwidth (RBW) options are directly related to the selected Range of Interest (ROI).

Allowable RBW values are limited due to the high processing demands on the host computer and often the limitations of the SDR hardware.

Legal limit RBW values include 4.8 Hz, 9.6 Hz, 19 Hz, 39 Hz, 77 Hz, 154 Hz, 308 Hz, 616 Hz. 1.2 kHz, 2.5 kHz, 4.9 kHz, 9.9 kHz, 20 kHz, 40 kHz, 79 kHz, 316 kHz, 631 kHz, 1.3 MHz, 2.5 MHz, and 5 MHz.

BB60C | Resolution Bandwidth Vs SPAN							
	6000 MHz	3000 MHz	2000 MHz	1000 MHz	500 MHz	200 MHz	100 MHz
5 MHz	✓	✓	✓	✓	✓	✓	✓
2.5 MHz	✓	✓	✓	✓	✓	✓	✓
1.3 MHz	✓	✓	✓	✓	✓	✓	✓
631 kHz	✓	✓	✓	✓	✓	✓	✓
316 kHz	✓	✓	✓	✓	✓	✓	✓
157 kHz	✓	✓	✓	✓	✓	✓	✓
79 kHz	✓	✓	✓	✓	✓	✓	✓
40 kHz	✓	✓	✓	✓	✓	✓	✓
20 kHz	✓	✓	✓	✓	✓	✓	✓
9.9 kHz		✓	✓	✓	✓	✓	✓
4.9 kHz			✓	✓	✓	✓	✓
2.5 kHz				✓	✓	✓	✓
1.2 kHz					✓	✓	✓
616 Hz						✓	✓
308 Hz							✓
154 Hz							
77 Hz							
39 Hz							
19 Hz							
9.6 Hz							
4.8 Hz							

BB60C RBW Chart Vs SPAN | v1.37xx

BB60C | Resolution Bandwidth Vs SPAN						
	50 MHz	20 MHz	10 MHz	5 MHz	2 MHz	1 MHz
5 MHz	✓	✓	✓	✓	✓	✓
2.5 MHz	✓	✓	✓	✓	✓	✓
1.3 MHz	✓	✓	✓	✓	✓	✓
631 kHz	✓	✓	✓	✓	✓	✓
316 kHz	✓	✓	✓	✓	✓	✓
157 kHz	✓	✓	✓	✓	✓	✓
79 kHz	✓	✓	✓	✓	✓	✓
40 kHz	✓	✓	✓	✓	✓	✓
20 kHz	✓	✓	✓	✓	✓	✓
9.9 kHz	✓	✓	✓	✓	✓	✓
4.9 kHz	✓	✓	✓	✓	✓	✓
2.5 kHz	✓	✓	✓	✓	✓	✓
1.2 kHz	✓	✓	✓	✓	✓	✓
616 Hz	✓	✓	✓	✓	✓	✓
308 Hz	✓	✓	✓	✓	✓	✓
154 Hz	✓	✓	✓	✓	✓	✓
77 Hz		✓	✓	✓	✓	✓
39 Hz			✓	✓	✓	✓
19 Hz				✓	✓	✓
9.6 Hz					✓	✓
4.8 Hz						✓

BB60C RBW Chart Vs SPAN | v1.37xx

Kestrel Workstation

The Kestrel TSCM ® Workstation is a powerful professional grade portable workstation that is specifically pre-configured for use with the Kestrel TSCM ® Professional Software by our Technical Security Branch (TSB) ™.

The technical operator will be required to utilize a Challenge and Response (CRC) string to obtain the Activation Security Key (ASK) ™ required for use with the Kestrel TSCM ® Workstation.

We do not ship the ASK ™ with the Kestrel TSCM ® Workstation for security reasons.

TIP: It is recommended that a current technology and more powerful professional (gaming) level Laptop be utilized as a host computer. The Kestrel TSCM ® Professional Software is optimized for use with quad-core processors. It is recommended that a minimum of 16GB RAM and 17-Inch display with a screen resolution of 1280 x 800 or higher be utilized to significantly enhance operator interaction and to facilitate extended collection related assignments.

Where the Kestrel TSCM ® Professional Software is actively deployment within a fixed command post or deployed in a long-term spectrum monitoring role, special external graphics adapters may be utilized with additional high-resolution display monitors that allow the full potential of the Kestrel TSCM ® Professional Software application to be unleashed.

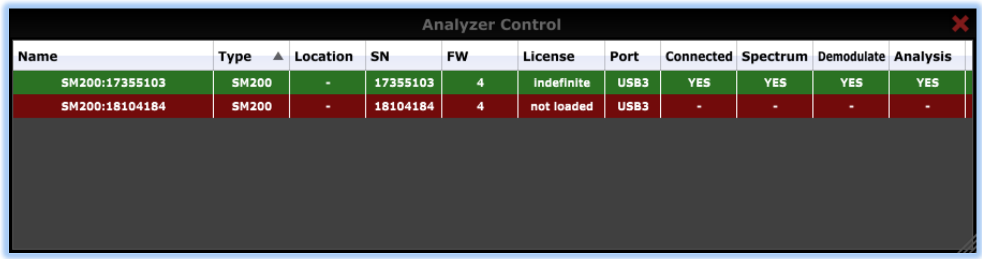
Contact the Technical Support Group (TSG) ™ for specific information and availability of the high resolution (USB 2.0) Kestrel Graphics Adapter (KGA) ™ modules for use in active command and control or fixed site monitoring installations.

Professional Development TSCM Group Inc., maintains the ability and equipment for the active deployment of the Kestrel TSCM ® Professional Software, Signals Intelligence Support System (SISS) ™ for large scale, real-time RF spectrum monitoring related assignments.

Analyzer Control

The selection of one (1) or more supported search receivers or analyzers is the first step in utilizing the Kestrel TSCM ® Professional Software, once the automatic initialization process is complete.

The initialization process is automatic, during the start-up of the application, as the software attempts to detect and initialize all receivers connected to the host computer, even if no valid Activation Security Key (ASK) ™ is present.


Analyzer Control

Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	indefinite	USB3	YES	YES	YES	YES
SM200:18104184	SM200	-	18104184	4	not loaded	USB3	-	-	-	-

Analyzer Configuration | v1.37xx

The | Analyzer Control | dialog window provides the details and status of all found search receivers and analyzers during the application start-up process.

It is recommended that the technical operator review and confirm the status and deployment programming for each of the search receivers and analyzers prior to navigating to the | New Project | menu option.

The Analyzer Control dialog window will automatically display when the Kestrel TSCM ® Professional Software application is first started.

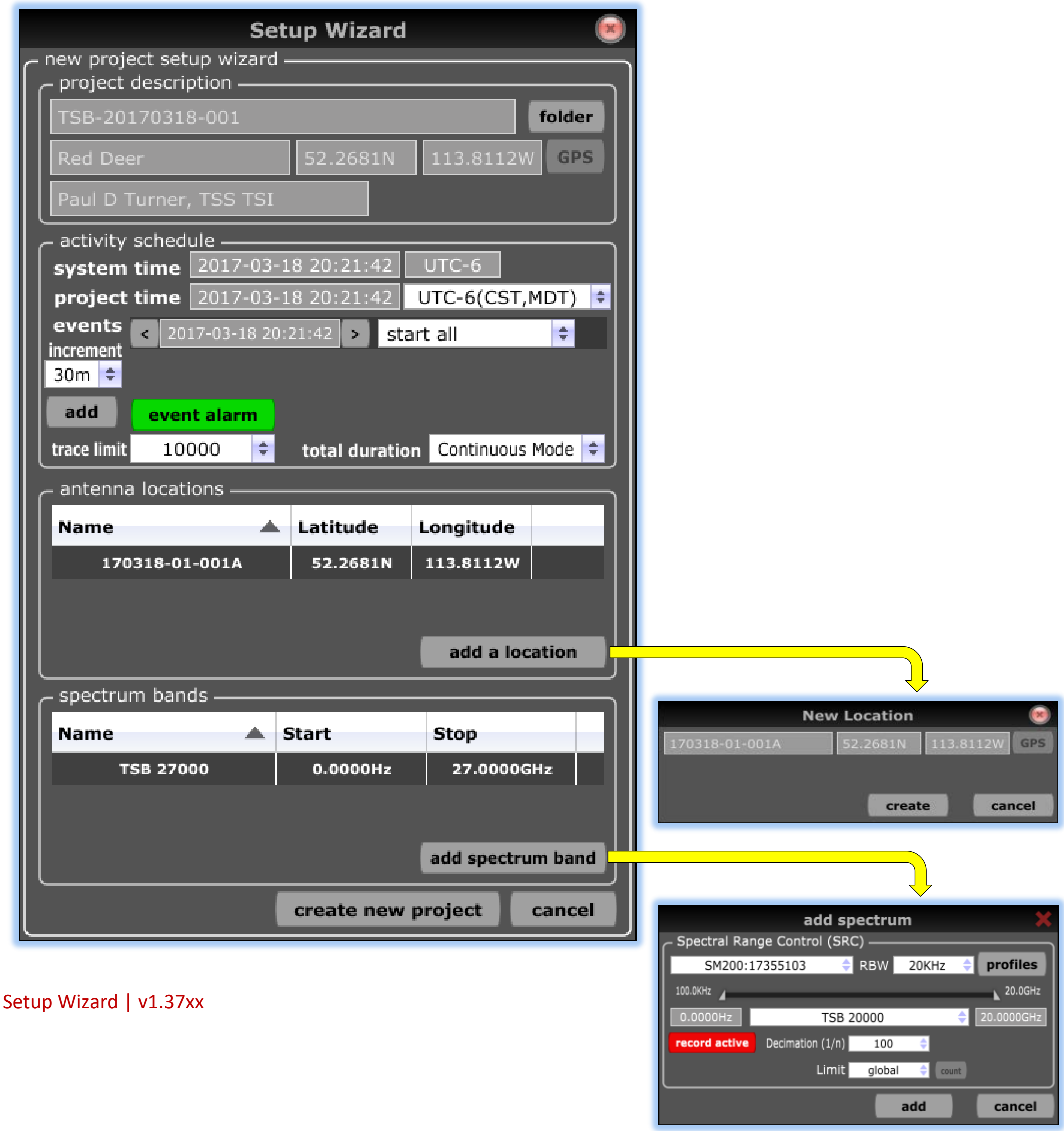
The technical operator may select and program any available; end-user licensed search receiver or analyzer from the| ACQUISITION | ANALYZER CONTROL | menu.

Only search receivers and analyzers supported by the Kestrel TSCM ® Professional Software may be utilized, even though all (supported) and found search receivers and analyzers will appear on the list.

An Activation Security Key (ASK) ™ is required for each search receiver.

The technical operator will require an Activation Security Key (ASK) ™, as part of the licensing management process, for each individual search receiver or analyzer.

The | Setup Wizard | dialog window is located on the | FILE | NEW PROJECT | menu structure within the menu structure.



Setup Wizard | v1.37xx

Support for a wide variety of professional level search receivers and spectrum analyzers is available or are currently under development for use with the Kestrel TSCM ® Professional Software.

The technical operator first selects a supported search receiver or spectrum analyzer and presses the | CONNECTED | button located within the Analyzer Control dialog window, if not currently connected, or when a valid Activation Security Key (ASK) ™ is not found during the initialization process.

A search receiver or analyzer configuration window may also be opened for the selected device and allows the technical operator to select various settings and features that are specific to the selected search receiver or spectrum analyzer.

The Kestrel TSCM ® Professional Software is specifically designed to mimic the characteristics and of the SDR search receiver or spectrum analyzer utilized.

This unique, technically sophisticated design permits unlimited flexibility and scalability at all known and developing threat levels and is ideal for a wide range of commercial, corporate security, law enforcement and government related deployment applications.

The ability of the technical operator to utilize a variety of supported search receivers and spectrum analyzers provides a wide range of basic, intermediate, and professional level options for deployment applications at all operational threat levels.

The ability to utilize several totally different search receiver or analyzers types is fully supported.

Signal Hound USB-SA44B (1 Hz - 4.4 GHz)

For the Signal Hound ™ Receiver, there are four (4) optional settings that need to be accepted as default or adjusted by the technical operator following the initialization process.

The technical operator can access the | Receiver Configuration | dialog by left mouse click on the search receiver name, or utilizing a right mouse click to display a menu dialog window.

Selecting the Configure menu option will also open the Configuration dialog window.

The factory default settings are highlighted in the following Signal Hound Initialization | Option Chart.

Signal Hound Initialization | Option Chart (USB-SA44B)			
Attenuation Level (dB)	***Low-Noise Amplifier (LNA)***	***Intermediate Frequency (IF) Sensitivity***	***Image Rejection Control (IRC)***
0 dB	***0 dB***	High	***On***
5 dB	+10 dB	Medium	HS Inject
10 dB		***Low***	LS Inject
15 dB			Off

Receiver Configuration | v1.37xx

Signal Hound USB-SA124B (100 kHz - 12.4 GHz)

For the Signal Hound ™ Receiver, there are three (3) optional settings that need to be accepted as default or adjusted by the technical operator following the initialization process.

The factory default settings are highlighted in the following Signal Hound Initialization | Option Chart.

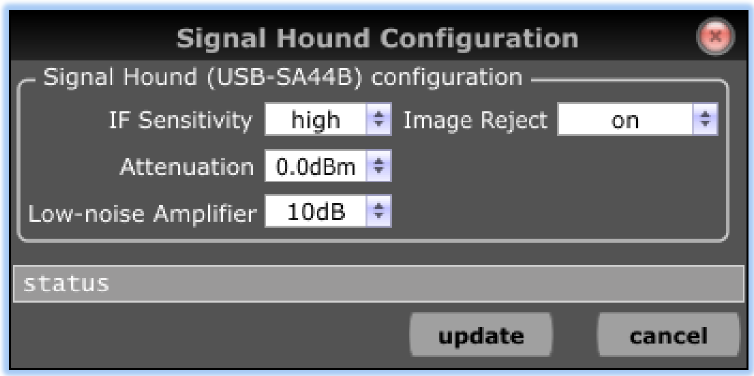
Signal Hound Initialization | Option Chart (USB-SA124B)			
Attenuation Level (dB)	***Low-Noise Amplifier (LNA)***	***Intermediate Frequency (IF) Sensitivity***	***Image Rejection Control (IRC)***
0 dB	***+10 dB***	High	***On***
10 dB		Medium	HS Inject
20 dB		***Low***	LS Inject
30 dB			Off

Receiver Configuration | v1.37xx

The USB-SA124B search receiver has an incorporated Low Noise Amplifier (LNA) that is always on and cannot be manaully controlled by the technical operator, unlike the USB-SA44B search receiver.

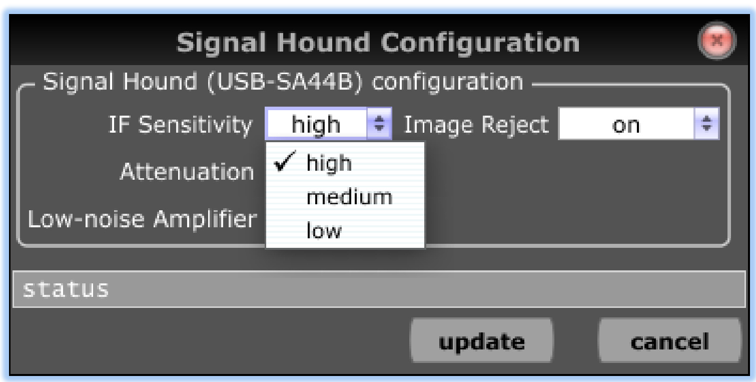
TIP: When the receiver is connected, and initialized for the first time, a set of factory default values are automatically selected. Once modified by the technical operator during the first initialization and analyzer configuration process, the Kestrel TSCM ® Professional Software will hold the current user settings as the new defaults until updated again in the future.

When the configuration menu option is selected; the Signal Hound ™ configuration dialog window will display and provide an opportunity for the technical operator to update the default or previously configured settings.



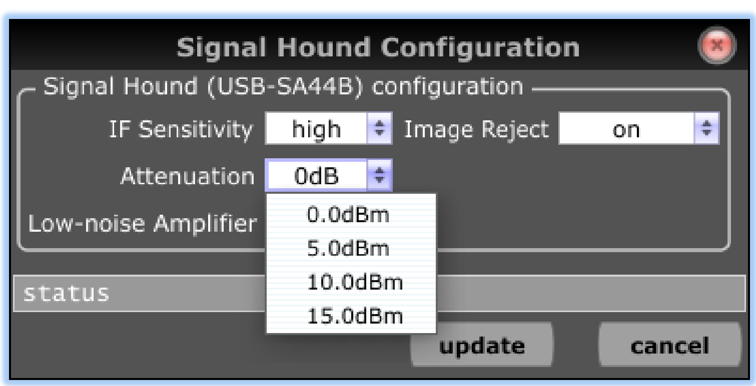
SA44B Signal Hound Configuration | v1.37xx

The above image represents the recommended settings for most deployment scenarios where collection is the primary function.



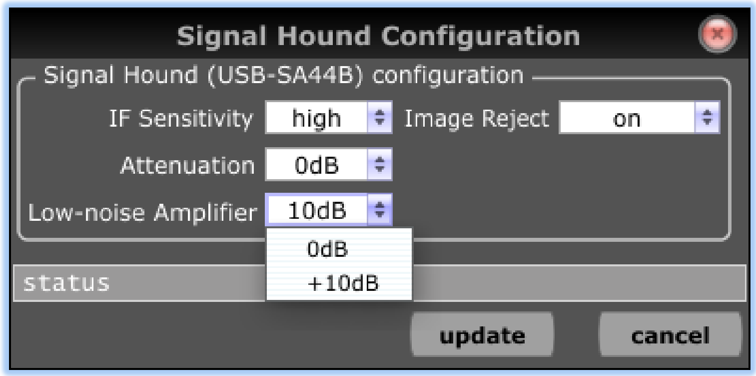
IF Sensitivity Signal Hound Configuration | v1.37xx

The IF Sensitivity may be set to | HIGH (16 dB Digital Gain) | MEDIUM (No Gain / No Attenuation) | LOW (12 dB Attenuation) | as required during deployment.



Attenuation Signal Hound Configuration | v1.37xx

Attenuation options are available | 0 dBm | 5 dBm | 10 dBm | 15 dBm | as required.



Low Noise Amplifier (LNA) Signal Hound Configuration | v1.37xx

A Low-Noise Amplifier (LNA) | 0 dB | +10 dB | may be utilized as required during deployment.

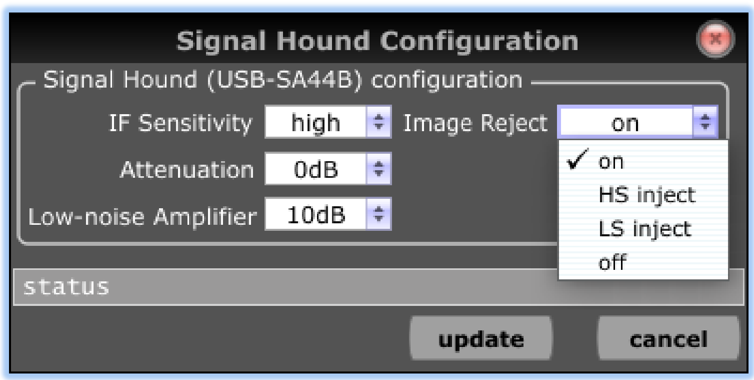


Image Rejection Signal Hound Configuration | v1.37xx

An Image Rejection control is also provided with selectable menu options including | ON | HS INJECT| LS INJECT | OFF | setting as may be required.

Signal Hound ™ Receiver | Error Codes

The following is an explanation of the various error codes that may be displayed during the hardware configuration and initialization process for the USB-SA44B and USB-SA124B receivers.

Error Code 1 | The Signal Hound ™ receiver was not found on an active USB port.

The most likely cause is forgetting to connect the hardware prior to initializing the software.

If the receiver is plugged in, check to see if the USB 2.0 cable is properly connected and not only partially plugged in.

If all appears correct, close the application, unplug the search receiver, reboot the host computer, re-install the USB driver and / or try a different USB 2.0 port.

Error Code 2 to 6 | The Signal Hound ™ receiver has experienced a USB related communications error.

If multiple errors occur, try closing the software application, unplug the Signal Hound ™ receiver, wait 30 seconds, connect the receiver and try again.

If you get a recurring or persistent error, make a note of the error code and contact technical support at support@signalhound.com.

Attenuation

Select the Attenuation setting as desired or required, given the Ambient RF Signal Environment encountered within the working target area.

Attenuation setting options for the Signal Hound ™ USB-SA124B include,

| 0 dB | 10 dB | 20 dB | 30 dB |

Attenuation setting options for the Signal Hound ™ USB-SA44B include,

| 0 dB | 5 dB | 10 dB | 15 dB |

The factory default is 10 dB.

Low Noise Amplifier (LNA)

The Signal Hound ™ Receiver (USB-SA124B) search receiver is equipped with an internal 10 dB LNA that is always ON and cannot be turned OFF or adjusted by the technical operator.

The Signal Hound ™ Receiver (USB-SA44B) is equipped with an internal 10 dB LNA that may be selected either ON or OFF as required by the technical operator.

The factory default is OFF.

Intermediate Frequency (IF) | Sensitivity

The IF Sensitivity may be set during the initialization process or adjusted in real-time during active runtime deployment.

The following Intermediate Frequency (IF) Sensitivity options are available to the technical operator | LOW | MEDIUM | HIGH | during the initialization process and may also be changed during deployment as required from within the application from the menu toolbar | ACQUISITION | ANALYZER CONTROL | CONFIGURATION | as required.

The Signal Hound ™ search receiver, IF sub-system offers three (3) operational modes, providing, attenuation, neutral gain and digital gain depending on the currently selected mode.

Signal Hound ™ IF Sub-System | Settings		
LOW	Inserts | IF Attenuation	16 dB
MEDIUM	Removes | IF Attenuation	Neutral Gain
HIGH	Adds | IF Digital Gain	12 dB
Factory Default	***16 dB | IF Attenuation***	***LOW***

Configuration | v1.37xx

Image Rejection

There are four (4) image rejection related control options available to the technical operator during the initialization and setup.

Image rejection setting may be adjusted during runtime.

Options include | ON | HS INJECT | LS INJECT | OFF |.

The technical operator can adjust the Image Rejection during the receiver initialization process, utilizing the | ACQUISTION | ANALYZER CONTROL | RECIEVER CONFIGURATION | dialog window during active deployment from the main menu structure.

Disabling | OFF | the Image Rejection will cause out of band image frequency spikes to be displayed on the RF Spectrum Display (RSD) and the Waterfall Display (WFD) and will not provide any filtering of noise related artefacts when a wide SPAN is selected.

Disabling the Image Rejection is recommended for the analysis of several types of signals and modulation, including Frequency Hopping Spread Spectrum (FHSS), Time Domain Multiple Access (TDMA) signals and other similar signal types when viewed in a narrow SPAN.

To minimize undesirable out of band images, the technical operator must narrow the search Range of Interest (ROI) to that specifically required for the analysis of the Signal of Interest (SOI).

The factory default for Image Rejection is ON.

Update Receiver Configuration

The Signal Hound ™ Receiver configuration may be updated during runtime operation and is accessed on the main toolbar menu| ACQUISITION | ANALYZER CONTROL | option.

Utilize a mouse click on the “default” or “friendly” name for the receiver or analyzer that you wish to configure, to display the configuration dialog window.

Available options are device specific.

The technical operator can change the Attenuation level, Low Noise Amplifier (LNA) settings, Intermediate Frequency (IF) Sensitivity and Image Rejection for the USB-SA44B search receiver.

The technical operator can change the Attenuation level, Intermediate Frequency (IF) Sensitivity and Image Rejection for the USB-SA124B search receiver.

When the technical operator has selected the desired configuration changes, the | UPDATE | button completes the process.

The | CANCEL | button may be utilized to cancel the configuration process without making any changes.

TIP: When any of the above settings (Attenuation Level; LNA; IF Sensitivity; or Image Rejection) are adjusted by the technical operator; it will be necessary to manually adjust the settings again in the future should this be desired. Changes to these settings are set to the Signal Hound firmware until updated again in the future.

Once the receiver setup process is successfully completed, the analyzer control window may be closed and the technical operator can navigate to the Setup Wizard and establish a project file.

The technical operator must carefully consider and establish a formal File Naming Convention (FNC) to ensure the integrity of project file data.

Project related information is utilized to populate various reporting parameters, including the Session Report Generator (SRG) ™ and therefore technical operator consistency is essential.

Kestrel Project File (KPF) ™ | Description

The technical operator is required to enter a | PROJECT FILE NAME | PROJECT LOCATION | TECHNICAL OPERATOR | in the project description section for the | Setup Wizard | in the File Naming Convention (FNC) of preference.

TIP: Please understand the importance of the File Naming Convention (FNC) utilized for the project description information, as this provides the ability to manage spectral data from multiple deployment dates; times; locations; and is utilized for report generation.

In the event that the technical operator wishes to provide collected data to a third party, for training purposes or any other reason that it is essential that a non-specific, non-identifying format be utilized for security reasons.

The following file format is utilized by Professional Development TSCM Group Inc., and is offered as an example of a consistent File Naming Convention (FNC) to better manage Project Files and Session Reports.

Project File: TSB-20171208-001

Location: Red Deer County

Technical Operator: Paul D Turner, TSS TSI

In the above example; the project file name is utilized to indirectly identify the client without breaching client confidentiality, should the file be compromised for any reason, the client is not directly compromised.

However, it must be remembered that other potentially identifying information may also be collected, such as GPS coordinates, etc.

TIP: It is recommended that this information be of a consistent and simplified format to aid in locating and accessing comparative data in the future. Project file information is utilized by the Kestrel TSCM ® Professional Software to populate the Automatic Threat List (ATL), project file management structure and for report generation. Utilizing short file names will enhance the displayed character limitations within the various GUI status displays.

There is also a Folder option located in the Setup Wizard to allow the technical operator to change and associate the physical Kestrel Project File (KPF) with a specific storage location.

The technical operator may also utilize the | MENU | FILE | PROJECT ROOT | option to set the default directory storage location for the host computer.

It is recommended that the technical operator create a directory on the desktop to store all individual project file directories and the associated file structure.

By default, project files are stored in the application installation directory unless changed by the technical operator during the install or after installation is accomplished.

Activity Schedule

The Kestrel TSCM ® Professional Software includes a cutting-edge Activity Schedule feature that provides the technical operator with multiple bands and multiple events scheduling capability at the project level.

The technical operator may run the software in uninterrupted Continuous Mode, select a Total Duration Time, or provide multiple band specific Start / Stop events.

The Activity Schedule programming dialog window is located and displayed as part of the | SETUP WIZARD | functionality.

The project Activity Schedule programming dialog window permits the technical operator to input custom settings, including the Total Duration Time, Continuous Mode operation, Delayed Start, Multiple Band and Multiple Event programming.

The ability to schedule multiple, START and STOP events, across multiple spectrum bands and search receivers, is fully supported within the Kestrel TSCM ® Professional Software and permits precise event activity control for unattended deployment scheduling.

The Total Duration runtime event scheduler can also be programmed by the technical operator to establish a limit on the total amount of active collection time; and may be set from the | FILE | SETUP WIZARD | or during runtime by accessing the | PROJECT | EVENT SCHEDULE |menu option.

Consider the following Activity Schedule, based on a single spectrum band.

Activity Schedule Programming – Example Chart (Single Band)		
Date / Time:	2012-04-06 08:00:00	Current ***Date / Time*** Setting
Activity (Start):	2012-04-06 08:30:00	Delayed Start Mode (DSM) = 30 Minutes
Activity (Stop):	2012-04-06 09:00:00	Collection Time = 30 Minutes
Activity (Start):	2012-04-06 11:00:00	Start Collection = 120 Minutes
Duration / Collection:	2012-04-06 13:00:00	Total Duration = 5 Hours / Collection = 2.5 Hours

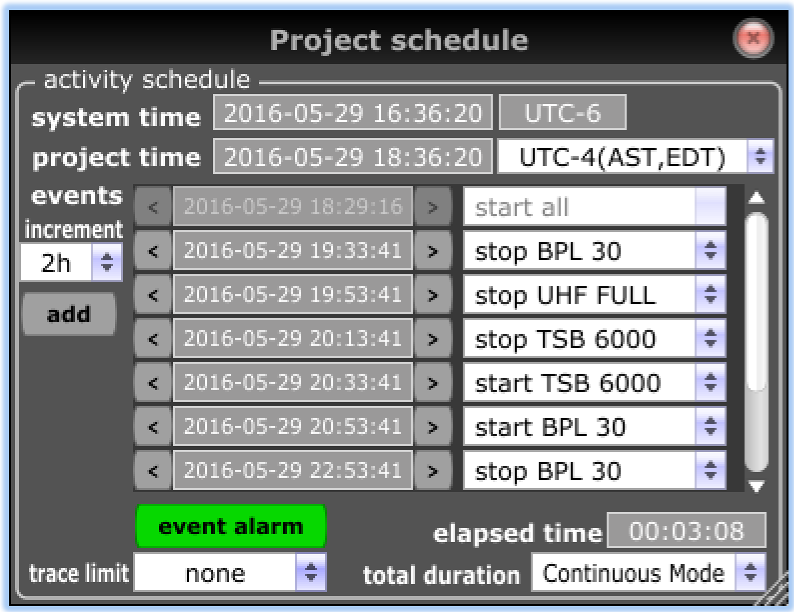
Activity Schedule | v1.37xx

The ability of the technical operator to initiate advance Activity Schedule programming or alter programming during runtime, set any number of multiple START and STOP project activity schedule events, across multiple bands and multiple search receivers, with the ability to program the | Total Duration | run time, or utilize the | Continuous Collection Mode (CCM) ™ | is another development milestone for the Kestrel TSCM ® Professional Software.

The project Activity Schedule and Event Schedule functionally provides outstanding flexibility for unattended operation and deployment.

The manual reactivation and Activity Schedule over-ride of any currently stopped spectrum band during runtime is fully supported by simply by pressing the Pause / Restart button.

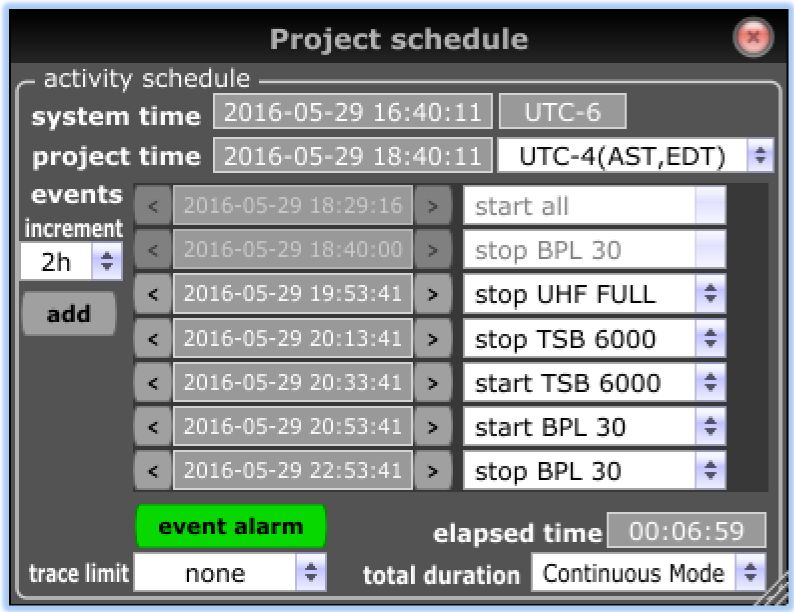
The use of the Delayed Start Mode (DSM) feature and the Total Duration runtime event settings are an excellent way to limit the large amount of perhaps unnecessary spectrum data that otherwise must be captured, stored and / or processed by the technical operator during post analysis review.



Project Schedule | v1.37xx

The above Project Schedule dialog window illustrates the programming events and status for various spectrum band allocations.

Active or pending schedule events can be edited during runtime, grayed out events are past events and cannot be edited.



Project Schedule | v1.37xx

When the | EVENT ALARM | button is active, an operator selected audible tone will sound in response to the completion of each scheduled project event.

The | TRACE LIMIT | setting takes precedence over the time-based scheduled project events.

The | TRACE LIMIT | feature is a global setting that stops collection on any runtime spectrum band when the selected trace count is reached.

The | TOTAL DURATION | setting takes priority over the time-based scheduled events.

This feature provides a hard-stop capability when the maximum operator defined run time is reached.

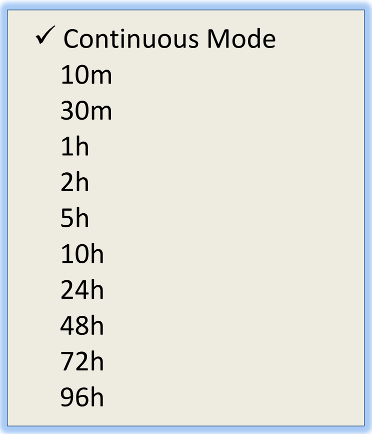
Total Duration

The technical operator can set the active collection | TOTAL DURATION | runtime and / or the | DELAY START MODE (DSM) | activity schedule for the current deployment.

The | TOTAL DURATION | quick selection box includes | CONTINUOUS | 10 MINUTE | 30 MINUTES | 1-HOUR | 2-HOURS | 5-HOURS | 10-HOURS | 24-HOURS | 48-HOURS | 72-HOURS | 96-HOURS | options.

The technical operator may also select the | Total Duration | text input box and enter an optional custom duration time setting as may be required for the current deployment.

TIP: The technical operator must enter the desired number of hours in the following format | 60m (minutes) | 120h (hours) | 10d (days) | to set the total duration to a custom duration, as desired. When no total during time is set, the software will run in Continuous Collection Mode (CCM) and respond to scheduled project events.



Total Duration Option Box | v1.39xx

The | Continuous Collection Mode (CCM) | allows the technical operator to bypass the scheduling (Delay Start / Duration) control functionality and cause a continuous runtime event until manually stopped by the technical operator or Activity Schedule event programming.

The Default setting on initialization is the Continuous Mode.

Project Scheduling | Delayed Start Mode (DSM)

The DSM ™ setting adds important functionality; and allows the technical operator to setup the Kestrel TSCM ® Professional Software in advance of an intended collection assignment for totally unattended operation.

Multiple instances of runtime activity scheduling are fully supported to START and STOP the data collection process at precise specific points in time.

The actual working duration collection time is limited only by the amount of storage space available on the host computer, or optional network storage drive.

Extended collection times at narrow Resolution Bandwidth (RBW) settings will result in very large project file sizes and will vary significantly depending on the active Range of Interest (ROI), collection duration time; number of active spectral windows and other factors, including active threat detection programming.

TIP: It is not possible to provide a definitive file size or storage requirement reference chart due to the number of variable conditions that potentially affect the actual file sizes. It is recommended that the technical operator ensure that sufficient storage space be available for the intended deployment.

Time Zone (Project Local Time Vs UTC)

The technical operator is able to adjust the working | PROJECT | time zone independently of the host computer regional time zone settings.

This important functionality prevents the need to alter the host computer regional time zone settings when either travelling in different active time zones, or when conducting analytics on a historical file within a different regional time zone.

In order to accommodate complex date and time relationships across multiple time zone deployment, the Kestrel TSCM ® Professional Software supports Universal Coordinated Time (UTC) and permits an operator defined programming option within the | SETUP WIZARD | and | PROJECT | EVENT SCHEDULE | menu to adjust the project collection date / time stamp off-set.

The ability to set the current project time zone from within the application, eliminates the need for the technical operator to constantly change the host computer regional date / time settings during travel and operational deployment, within different active time zones.

The technical operator is able to adjust the working project level time zone independently of the host computer regional local time settings.

To accommodate multiple time zone deployment, the Kestrel TSCM ® Software supports Universal Coordinated Time (UTC).

By default; the application will utilize the host computer regional date / time zone settings as the date time source for time stamping.

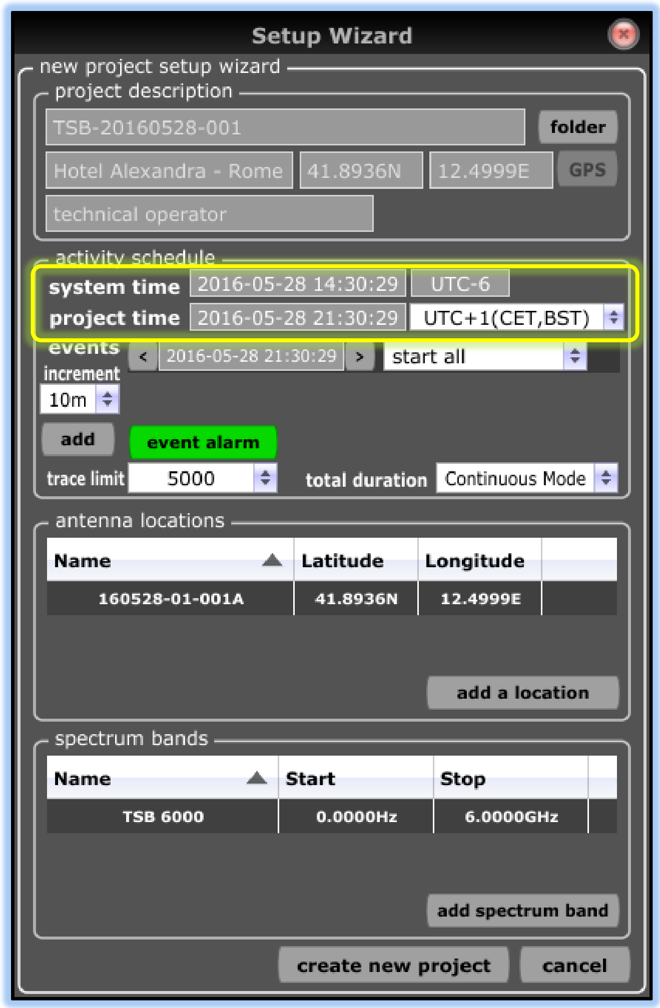
The current date / time will appear within the | SETUP WIZARD | and may be off-set by the technical operator to reflect the time zone the technical operator is currently deployed.

The time zone dialog will also display on the Project Schedule dialog window accessed from the | PROJECT | EVENT SCHEDULE | menu during runtime.

The correct computer (home) date / time regional settings are essential for a variety of operational and legal reasons.

TIP: Recent code level updates to the time handling system within the software at the v1.37xx release level has resulted in several benefits and a couple of notable steps to ensure full and unrestricted backward compatibility with historical Kestrel Project Files (KPF) ™ captured in previous versions of the software. First, from release v1.37xx and later, the software will calculate the time zone and local time against Universal Time Coordinated (UTC), whereas in previous software releases, time zone and time stamps were calculated against UTC and local time values. Therefore, attempting to open a historical captured file in v1.37xx and later requires that the time stamps within the file be updated to reflect UTC values. This process is handled automatically by v1.37x or later when the operator attempts to open a project, captured in a software version prior to v1.37xx. A message will alert the operator that the file contains old time stamp values and can be updated to the latest time stamp format. Please note that large files may take an extended period of time to complete the update process, which I reversible, if required. The original data files are retained within the project file structure. As this will double the project file size, it is recommended that the operator confirm the updated file integrity and then delete the old file data. The second notable relates to any attempt to open an updated (converted) project file in a software release prior to v1.37xx. To prevent this from occurring, a user-interface inter-lock has been implemented to prevent the file from opening, rendering only the UI and not the project. It is strongly recommended that all operators maintain the latest software releases, however, it is our commitment to ensure full backward compatibility for historical project files when modernizing the software code base with each new build.

The failure to ensure that the | HOST COMPUTER | or | TIME ZONE | settings are correct, may result in all collected trace data being flagged with incorrect date / time stamps.



Setup Wizard | v1.37xx

The above example illustrates the home time zone (-6 UTC) and the working time zone (+1 UTC).

The technical operator is able to review the activity schedule at any time during by accessing the | PROJECT | EVENT SCHEDULE | menu option.

The ability to deploy the Kestrel TSCM ® Professional Software for unattended collection significantly enhances the technical operator workflow management concept.

Unattended deployment is critical to making the most of limited budgets and the typically limited “time-on-task” during inspections.

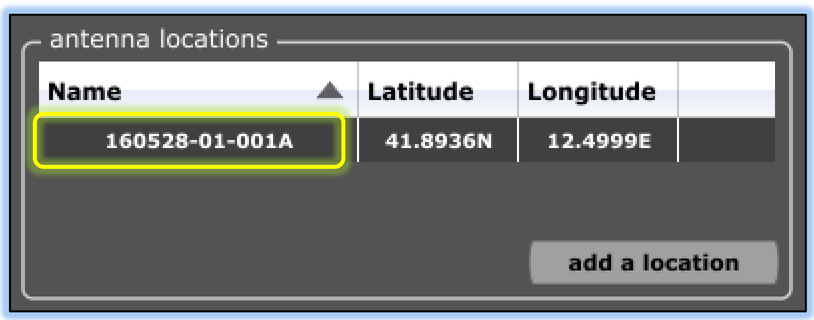
The ability of the Kestrel TSCM ® Professional Software to work in the background allows the technical operator to complete other essential tasks and perhaps focus on physical inspection elements, for example.

Antenna Location

The Antenna Location window allows the technical operator to define one (1) or more collection locations for the purpose of establishing a working Differential Signal Analysis (DSA) session.

It is essential to enter the location description even if there is no intention of utilizing the DSA feature.

Otherwise; the Antenna Location status display and the Automatic Threat List (ATL) will display “default” making it difficult or impossible to determine the collection location during post analysis review.

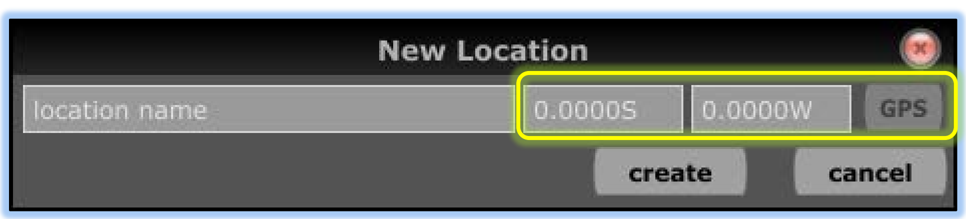


Antenna Location | v1.38xx

The Antenna Location is defined as the precise physical location of the search receiver or spectrum analyzer Antenna for the purpose of active collection.

The above image illustrates the ability of the technical operator to define and add multiple Antenna Locations from within the | Setup Wizard |.

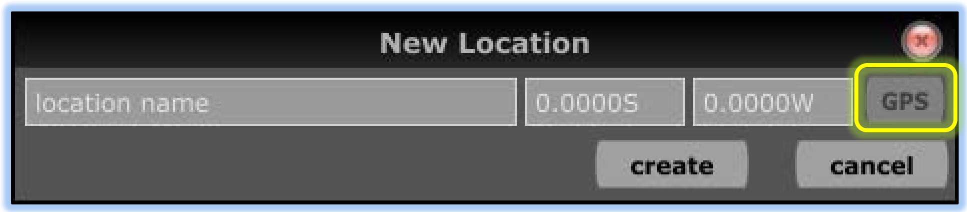
To define a new | ANTENNA LOCATION | the technical operator may either mouse click on the gray background to reveal the | NEW LOCATION | menu option or press the | NEW LOCATION | button.



Antenna Location | v1.38xx

The above example illustrates the default New Location dialog window and indicates that a GPS receiver is not currently connected.

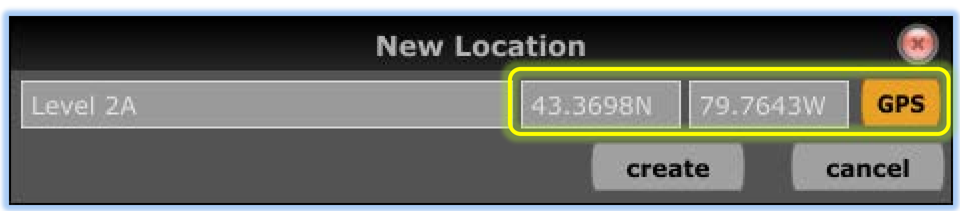
When the | GPS | button is grayed out, there is no satellite data available.



Antenna Location | v1.38xx

When GPS satellite data is available the button will display orange in colour.

When the technical operator presses the GPS button, the coordinates of the current location will be populated for the current location.



Antenna Location | v1.38xx

The technical operator has entered a name for the current antenna location; this name may be a floor or facility level, room number or department; or any other description of the target area as desired.

It is recommended that this description or tag be keep to a maximum of approximately 14 characters, numbers and space separators to ensure that the entire name displays correctly on the | DSA ICONS |.

It is strongly recommended that a consistent File Naming Convention (FNC) be established.

The following is an example of the standardized | TSB2000 (Technical) Standard | FNC | format descriptor.

< 160529-03-001A >

Decoded, the above format descriptor represents the | DATE **< 160529 >** | FACILITY LEVEL **< 03 >** | ROOM / AREA LOCATION **< 001 >** | LOCATION WITHIN ROOM / AREA **< A >** |.

Try your hand at decoding the following | DSA | ANTENNA LOCATION | descriptors; **< 160531-02-001B >** | **< 150423-07-004C >** | **< 130219-72-001A >** |.

When any supported generic USB GPS receiver is connected to the host computer, active GPS coordinates may be captured during the setup process for each defined Antenna location.

The technical operator can also manually enter the geographical coordinates including the Latitude and Longitude, if known, when no GPS receiver or GPS signal is available.

TIP: Our Software Development Group (SDG) has developed GPS receiver data integration for use with the Kestrel TSCM ® Professional Software application that will automatically populate the Latitude and Longitude when GPS data is available.

The current active Antenna Location is utilized by the Kestrel TSCM ® Professional Software to identify the actual collection location for post analysis review and for DSA comparative analysis.

The Antenna Location is the actual physical location of the search receiver antenna and not necessarily the search receiver or the operator when the Kestrel TSCM ® Professional Software is remotely deployed or network monitored.

TIP: The technical operator may deploy the actual search receiver antenna in a specific target area, meeting room, or office; and monitor the ambient RF spectral environment from a remote location. Therefore, the technical operator's working location; or that of the actual search receiver are not important; however, the precise location of the actual receiving antenna is a critical factor.

The actual antenna location is defined and utilized to identify the precise location of collection when utilizing the Differential Signal Analysis (DSA) functionality to identify individual collection locations for comparative purposes and permitting meaningful post analysis review.

It is essential that the technical operator utilize a descriptive and consistent File Naming Convention (FNC) to ensure that the precise location, for which spectral data was previously collected, can be quickly and accurately determined.

In the event that the technical operator wishes to provide collection related data to a third party or for training purposes, it is essential that a non-specific, non-identifying format be utilized for security reasons.

This is a common sense, due diligence and best practice for general in-house data storage.

TIP: For example, utilizing "John Smith's Office" might be problematic from a data security point of view, whereas utilizing "160523-01-002A" removes specific client related identifying factors when combined with graphical floor plan and mapping.

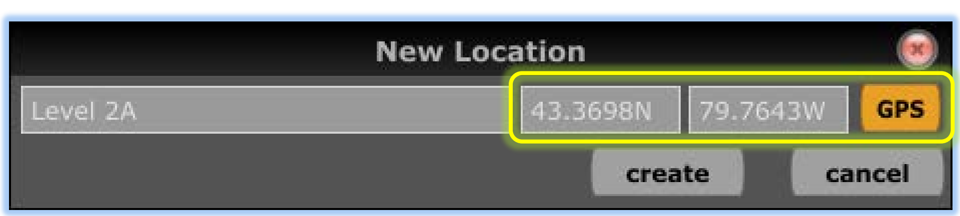
It is essential that the technical operator develop a consistent File Naming Convention (FNC) so that historical files can easily be located for comparative purposes; and for data security reasons in protecting confidential client related information.

It is important to recognize that there is a displayed character limitation within the DSA and other information status windows.

The technical operator is advised to keep the Antenna Location description names as short is possible to ensure they are correctly displayed.

GPS Integration

The ability to capture the latitude and longitude is possible when an approved and supported generic USB GPS receiver module is connected to the host computer.



GPS Data | v1.38xx

When a supported GPS receiver module is connected, but no GPS fix is available, a warning dialog box will display when the capture GPS coordinates button is pressed.

See Chapter 16

Advanced Signal Intelligence Database (ASID)

When active GPS data is available during the initial set-up process, or when a new location is created, pressing the GPS button results in the capture of the current Latitude and Longitude for that specific location.

It is also possible to enter a master set of coordinates within the Setup Wizard, which will then populate as the default coordinates when new DSA locations are added.

For example, when the technical operator cannot receive GPS data, coordinates can be entered manually and will display as the default coordinates.

Should GPS data be available, pressing the capture button will have the same result and is useful when working indoors and at a single sweep location.

The technical operator may optionally enter a set of geographical coordinates manually from within the | ANTENNA LOCATION | dialog window during the initialization process or during runtime when a new location is created, in the event that GPS data is not available.

The Latitude and Longitude text entry boxes are located within the | SETUP WIZARD | ANTENNA LOCATION | control group and the | NEW LOCATION | dialog window.

The Signal Hound SM200A has on-board GPS capability and ports GPS coordinates and precision time stamping ability when a GPS signal is present.

This ability provides GPS and GLONASS location telemetry data.

Spectral Range Control (SRC)

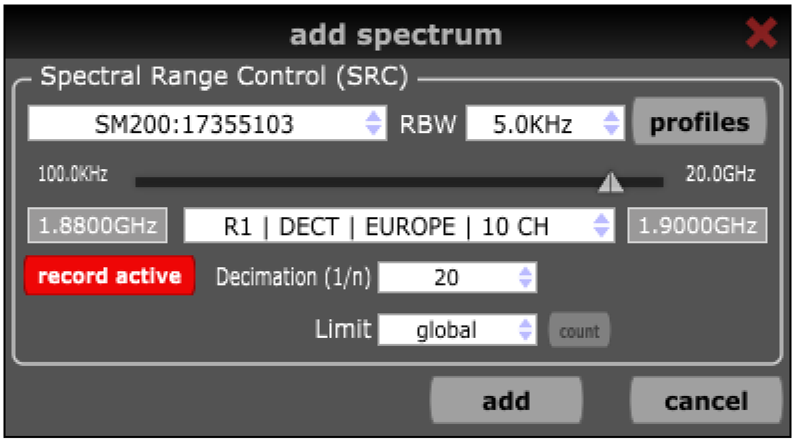
The technical operator can select the Range of Interest (ROI) utilizing several methods during the project set-up phase and during runtime.

The ROI slider bar may be utilized to quickly and roughly select the START and STOP frequency range.

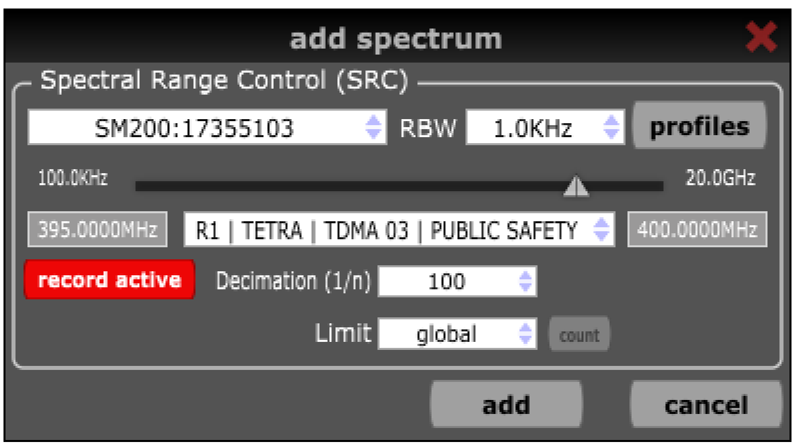
The ROI slider bar provides a non-precise method and simply allows the technical operator to open a spectral window based on an approximate bracketing of the START and STOP frequency range desired.

The technical operator can manually enter the desired | START | and | STOP | frequency or select various default and custom, operator specific Spectral Profiles from the SRC selection box.

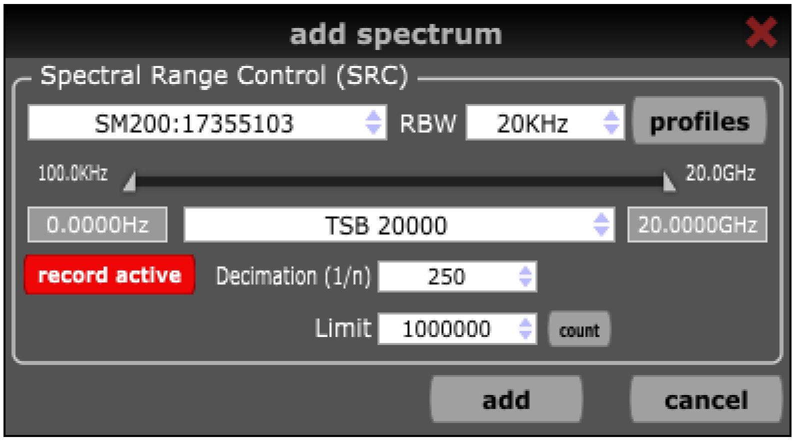
This advanced functionality provides the technical operator with unprecedented flexibility in customizing the application for use in specific operational environments.



Spectral Range Control (SRC) | v1.38xx



Spectral Range Control (SRC) | v1.38xx



Spectral Range Control (SRC) | v1.38xx

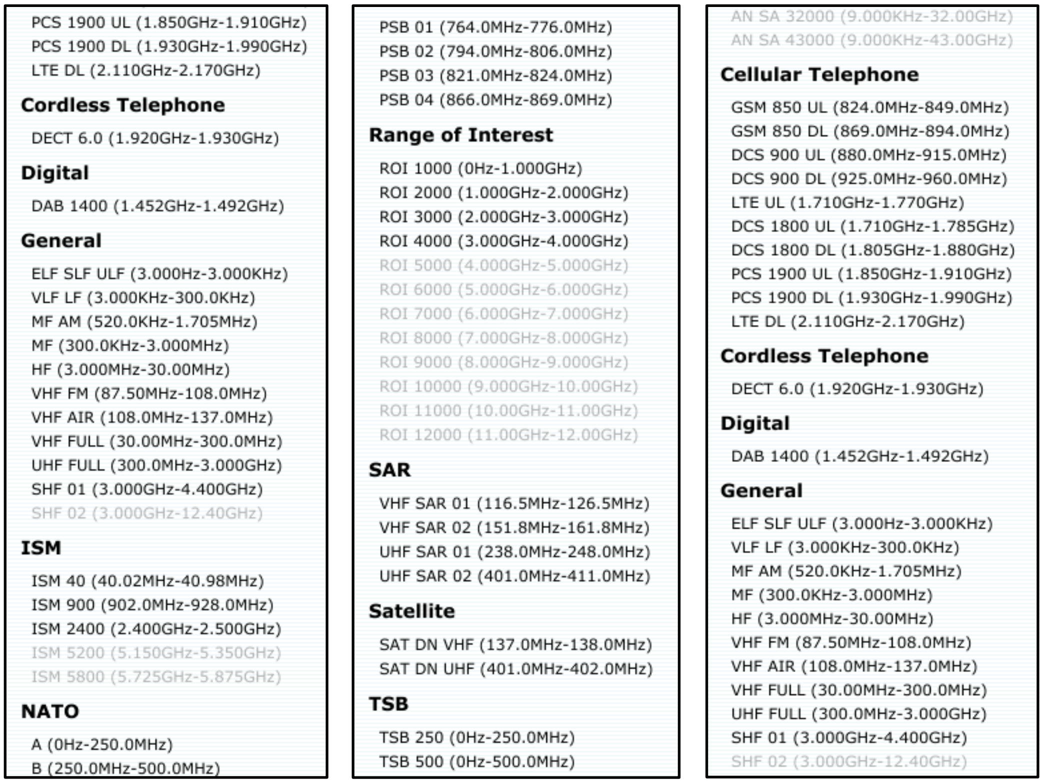
The spectral profile list option box is populated with a number of default ranges when the software is first installed, however the technical operator is able to create, edit, copy, import or delete those that are not appropriate for the country or region of deployment.

The ability to maintain multiple, Spectral Profiles (SPF) is fully supported and the technical operator can select the required SPF file.

The technical operator may add, delete and edit the spectral range profiles based on deployment specific requirements, or a working geographical and regional location basis.

Spectral ranges that are outside of the currently initialized search receiver or spectrum analyzer will not be available for selection and will appear on the list, but as grayed out items.

This unique flexibility and control allow spectral ranges to be established for more than one (1) supported and licensed search receiver or spectrum analyzer type.



Spectral Profile List | v1.37xx

The above example illustrates the benefits of a technical operator modified spectral range list, with customized categories.

The technical operator will note that some options are not available for the selected and initialized search receiver (DC to 4400 MHz) as they are outside of the range capability of the selected receiver.

These Spectral Profile options will only appear for selection when a supported search receiver covering the required frequency range is initialized.

The Spectral Profile list file is named, "SpectralProfiles.spf" and can be moved to another host computer running the Kestrel TSCM ® Professional Software by the technical operator for operational, convenience or security reasons.

The "SpectralProfiles.spf" file is located within the default installation directory and may be relocated utilizing the | FILE | SETTINGS DIRECTORY | menu item.

This advanced capability is not only an important security feature; but also ensures that the technical operator will not need to recreate mission specific Spectral Profiles when utilizing the Kestrel TSCM ® Professional Software on another host computer during field deployment.

TIP: The ability to create and maintain specific and separate spectral profiles; that are mission; or client specific; is fully supported by the Kestrel TSCM ® Professional Software.

This unique concept allows the technical operator to create; edit; select; copy or delete mission specific spectral profiles in advance rather than in the field; and focusing the technical operator's full attention on collection and analysis, rather than mission preparation and setup.

Spectral Range Control (SRC) | Defaults

During the software installation process, a default Spectral Profile is created as a sample and reference and may be customized by the technical operator.

The technical operator can create, edit, select, cop or delete the "Default" spectral profile, as well as create any number of custom spectral profiles and associated category headings.

The technical operator can utilize the Spectral Profile Editor (SPE) to assign or change the current or "Default" spectral profile displayed when the application is first started.

The following Spectral Profile table outlines the installation default Spectral Profile band allocations.

The ability of the technical operator to "Select SPF File", "Copy SPF to New File", "Import SPF from (.CSV)", is fully supported.

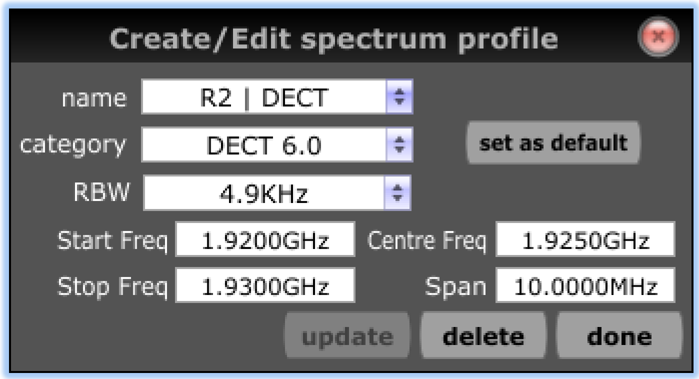
Editing the current or default SPF is accomplished utilizing the Spectrum Profile Editor (SPE) accessed from the | SPECTRUM | SPECTRUM PROFILE EDITOR | menu option.

Spectral Profile Editor (SPE)

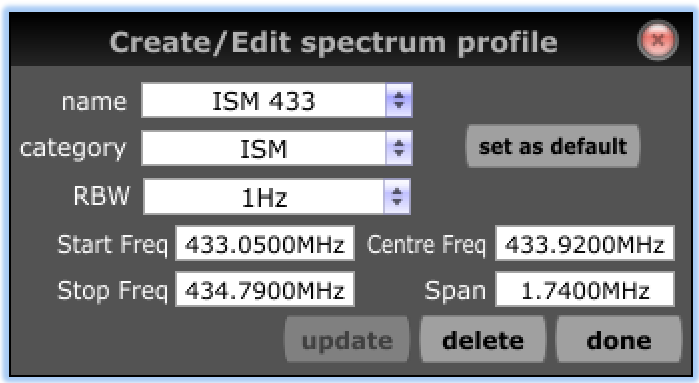
The Spectral Profile Editor (SPE) is a powerful software feature that allows the technical operator to create, edit, rename, reorder and delete any default or custom Spectral Profile File (SPF).

The Spectral Profile Editor (SPE) allows the technical operator to enter a spectral profile name, category and the desired profile details for storage in the default

"SpectralProfiles.spf" file that can be moved to another host computer running the Kestrel TSCM ® Professional Software.



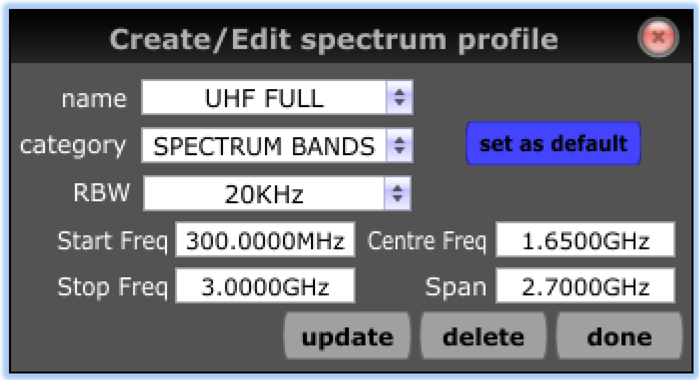
Spectral Profile Editor (SPE) | v1.38xx



Spectral Profile Editor (SPE) | v1.38xx

The following Spectral Profile Editor (SPE) dialog window indicates that the displayed spectrum band is currently set as the Default profile.

When the application is first started; the default spectral profile will display automatically in the | SETUP WIZARD | SPECTRAL RANGE CONTROL (SRC) | window and may be edited at any time.



Spectral Profile Editor (SPE) | v1.38xx

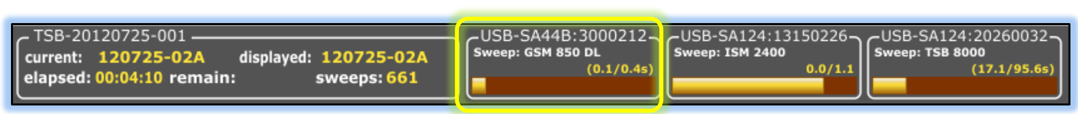
TIP: The SPE name; custom bandwidth; or short description utilized by the technical operator will appear within the independent activity status display located on the bottom of the GUI for each receiver or analyzer; and within the SDR runtime activity status display located on navigation control group. Consideration to short but descriptive profile names will ensure that they are correctly displayed.

The technical operator can enter the | START | frequency, | STOP | frequency, | CENTER | frequency, | SPAN | and | RBW |.

When the technical operator enters the | CF | and | SPAN |, the software dynamically populates the | START | and | STOP | frequency details.

When the technical operator enters the | START | and | STOP | frequency, the software dynamically populates the | CF | and | SPAN | frequency details.

The | NAME | of the Spectral Profile is utilized by the software when selected from the option list.



Activity Status | v1.38xx

The | START | and | STOP | frequency is utilized by the software when the technical operator manually enters the | START | and | STOP | frequency, rather than selecting an established spectral profile.

In the example below, the technical operator manually entered the | START | and | STOP | frequency Range of Interest (ROI) as 2150 MHz – 2250 MHz rather than selecting a spectral profile.

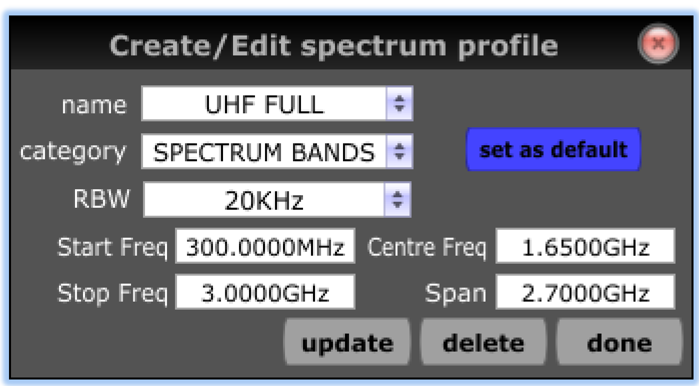
Activity Status | v1.38xx

Setting the Resolution Bandwidth (RBW) sets the desired RBW as the “default” value displayed during initialization for any specific Spectral Profile band allocation selected.

The technical operator may select a Spectral Profile from the list and change the “default” value of the RBW at any time during the initialization process or during an active sweep session as desired.

Set Default | Spectral Profile

The technical operator has the ability to set any of the Spectral Profiles list options as the active default value during the initialization process utilizing the Spectral Profile Editor (SPE).



Spectral Profile Editor (SPE) | v1.38xx

The technical operator is able to select any currently available Spectral Profile or create a new profile and once selected, the operator can open the Spectral Profile Editor (SPE) and press the "Set as Default" button.

This action causes the selected profile to appear as the Default spectral profile within the | SETUP WIZARD | SPECTRAL RANGE CONTROL (SRC) | in the future, until a new default value is selected by the technical operator.

Resolution Bandwidth (RBW)

The RBW determines the Fast Fourier Transform (FFT) bin size or the smallest frequency that can be resolved for detection, display and threat analysis.

When utilizing an analog spectrum analyzer, the RBW is the bandwidth of the Intermediate Frequency (IF) filter, which determines the selectivity of the instrument.

For wide frequency range sweeps the RBW is utilized to reduce the actual acquisition time and for smaller sweep ranges, a narrow filter is used to improve overall frequency resolution.

In digital FFT based spectrum analyzers the RBW is inversely proportional to the number of samples acquired.

The more samples taken in the Time Domain or by increasing the Acquisition Time while keeping the Sampling Rate at the same level will lower the RBW and increase the number of bins for the same SPAN and therefore, an improved frequency resolution will be realized.

By utilizing narrow Resolution Bandwidths (RBW), the Kestrel TSCM ® Professional Software can often resolve the SOI sidebands even with a low-cost search receiver or spectrum analyzer.

The penalty for higher Resolution is an increase in the acquisition time and the number of actual data points that must be processed by the host computer.

Ultimately, narrow Resolution Bandwidths (RBW) settings result in significantly larger storage requirements for collected data.

A wider Resolution Bandwidth (RBW) is utilized when the display needs to be updated rapidly or when wide modulation bandwidths need to be displayed and analyzed.

The Kestrel TSCM ® Professional Software technical operator must select the desired Resolution Bandwidth (RBW) for the desired sweep range (kHz) (MHz) (GHz) based on either a wide frequency search Range of Interest (ROI) or a narrow frequency search Range of Interest (ROI) and / or for a specific Signal of Interest (SOI), during collection and analysis.

The operator will utilize the 26 kHz, 51 kHz or 102 kHz (RBW) settings for large and / or full frequency Search Range (MHz) sweep sessions that are greater than 1000 MHz (1.0 GHz).

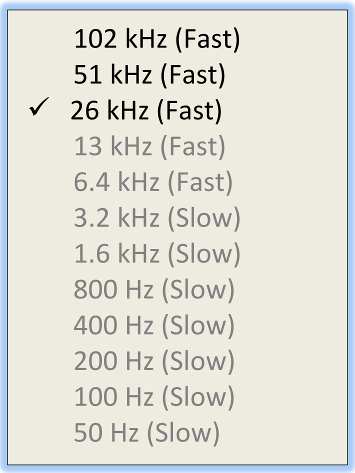
The RBW options available are SDR (hardware) receiver dependent.

Resolution bandwidth (RBW) | FAST MODE |

The RBW control allows the technical operator to select the desired RBW for any given bandwidth or specific Range of Interest (ROI) selected.

1 Hz - 4400 MHz – RBW Availability

The RBW options for any bandwidth (1 Hz – 4400 MHz), include | 102 kHz (Fast) | 51 kHz (Fast) | 26 kHz (Fast) |.



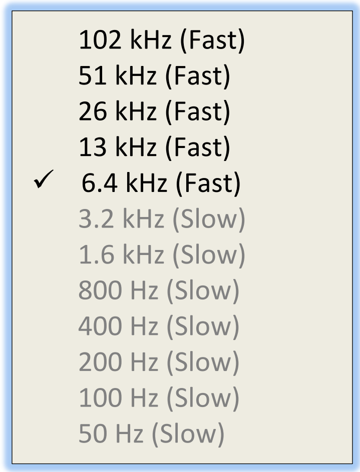
RBW Option Menu (1 Hz to 4400 MHz) | v1.37xx

RBW Options (Full Range = 1 Hz to 4400 MHz)	
102 kHz (Fast)	4400 MHz SPAN
51 kHz (Fast)	4400 MHz SPAN
26 kHz (Fast)	4400 MHz SPAN

RBW Options (1 Hz to 4400 MHz) | v1.37xx

1 Hz - 1000 MHz – RBW Availability

The RBW options for any bandwidth (1 Hz - 1000 MHz), include | 102 kHz (Fast) | 51 kHz (Fast) | 26 kHz (Fast) | 13 kHz (Fast) | 6.4 kHz (Fast) |.



RBW Option Menu (1 Hz to 1 GHz) | v1.37xx

RBW Options (ROI = 1 Hz to 1 GHz)	
102 kHz (Fast)	4400 MHz SPAN
51 kHz (Fast)	4400 MHz SPAN
26 kHz (Fast)	4400 MHz SPAN
13 kHz (Fast)	1000 MHz SPAN
6.4 kHz (Fast)	1000 MHz SPAN

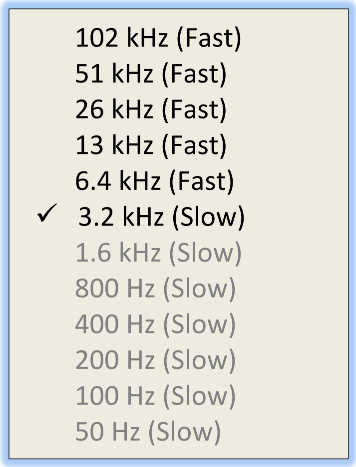
RBW Options (1 Hz to 1000 MHz) | v1.37xx

Resolution bandwidth (RBW) | SLOW MODE |

The RBW control allows the technical operator to select the desired RBW for any given bandwidth or specific Range of Interest (ROI) selected.

100 - 250 MHz – RBW Availability

The RBW options for any bandwidth (100 MHz - 250 MHz), include | 102 kHz (Fast) | 51 kHz (Fast) | 26 kHz (Fast) | 13 kHz (Fast) | 6.4 kHz (Fast) | 3.2 kHz (Slow) |.



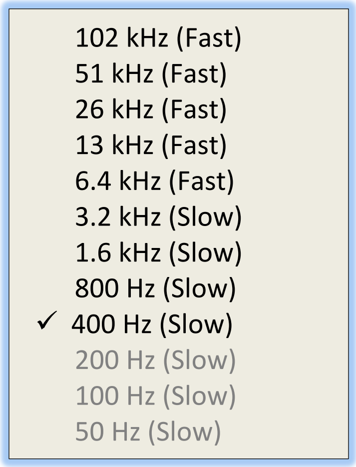
RBW Option Menu (250 MHz ROI) | v1.37xx

RBW Options (1 Hz = 250 MHz and Below)	
102 kHz (Fast)	4400 MHz SPAN
51 kHz (Fast)	4400 MHz SPAN
26 kHz (Fast)	4400 MHz SPAN
13 kHz (Fast)	1000 MHz SPAN
6.4 kHz (Fast)	1000 MHz SPAN
3.2 kHz (Slow)	250 MHz SPAN

RBW Options (250 MHz ROI) | v1.37xx

1 Hz - 100 MHz – RBW Availability

The RBW options for any bandwidth (1 Hz - 100 MHz), include | 102 kHz (Fast) | 51 kHz (Fast) | 26 kHz (Fast) | 13 kHz (Fast) | 6.4 kHz (Fast) | 3.2 kHz (Slow) | 1.6 kHz (Slow) | 800 Hz (Slow) | 400 Hz (Slow) | 200 Hz (Slow) | 100 Hz (Slow) | 50 Hz |.



RBW Option Menu (100 MHz ROI) | v1.37xx

RBW Options (ROI = 100 MHz and Below)	
102 kHz (Fast)	4400 MHz SPAN
51 kHz (Fast)	4400 MHz SPAN
26 kHz (Fast)	4400 MHz SPAN
13 kHz (Fast)	1000 MHz SPAN
6.4 kHz (Fast)	1000 MHz SPAN
3.2 kHz (Slow)	**100 MHz SPAN**
1.6 kHz (Slow)	**100 MHz SPAN**
800 Hz (Slow)	**100 MHz SPAN**
400 Hz (Slow)	**100 MHz SPAN**
200 Hz (Slow)	**50 MHz SPAN**
100 Hz (Slow)	**25 MHz SPAN**
50 Hz (Slow)	**12 MHz SPAN**

RBW Options (100 MHz ROI) | v1.37xx

The RBW option list is dynamically populated based on the current Range of Interest (ROI) or SPAN selected by the technical operator.

All RBW options are available when the Range of Interest (ROI) is 12 MHz or less.

Based on the selected ROI or SPAN, RBW settings that are considered “out of range” for the current ROI, cannot be selected by the technical operator.

It will be necessary to adjust the Range of Interest (ROI) or SPAN to a maximum spectral range not exceeding the values in the following chart.

Resolution bandwidth (RBW) Availability Reference Chart	
Range (Maximum Bandwidth)	**Availability**
1000 MHz	13 kHz (Fast), 6.4 kHz (Fast)
250 MHz	3.2 kHz (Slow)
100 MHz	1.6 kHz (Slow), 800 Hz (Slow), 400 Hz (Slow)
50 MHz	200 Hz (Slow)
25 MHz	100 Hz (Slow)
12 MHz	50 Hz (Slow)

RBW Options Chart | v1.37xx

Once all of the setup preferences have been either accepted as Default or adjusted by the technical operator, the | CREATE NEW PROJECT | button loads the selected spectrum parameters and the software immediately begins the collection process, unless the activity schedule has been programmed for Delayed Start Mode (DSM).

Should the technical operator need to override the Delayed Start programming, the PAUSE / RESTART button may be pressed to immediately begin the collection process.

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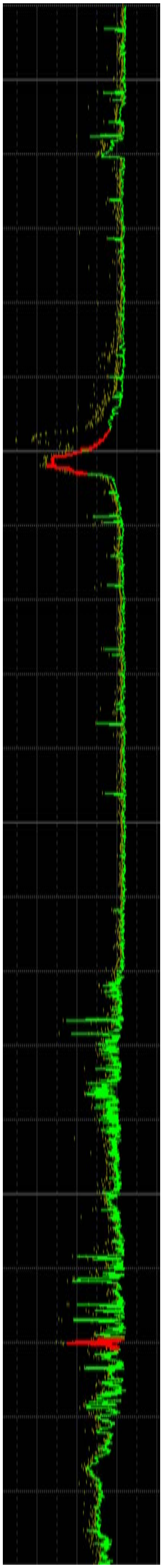
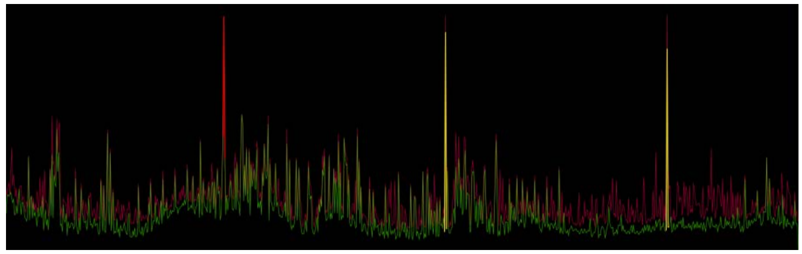
Intentionally Left Blank



Chapter 4

Multiple Receiver Operation (MRO)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Multiple Receiver Operation (MRO) ™

There are four (4) active runtime modes of defined receiver and analyzer operation available to the technical operator during active field deployment of the Kestrel TSCM ® Professional Software, regardless of whether the application is operator assisted TSCM, or autonomously deployed for the purpose of managed Remote Spectrum Surveillance and Monitoring (RSSM) ™.

These modes of operation include | Single Receiver Operation (SRO) ™ |, for which the receiver or analyzer, is designated and deployed at a single collection location, and all assigned spectrum bands are associated with a single collection location, | Dual Receiver Operation (DRO) ™ |, which can, by default, include operation across a single location, or receivers can be operator defined, as independent receivers representing multiple deployment locations, and | Multiple Receiver Operation (MRO) ™ |, which also may be operated at a single location by default, or each receiver may be independently assigned an independent location, as defined by the technical operator.

All modes of operation are fully supported by the Kestrel TSCM ® Professional Software, including the ability to dynamically "hand-off" any actively sweeping spectrum band allocation, audio demodulation and / or analysis function, independently across any number of search receivers, analyzers or operator defined locations.

Our "on-the-fly" dynamic "hand-off" capability includes the ability to transfer real-time spectrum and demodulated signal events from a dedicated primary search receiver, analyzer, or location, to a secondary search receiver, analyzer, or location, or any other connected search receiver or analyzer, to better facilitate real-time technical operator assisted analysis, and take advantage of the many advanced demodulation and FFT signal visualization processes, without the interruption of the search and collection process.

Our dynamic "on-the-fly" spectrum and demodulation "hand-off" synchronization is virtually seamless, and can be accomplished during active runtime, during both the normal sweep mode, and IFB mode of operation.

Simultaneous runtime operation of all connected search receivers and spectrum analyzers, fully supports the ability to sweep multiple spectrum band allocations, across multiple search receivers, spectrum analyzers, and independently assigned collection locations.

Multiple Receiver Operation (MRO) ™, includes the ability to simultaneously utilize two (2) or more different search receiver or spectrum analyzer types supported by the Kestrel TSCM ® Professional Software.

For example, the technical operator may assign a Signal Hound ® SM200A (100 kHz to 20 GHz receiver as the primary collection hardware and utilize a Signal Hound ® BB60C (9 kHz to 6 GHz) receiver for in-band spectrum (at the band level), or demodulation (at the signal level), for synchronized dynamic "hand-off".

The ability to sweep any number of independent Range of Interest (ROI), spectrum bands, or sub-band allocations across each assigned search receiver or analyzer is fully supported.

There are a number of logic-based deployment interlocks in place to prevent the accidental (or intentional) “hand-off” of unavailable or “out of range” values to another search receiver, or spectrum analyzer during runtime.

Any attempt to “hand-off” to an out of range search receiver is prevented by making the selection unavailable to the technical operator.

Single Receiver Operation (SRO) ™

The default | Single Receiver Operation (SRO) ™ | mode includes the ability to utilize Sweep + Demodulation + Analysis, options on a supported single initialized search receiver, or spectrum analyzer, at a single operator defined collection location, which can be moved and reassigned any number of unique locations, with all bands at all locations assigned to the SRO receiver.

In this configuration, the selected device handles the sweep process, and is available for demodulation and operator assisted signal event analysis, on demand.

The runtime sweep activity will pause during the demodulation process during manual and automatic modes of operation, including the CTM signal analysis process.

In normal sweep mode, it is not possible for a single receiver to sweep the spectrum during the demodulation, or active analysis process.

However, operation within the | Intermediate Frequency Broadband (IFB) ™ | mode, allows the technical operator to visualize the maximum hardware real-time bandwidth in active demodulation, providing additional functionality, not available in normal sweep mode.

Dual Receiver Operation (DRO) ™

Within a | Dual Receiver Mode (DRO) | mode of operation, synchronized hand-off may is supported during active runtime deployment of the Kestrel TSCM ® Professional Software, as required by the technical operator across two (2) receivers or analyzers, and any number of Ranges of Interest (ROI), bands, or sub-bands deployed across both receivers or analyzers, and handed-off accordingly.

However, when two (2), or more radios are available, each radio may be assigned a unique independent collection location, providing the ability for the real-time display of spectra and waterfall from both collection locations on a single display overlay.

Both of the connected search receivers or spectrum analyzers are available and may be assigned to sweep a single (Sweep + Demodulation + Analysis) spectrum band allocation or Range of Interest (ROI) on one (1), or across both, search receivers, or spectrum analyzers.

This provides the capability to deploy a receiver for uninterrupted runtime collection, while the operator utilizes hand-off to accomplish demodulation and analysis on another available receiver, or analyser.

The ability to sweep on one (1) search receiver and demodulate on the second search receiver, or analyzer, is fully supported.

Our multiple band deployment capability, is fully supported across both of the connected search receivers, or spectrum analyzers.

Only one (1) search receiver or spectrum analyzer may be assigned for active signal analysis during runtime, and it is therefore not possible to program both of the search receivers, or spectrum analyzers, for active analysis, when assigned at a single collection location.

However, when multiple receivers are assigned unique independent locations, each receiver, may be assigned as an analysis receiver.

It is possible to move the analysis functionality to the other search receiver or analyzer manually at any time from the| ACQUISITION | ANALYZER CONTROL | dialog window at a single collection location.

Independent spectrum bands may be paused, or actively sweeping across connected the search receivers or spectrum analyzers.

The technical operator has the ability to move a sweeping band to the secondary search receiver during active runtime deployment as part of the spectrum “hand-off” process as long as the secondary search receiver or spectrum analyzer is also assigned as a sweep device within the | Analyzer Control | group, dialog window.

The demodulation process follows the same logic as the runtime sweep “hand-off” functionality, and the technical operator is able to choose another search receiver for demodulation, as desired, during active deployment, as long as the second search receiver is also assigned as a demodulation device in the | Analyzer Control | group, dialog window.

Sweep + Demodulate + Analysis

The “Sweep + Demodulate + Analysis” is the default mode of operation and is typical of Single Receiver Operation (SRO) deployment.

The assigned primary (single) search receiver will sweep the active spectrum and may be stopped at any time by the technical operator to demodulate a signal event or analyze a Signal of Interest (SOI) when the search receiver, or analyzer is selected for Demodulation + Analysis functions within the | Analyzer Control | group, dialog window.

When the Chirp Threat Mode (CTM) ™ is selected active during runtime, all signal events that meet, or exceed the detection threshold will be analyzed, as a separate cycle immediately following the completion of active each sweep cycle on the search receiver, or analyzer that is assigned for analysis.

Sweep

The | SWEEP | option provides the ability to utilize a dedicated search receiver or analyzer as a primary collection device with the ability to "hand-off" signal events for demodulation or analysis, to another connected search receiver or analyzer.

The | SWEEP | configuration supports uninterrupted spectrum sweep collection, allowing for "hand-off" of significant signal events to a secondary search receiver or analyzer to facilitate technical operator analysis.

TIP: Spectrum "hand-off" to another search receiver or analyzer may result in RSD and WFD amplitude differences due to device calibration inconsistences, as well as the effects of different receiver types, antenna location and orientation and other operational factors, such as gain and attenuation.

Demodulation

Assigning a search receiver for | DEMODULATION | permits the technical operator to review the audio for signals that have been "handed-off" by the primary search receiver or analyzer for active demodulation or signal event analysis utilizing the Kestrel TSCM ® Professional Software, advanced FFT Demodulation Visualizer.

It is also possible for the technical operator to utilize the secondary "hand-off" search receiver or analyzer to manually monitor a specific, discrete Signal of Interest (SOI) event, while the primary search receiver or analyzer continues to sweep a single, or any number of assigned spectrum band allocations.

Analysis

Assigning a search receiver for | ANALYSIS | permits the CTM process to occur on any other available receiver, or analyzer, permitting the primary collection receiver to operator in an uninterrupted capacity, during runtime.

Independent Receiver | RDSA ™ Locations

The traditional SRO ™, DRO ™, and MRO ™ concept, assumes that all available receivers and analyzers, and assigned spectrum bands, are associated with a single collection location, across one or more hardware options, and are physically moved to accomplish, or establish a new collection location for comparative purposes, referred to as Location Differential Signal Analysis (LDSA) ™, formerly DSA ™ within the Kestrel ® platform.

However, a powerful new mode of operation, unlocks the single collection location limitation, and opens up a new deployment channel, referred to as | Receiver Differential Signal Analysis (RDSA) ™.

The ability of the technical operator to define each available receiver, or analyzer independently, as a unique location, is easily accomplished during the initialization process, within the | Analyzer Control | group, dialog window.

Leaving the | LOCATION | table box unpopulated for any available receiver or pressing the | RESET | button for each available receiver, if a location has been previously defined by the technical operator, defaults the application to the familiar single collection, location mode of operation.

However, the technical operator can assign each available receiver, or spectrum analyzer with a unique, independent location, when two (2) or more receivers, or analyzers are available.

Receivers may be physically deployed in multiple rooms, multiple floors, or in a single target area such as a large conference hall, or both inside and outside a conference or meeting room, or inside and outside a facility for example, providing real-time analytical comparative data across multiple bands, sub-bands, and Ranges of Interest (ROI), as well as RSSI based, geo-location capability.

This is accomplished when the operator defines a unique location name for each available receiver during the initialization process, keeping firmly in mind that the designation assigned must be descriptive enough to clearly identify the location during the deployment monitoring process.

For example, room one and room two, may not provide clear information as to the physical location within a facility, with many rooms across multiple floors, and definitely will not allow future reuse of the same name for comparative import.

Utilizing a formal, consistent File Naming Convention (FNC), will allow past, present, and future collected data to be accurately assimilated and maintained.

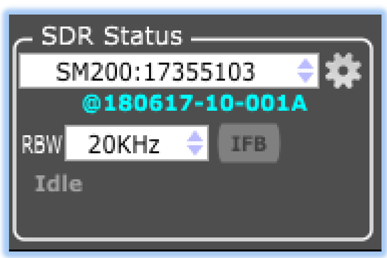
Sloppy, naming conventions, often result in meaningless, and generally unassociated data, with no coordination, or situational awareness for the operator, or the technical analyst.

Consider, developing a formal FNC process across the organization, and for the purpose of centralized data storage.

Multiple Receiver Operation (MRO) ™

The MRO ™ mode of operation may be dynamically adjusted during active deployment of the Kestrel TSCM ® Professional Software, as required by the technical operator.

Any combination of connected search receivers and analyzers are available and may be assigned to sweep a single (Sweep + Demodulation + Analysis) spectrum band allocation or Range of Interest (ROI) on one, or across multiple search receivers, or spectrum analyzers.



SDR (Hand-Off) Status | v1.38xx

The Kestrel TSCM ® Professional Software supports synchronized dynamic “on-the-fly” spectrum “hand-off” accomplished directly from the SDR Status window located on the User Interface (UI).

All available search receivers and spectrum analyzers are displayed utilizing either the default naming convention, for example (SM200:17355103) or the technical operator defined “friendly” name, for example (Boardroom) as assigned by the technical operator from the | ACQUISITION | ANALYZER CONTROL | menu structure.

Sweeping independent Multiple Band Deployment (MBD) is supported across all of the connected search receivers and analyzers.

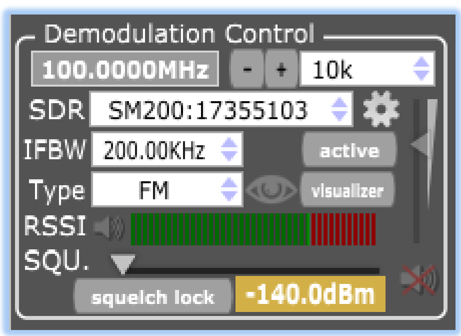
Only one (1) search receiver or analyzer may be assigned for active Analysis during runtime and it is not possible to program more than one (1) of the search receivers or analyzers for active analysis.

However, it is possible to move the | ANALYSIS | functionality to another search receiver or analyzer manually at any time from the | ACQUISTION | ANALYZER CONTROL | dialog window.

Independent spectrum band allocations may be paused, or actively sweeping across any of the connected search receivers or analyzers.

The technical operator has the ability to move a sweep to another search receiver during active runtime deployment as part of the signal event, or spectrum "hand-off" process as long as the other search receiver or analyzer is also assigned as a | SPECTRUM | device.

The | DEMODULATION | "hand-off" process follows the same logic as the | SPECTRUM | "hand-off" functionality and the technical operator is able to choose another search receiver for demodulation as required or desired during active deployment as long as the second search receiver is also assigned as a demodulation device in the | Analyzer Control | dialog window.



Demodulation (Hand-Off) Control | v1.38xx

The Kestrel TSCM ® Professional Software supports "on-the-fly" demodulation "hand-off" and is accomplished directly from the | Demodulation Control | Group or the | Visualizer Control | Group dialog window.

All available search receivers and analyzers are displayed utilizing either the default naming convention, for example (SM200:17355103), or the technical operator defined Friendly name, for example (Boardroom).

Sweep + Demodulate + Analysis

The "Sweep + Demodulate + Analysis" is the default mode of operation and is typical of Single Receiver Operation (SRO) ™.

The assigned primary search receiver will sweep the active spectrum and may be stopped at any time by the technical operator to demodulate a signal event or analyze a Signal of Interest (SOI) when a dedicated search receiver or analyzer is selected for Demodulation and Analysis functions.

When the Threat Detection Algorithm (TDA) ™ is selected active during runtime, all signal events that meet or exceed the detection threshold, will be analyzed as a separate cycle immediately following the completion of active each sweep cycle on the search receiver or analyzer that is assigned for analysis.

Sweep

The | Sweep | option provides the ability to utilize a dedicated search receiver or analyzer as a primary collection device (Sweep Only), or with the ability to "hand-off" signal events for demodulation; or analysis to another search receiver or analyzer.

The | Sweep | configuration supports uninterrupted spectrum sweep and data collection, allowing for "hand-off" of significant signal events to a secondary search receiver or analyzer for technical operator analysis.

TIP: Spectrum "hand-off" to another search receiver or analyzer may result in RSD and WFD amplitude differences due to device calibration inconsistences; as well as the effects of different receiver types; antenna location and orientation; and other operational factors.

Demodulation

Assigning a search receiver for "Demodulation" permits the technical operator to review signal events that have been "handed-off" by another search receiver or analyzer for active demodulation, or signal event analysis utilizing the Kestrel TSCM ® Professional Software advanced FFT Demodulation Visualizer.

It is also possible for the technical operator to utilize a secondary "hand-off" search receiver or analyzer to manually monitor a specific discrete Signal of Interest (SOI) event, while the primary search receiver or analyzer continues to sweep a single, or any number of assigned spectrum band allocations.

Initialization Process

When the Kestrel TSCM ® Professional Software is first started, the application will search for all connected devices, identify and attempt to open each individual search receiver or analyzer, regardless of whether a valid Activation Security Key (ASK) ™ is present for each individual found device.

The Splash Screen status display will provide the technical operator with visual feedback by displaying the individual serial numbers of each search receiver or analyzer detected, identified and opened during the initialization process.

The | ANALYZER CONTROL | dialog window will display along with a gray background | User-Interface | workspace, once the application has successfully started allowing the technical operator to verify, accept, or alter the currently selected, or default settings presented for each search receiver or analyzer.

In the event that no Activation Security Key (ASK) ™ is found for any connected device, the affected search receiver or analyzer will display in (RED) indicating that it is not connected and therefore is not available for active deployment during the current runtime session.

The technical operator will be required to obtain a valid Activation Security Key (ASK) ™, prior to being able to utilize the search receiver or analyzer.

Analyzer Control | Dialog Window

The technical operator can open the | ANALYZER CONTROL | dialog window from the main menu by navigating to the | ACQUISITION | ANALYZER CONTROL | menu option.

The | ANALYZER CONTROL | dialog window is displayed automatically during the start-up process and displays the details of each search receiver or analyzer detected, identified and opened during the initialization “start-up” process.

Analyzer Control | Receiver Configuration

There are several important visual feedback elements and menu structures that allow the technical operator to establish the desired mode of operation and set parameters for each connected search receiver or analyzer.

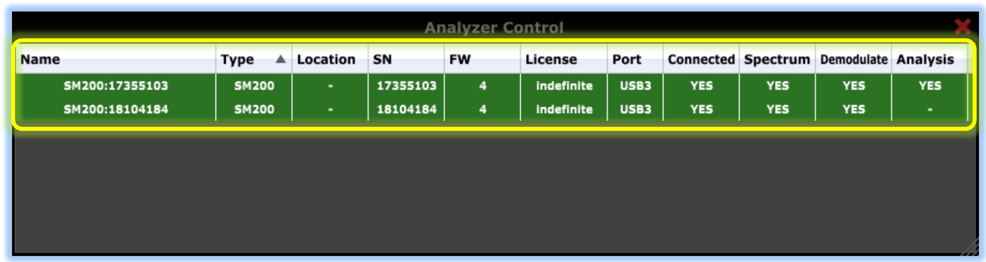
The following example of the Analyzer Control dialog window indicates that there are two (2) search receivers or analyzers are present.

The (SM200:17355103) receiver is currently configured to provide Spectrum, Demodulation and Analysis capability.

The (SM200:18104184) receiver is currently configured to provide Spectrum, Demodulation, but is not available for Analysis.

Only one (1) search receiver or analyzer may be assigned for automatic signal event analysis during runtime.

If the operator selects a second radio for analysis the current radio will release the analysis mode.



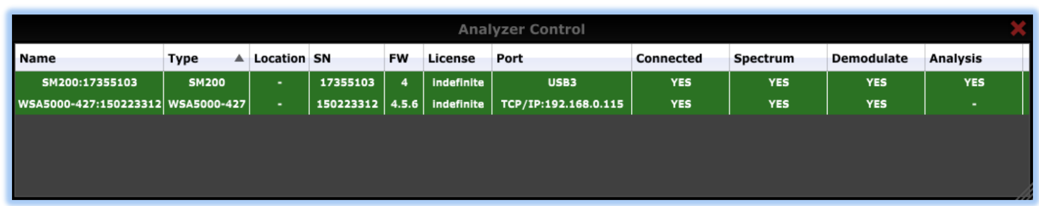
Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
SM200:18104184	SM200	-	18104184	4	Indefinite	USB3	YES	YES	YES	-

Analyzer Configuration | v1.38xx

Assign (Friendly) Name

Utilizing a Right (or left) mouse click on any listed radio results in the display of a menu option dialog window.

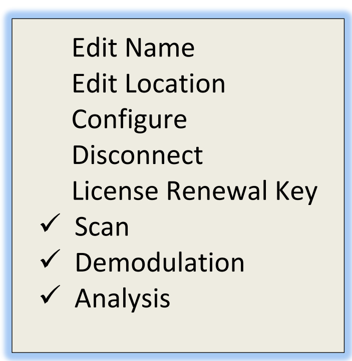
Utilizing a Left (or right) mouse click will display the radio Hardware Configuration window menu option.



Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control | v1.38xx

The right (or left) mouse click popup menu provides access to a number of important programming and setup features.



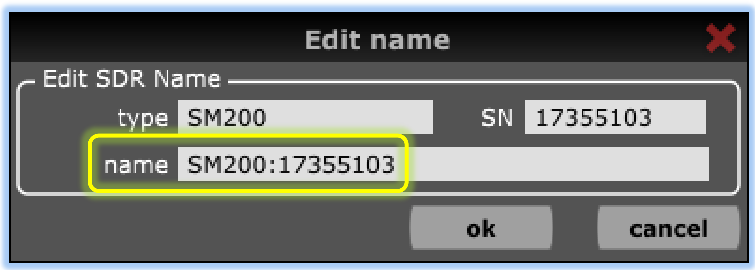
Analyzer Control Menu | v1.38xx

The | NAME | column is a dual-purpose control that allows the independent configuration of each search receiver or analyzer and also provides access to the above optional menu structure for direct access to various programming features.

Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Initialization Default Name) | v1.38xx

The following examples are representative of the default name and configuration dialog window for the SM200 and WSA5000-427 radios, along with the serial numbers (17355103) and (150223312) of the devices.

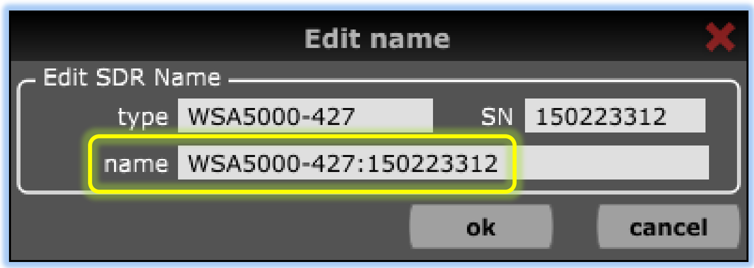


Default Reference | v1.38xx

The default name (SM200) can be edited to display a friendly name (Boardroom) as illustrated below.

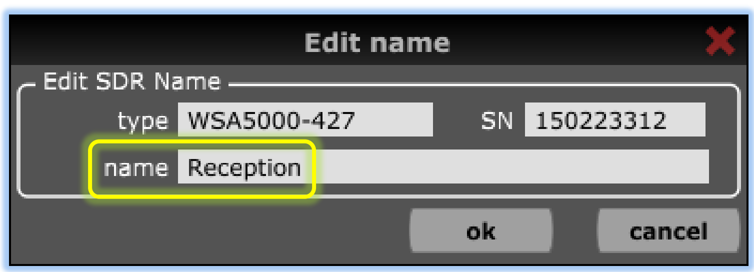
Friendly Name Reference | v1.38xx

The default name (WSA5000-427) can be edited to display a more convenient friendly name.



Default Name Reference | v1.38xx

The default name (WSA5000-427) can be edited to display a friendly name has illustrated below.



Friendly Name Reference | v1.38xx

The ability to edit the SDR Default radio name is fully supported in the Kestrel TSCM ® Professional Software.

The technical operator can assign a friendly name for each connected device.

The | FRIENDLY NAME | can be representative of the radio, antenna location, or even the collection zone of interest within the target area.

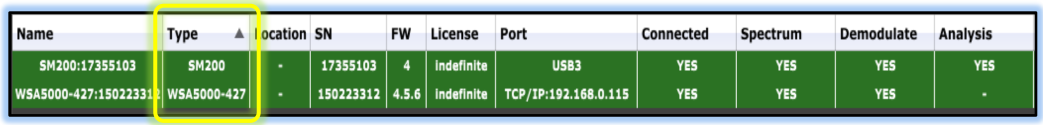
The technical operator can enter a short description, location, or | FRIENDLY NAME | for the selected radio.

Once the desired | FRIENDLY NAME | has been entered by the technical operator, press | OK | to close the "Edit Name" dialog window.

Should the technical operator wish to return to the original default File Naming Convention (FNC) for any radio, deleting the operator defined "Friendly" name results in the return to the default name for that device.

Type

The search receiver or analyzer "Type" (model number) is displayed for easy identification and reference when multiple device types, or multiple search receivers and analyzers are present and cannot be edited by the technical operator.



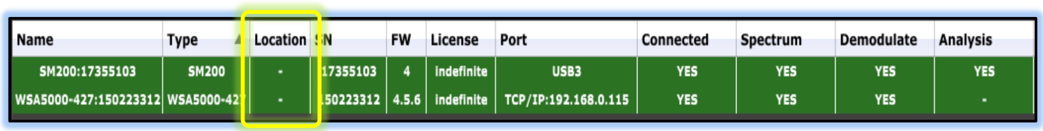
Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Type) | v1.38xx

RDSA ™ | Location Name

The location name is associated with the Receiver Differential Signal Analysis (RDSA) ™ location name of each connected device.

If no location name is assigned for initialized radios, the software will operate on the basis of a single defined location, with multiple antenna collection locations.

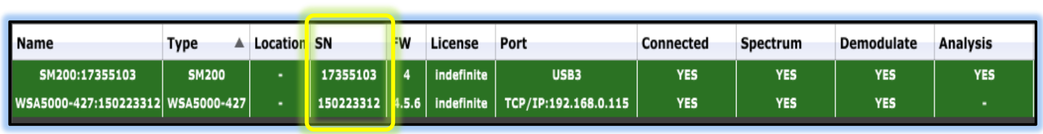


Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (RDSA ™ | Location Name) | v1.38xx

Serial Number

The serial number of each connected device will be displayed and cannot be edited by the technical operator.



Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Serial Number) | v1.38xx

Radio Firmware Version

The radio firmware version for each connected device will be displayed and cannot be edited by the technical operator.

Name	Type ▲	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	ndefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	15022331	4.5.6	ndefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Firmware) | v1.38xx

Licence Status

Each individual search receiver or analyzer requires an individual Activation License Key (ASK) for use with the Kestrel TSCM ® Professional Software.

The current license status, displays the number of days or hours remaining before the license is due to expire for each individual search receiver or analyzer.

Name	Type ▲	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (License Status) | v1.38xx

When the “Licence” status box is not populated, no Activation Security Key (ASK) is present for the device and the search receiver or analyzer cannot be “Connected” until a valid ASK is entered for the device.

When the device has a valid ASK, the “License” box will display the number of days or hours remaining for the license before expiry, a permanent ASK will display “Indefinite” and does not expire.

There are inter-locks in place to prevent the software from terminating collection should the Activation Security Key (ASK) expire during runtime.

Port

USB and LAN connectivity is fully supported and is search receiver or analyzer dependent.

Utilizing the Kestrel LAN Remote (KLR) ™ module to extend the distance between the receiver and host computer; provides a virtual USB connection and will display as a USB connected device in the | ANALYZER CONTROL | dialog window.

For example; the Anritsu Spectrum Master (“C” and “T” Series) may be connected via a direct LAN connection or by a USB connection.

When connected via LAN connection, the TCP/IP address will be displayed.

The Signal Hound ™ SA44B connects via a USB 2.0 Port only and will display as USB connected when the KLR module is deployed.

The Signal Hound ™ SM200 connects via a USB 3.0 Port only and will display as USB3 connected when the KLR module is deployed.

Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

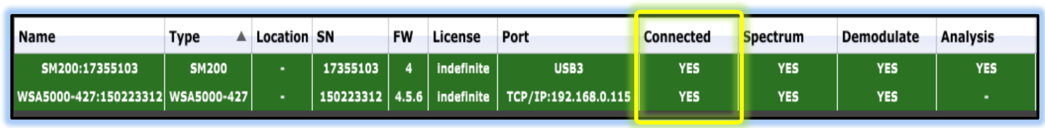
Analyzer Control (Port) | v1.38xx

Connected

The connection status of each search receiver or analyzer is displayed.

If the receiver is connected | **YES** | will be displayed for the selected search receiver or analyzer.

Should the receiver not currently be connected | **-** | will be displayed for the affected device.

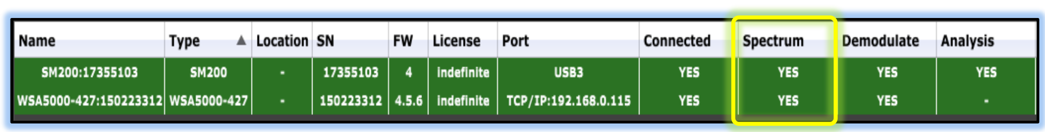


Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Connected) | v1.38xx

Spectrum

Each connected device can be individually set to SWEEP ONLY, or SWEEP + DEMODULATE for dynamic spectrum or demodulation “hand-off” purposes.



Name	Type	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Spectrum) | v1.38xx

Demodulate

Each connected device may be individually set to DEMODULATE ONLY, or SWEEP + DEMODULATE for dynamic spectrum or demodulation “hand-off” purposes.

Name	Type ▲	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Demodulate) | v1.38xx

Analysis

Any connected search receiver or analyzer can be assigned for active threat detection analysis when utilizing the Minimum Detection Amplitude (MDA) + Chirp Threat Mode (CTM) + Harmonic Signature Threshold (HST) functionality.

However, it is only possible to assign one (1) search receiver or analyzer for the analysis function during active runtime deployment, unlike the sweep and demodulation functionality, which may be assigned to multiple search receivers or analyzers.

Name	Type ▲	Location	SN	FW	License	Port	Connected	Spectrum	Demodulate	Analysis
SM200:17355103	SM200	-	17355103	4	Indefinite	USB3	YES	YES	YES	YES
WSA5000-427:150223312	WSA5000-427	-	150223312	4.5.6	Indefinite	TCP/IP:192.168.0.115	YES	YES	YES	-

Analyzer Control (Port) | v1.38xx

It is possible to assign the sweep, demodulation and analysis to the same search receiver or analyzer.

It is also possible to assign the sweep, demodulation and analysis functions to separate search receivers or analyzers.

Single Receiver Operation (SRO) ™ | Example

The following example illustrates the typical Single Receiver Operation (SRO) setup.

Analyzer Control | Single Receiver Operation (SRO)		
Spectrum	**Demodulate**	**Analysis**
Yes	Yes	Yes

SRO Example | v1.38xx

The above example illustrates a single search receiver or analyzer that supports the sweep, demodulation and analysis cycles during runtime.

The ability to utilize SRO ™ configuration for triggered IQ capture is supported in both normal sweep mode and IF Broadband (IFB) ™ mode during runtime.

Dual Receiver Operation (DRO) ™ | Example

The following example illustrates the typical Dual Receiver Operation (DRO) setup.

Analyzer Control | Dual Receiver Operation (DRO)		
Spectrum	**Demodulate**	**Analysis**
Yes	---	---
---	Yes	Yes

DRO Example | v1.38xx

The above example illustrates, dual search receivers or spectrum analyzers that fully support uninterrupted sweep progress on the primary search receiver and demodulate and analysis on a secondary search receiver or analyzer.

The threat detection analysis cycle is assigned to the secondary (demodulation) search receiver or analyzer during runtime.

The ability to utilize a DRO configuration for triggered IQ capture is supported in both normal sweep mode and IF Broadband (IFB) mode during runtime and is advantage in permitting uninterrupted collection during the triggered IQ capture process which can be handed-off to the second receiver.

Multiple Receiver Operation (MRO) ™ | Example

The following example illustrates the typical Multiple Receiver Operation (MRO) setup.

Analyzer Control – Multiple Receiver Operation (MRO)		
Spectrum	**Demodulate**	**Analysis**
---	Yes	Yes
Yes	---	---
Yes	---	---
Yes	---	---
Yes	Yes	---

MRO Example | v1.38xx

The above example illustrates, multiple search receivers or analyzers that support uninterrupted sweep progress for any number of spectrum band allocations across four (4) separate search receivers or analyzers (3 dedicated / 1 shared).

The technical operator has assigned one (1) dedicated demodulation search receiver or analyzer that is also assigned to threat detection analysis during runtime and is not available for active sweeping.

An additional search receiver or analyzer allows both spectra sweeping and demodulation functionality.

TIP: The ability to open the Analyzer Control dialog window and edit the current search receiver or analyzer assignment and configuration is fully supported.

Signals Intelligence Support System (SISS) ™

The Kestrel TSCM ® Professional Software is an ideal Signals Intelligence (SIGINT) application for fixed site, portable, and mobile tactical deployment.

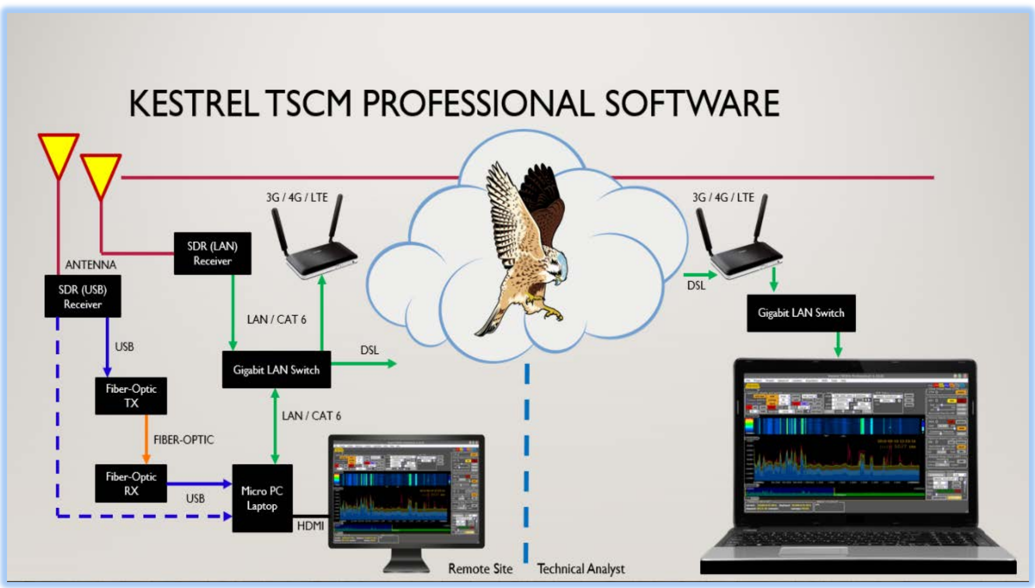
The system supports a wide range of hardware-based receiver and analyzer options and mission specific software deployment configurations in support of real-time spectrum surveillance and monitoring, tactical interception, interference analysis, signals intelligence, signal identification and characterization, spectrum trace and IQ recording, Angle of Arrival (AOA) based directional finding and spectrum management requirements.

The Signals Intelligence Support System (SISS) ™ is both flexible and scalable to accommodate virtually all mission specific deployment considerations and operational requirements.

The SISS ™ system is unique in that the Kestrel TSCM ® Professional Software is capable of communicating with any supported SDR search receiver or spectrum analyzer over USB 2.0, USB 3.0, USB-C, and Local Area Networks (LAN), as well as via Remote Desktop Software (RDS) over a high-speed Internet connection, regardless of the manufacturer and / or type or search receiver, or spectrum analyzer utilized.

The following example illustrates the power and versatility of the Kestrel TSCM ® Professional Software, Signals Intelligence Support System (SISS) ™ when deployed in support of a Signals Intelligence (SIGINT) role.

Please note that not all possible hardware and configuration, combinations and options are illustrated in the example below.



System Engineering | v1.38xx

The ability to configure a customized deployment system is easily accomplished utilizing a combination of hardware and software building blocks to create a mission specific solution.

Utilizing a standalone laptop, desktop or supported tablet-based host computing platform guarantees field serviceability and the ability to take full advantage of new powerful computer hardware as technology advancements are introduced into the market.

The ability to add on additional system components allows the technical operator to scale the system for today's needs and easily expand the system for changing future requirements.

The ability to utilize USB 2.0, USB 3.0, USB-C, LAN, WAN, Fiber-Optic connectivity, means significant flexibility when faced with challenging, mission specific applications and requirements.

The ability to configure a system to meet specific operational requirements on a site by site is budget friendly and expandable.

Local Oscillator Radiation (LOR)

Local Oscillator Radiation (LOR) can prove to be a significant problem when technical operators utilize a number of equipment resources containing super-heterodyne based receivers containing local oscillators, in close proximity.

"Close proximity", is a relative term, and the actual LOR distance can be localized, or prove to be problematic at some distance from the offending emitter.

Virtually all search receivers, analyzers and scanning receivers will exhibit varying degrees of LOR that can cause the LO sweep activity to be detected by other, or even the same offending search receiver or analyzer, or those located in close proximity.

Local Oscillator Radiation (LOR) can be an issue when the technical operator places a spectrum analyzer for example, in close proximity to an active search receiver or radio scanner, or when running multiple search receivers in the Kestrel TSCM ® Professional Software, Multiple Search Receiver (MRO) mode, causing LOR to be introduced into one (1) or more of the connected devices.

It is recommended that during Dual Receiver Operation (DRO) and Multiple Receiver Operation (MRO), the technical operator place the devices and antennas at some distance apart.

The use of quality, well shielded RF and peripheral computer cables, connectors, adapters and attention to cable placement can have a positive effect on minimizing LOR.

Likewise, extending the operational distance and orientation of search receivers and analyzers away from the host computer is considered to be best practice.

Oftentimes, the cause of LOR can be traced to poor shielding and circuit level design and engineering factors well beyond the technical operator's control.

TIP: It is essential that the technical operator be familiar with the individual Local Oscillator (LO) characteristics of all operational deployment equipment resources, including the spectrum display effects and typical frequency range of detection.

It should be remembered that along with a problematic issue such as Local Oscillator Radiation (LOR), it is possible to utilize this unintentional emission to identify and locate super heterodyne receivers that otherwise, do not transmit identifiable RF signatures.

The attacker may not be aware that the receiver might be detectable.

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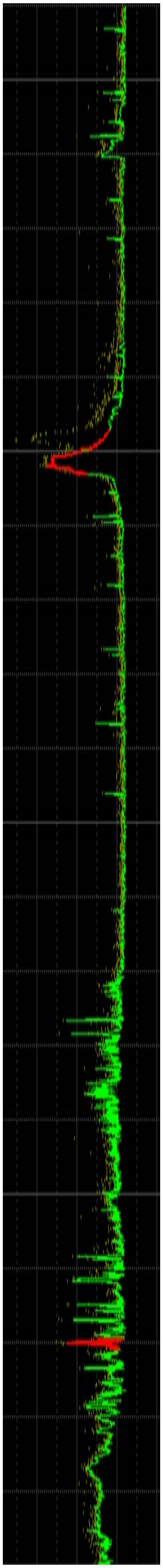
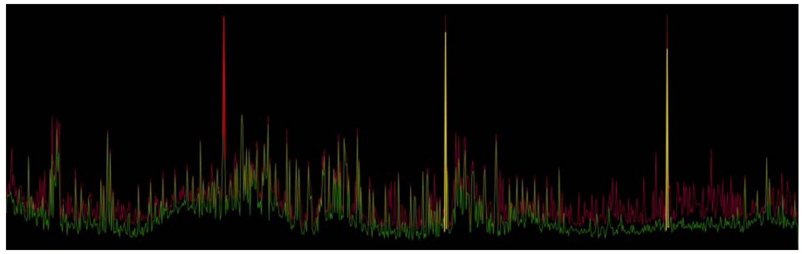


Chapter 5



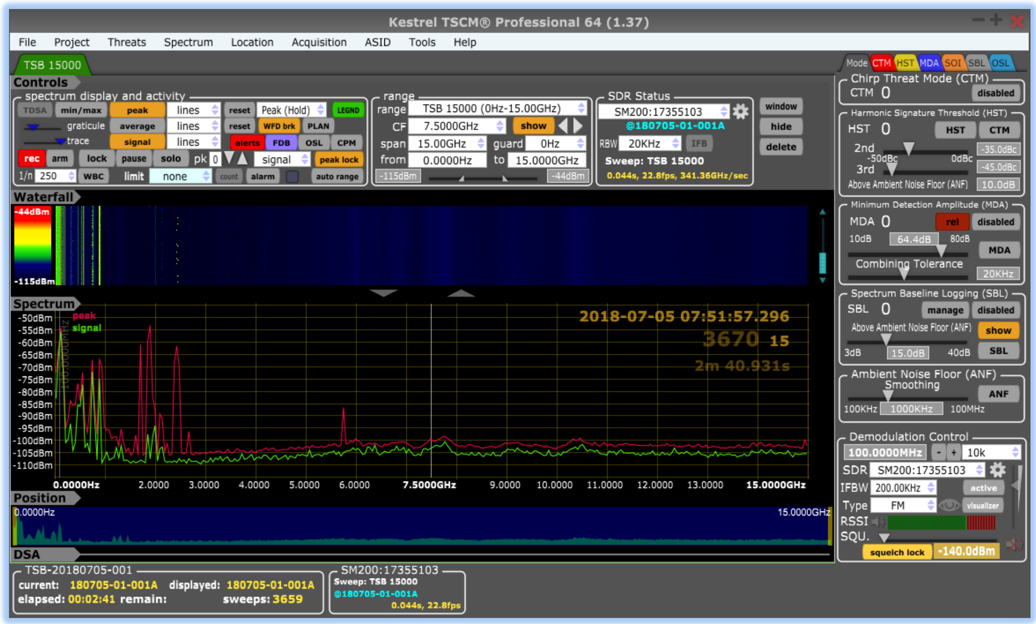
User Interface (UI)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

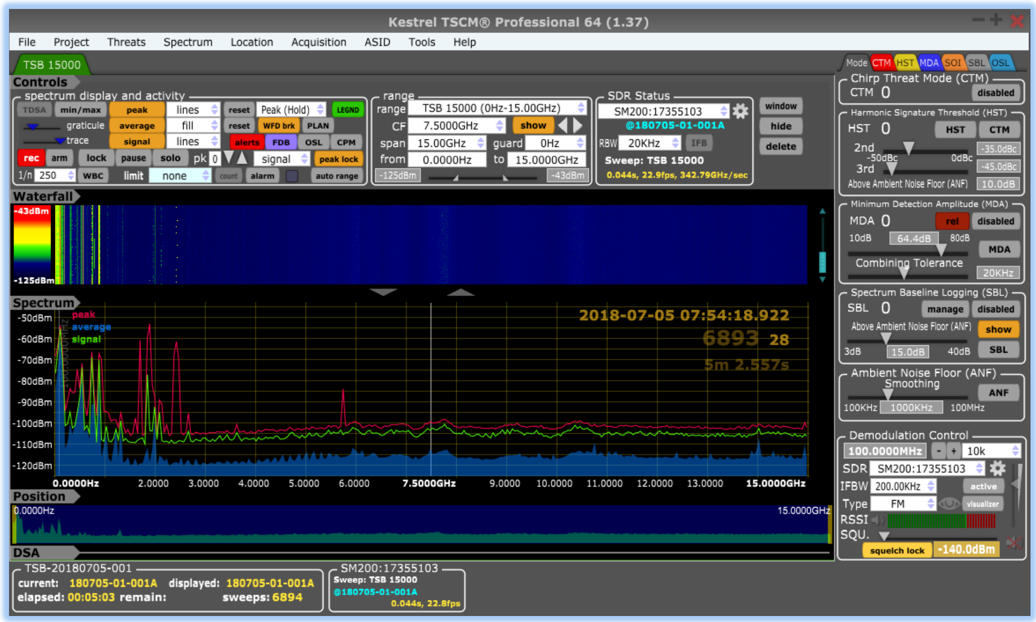
User Interface (UI)

The Kestrel TSCM ® Professional Software utilizes a high resolution and high contrast full colour User Interface (UI) with intuitive and simplified control groups that are backed by complex software coding, artificial intelligence (AI), dynamic predictive logic and workflow management concepts that allow the operator to focus on the collection and analysis process.



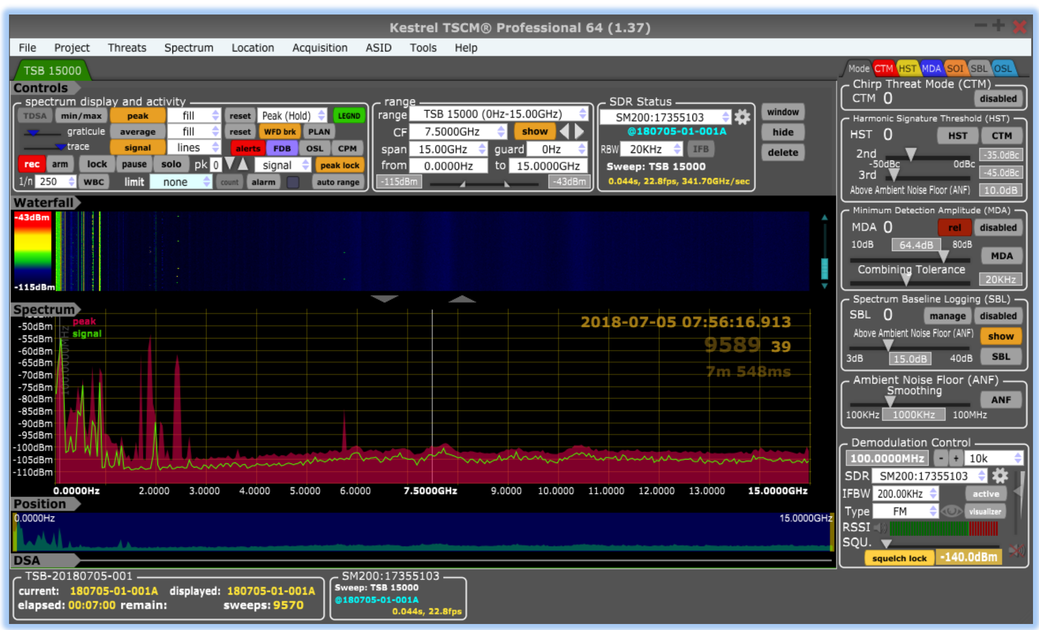
User Interface | v1.37xx

The example above illustrates the Real-Time Event (RTE) trace (LINE) and the Peak Envelope Capture (PEC) trace (LINE).



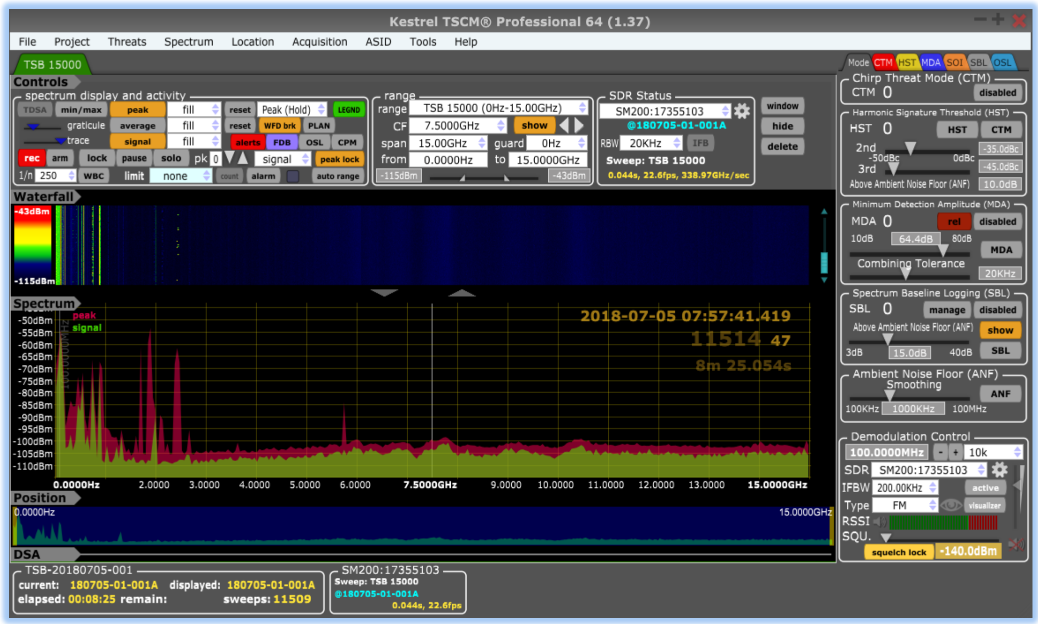
User Interface | v1.37xx

The example above illustrates the Real-Time Event (RTE) trace (LINE), Peak Envelope Capture (PEC) trace (LINE) and Spectral Average Trace (SAT) as a (FILL).



User Interface | v1.37xx

The example above illustrates the Real-Time Event (RTE) trace (LINE) and the Peak Envelope Capture (PEC) trace (FILL).



User Interface | v1.37xx

The example above illustrates the Real-Time Event (RTE) trace (FILL) and the Peak Envelope Capture (PEC) trace (FILL).

The ability to display spectral data utilizing advanced graphical display options is fully supported as part of the Kestrel TSCM ® Professional, operator centric and workflow management design process.

The technical operator has the ability to dynamically update the spectral and waterfall display, without interrupting the data collection process in real-time, during collection and during post analysis review.

Reference Level | Range Control Options

On establishing the initial runtime sweep process for any active spectrum band requires three (3) full sweeps, in order to collect the trace averaging data needed to determine the actual Reference Level and Ambient Noise Floor (ANF) automatically.

When utilizing a fast search receiver or narrow SPAN, this occurs almost instantly, however, with slow search receivers and wide SPANS, this process takes a little longer to see the auto range engage.

To accommodate the wide range of support search receivers and analyzers supported by the Kestrel TSCM ® Professional Software, there are three (3) levels of reference level | Auto Range | controls that work together or independently to assist the technical operator in displaying the active trace information centered on the Graticule.

Reference Level | Auto Range Trigger (ART) ™

Depending several combined factors, including the receiver or analyzer utilized, it is a requirement for the technical operator manually activate, the Auto Range Check Box or press the Auto Range Button after the Graticule trace display stabilizes.

The | Auto Range Trigger (ART) ™ | feature automatically strobes the Auto Range feature immediately following the completion of three (3) sweeps and centers the active trace on the Graticule.

The ART feature strobes each new Spectral Range or Spectrum Band Allocation automatically after the completion of three (3) sweeps during runtime.

There are no technical operator controls exposed for the | Auto Range Trigger (ART) ™ | feature.

Reference Level | Auto Range Button

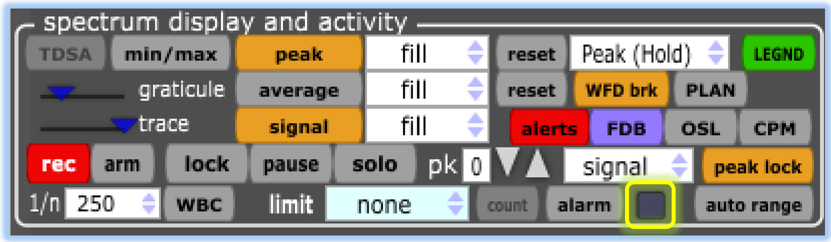
The technical operator can press the | **AUTO RANGE** | button at any time in order to center the currently displayed trace on the Graticule.

Pressing the | AUTO RANGE | is fully supported, even when the Auto Range Check Box is selected active.

Spectrum Display and Activity | v1.38xx

Reference Level | Auto Range Check Box

The Auto Range Check Box is co-located with the Auto Range Button and provides auto range control when utilizing the Positional Zoon Control (PZC) to zoom in on Signals of Interest (SOI).



Spectrum Display and Activity | v1.38xx

When the Auto Range Check Box option is selected during runtime, the RF Spectral Display (RSD) will automatically adjust, when a new high amplitude signal event occurs and when manually utilizing the Positional Zoom Control (PZC) to narrow the displayed Range of Interest (ROI).

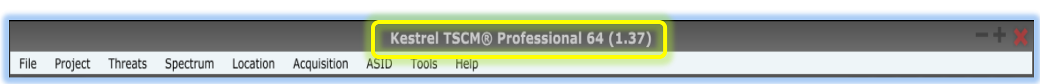
The Auto Range Button can be utilized, even when the Auto Range Checkbox is selected active.

When the Auto Range Check Box option is selected, the manual reference level control (mouse control) is disabled for the active spectrum.

The independent Waterfall Display (WFD) scaling is unaffected and remains active, even when the Auto Range Checkbox is selected active.

Project Window

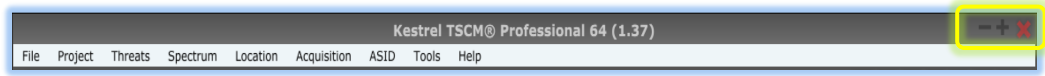
The Kestrel TSCM ® Professional Software, official release identification banner is displayed at the top of the window and identifies the software release.



Identification Banner | Menu Bar | v1.38xx

A double mouse click on the area above the main menu bar causes the main application window to either EXPAND (FULL SCREEN) or WINDOW, allowing the application to be dragged to another monitor or for the purpose of accessing the host PC desktop.

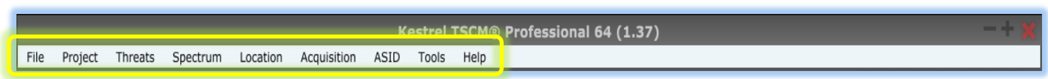
The | MINIMIZE | EXPAND (FULL SCREEN) / WINDOW | CLOSE | buttons are standard and familiar controls that are common to most windows-based software applications.



Window Control ICONS | v1.38xx

Menu Bar

Menu options include | FILE | PROJECT | THREATS | SPECTRUM | LOCATION | ACQUISITION | HELP | and are populated with a wide range of settings, options, tools and features that remain only one (1) level away.



Menu Bar | v1.38xx

The Kestrel TSCM ® Professional Software, workflow management development process strategy ensures that all common control functionality is accessible on the GUI or accessible as a direct menu option.

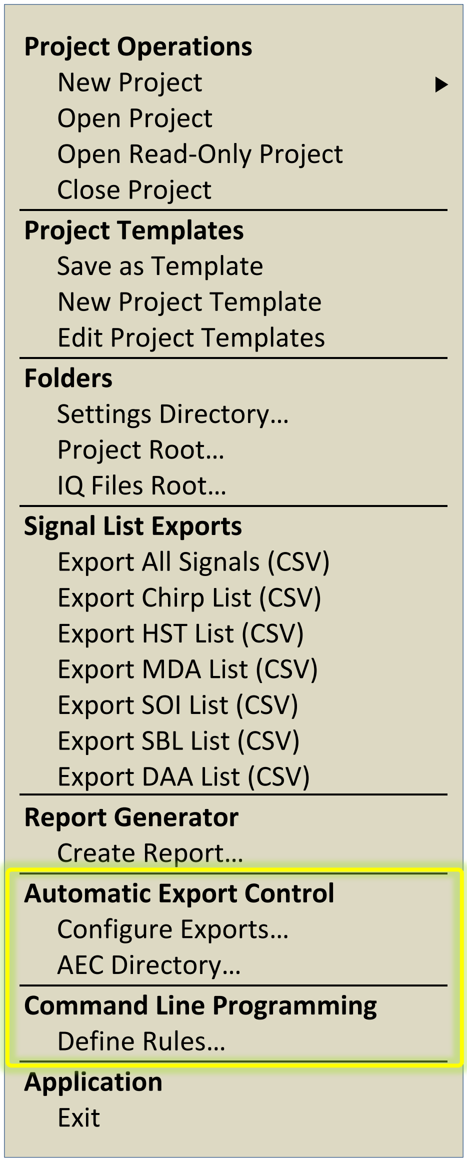
File (Menu Option)

The | FILE | menu option contains the | New Project | Open Project | Open Read-Only Project | Close Project | Save as Template | New Project Template | Edit Project Template | Settings Directory | Project Root | Export Chirp List (.CSV) | Export HST List (.CSV) | Export MDA List (.CSV) | Export SOI List (.CSV) | Export SBL List (.CSV) | Export DAA List (.CSV) | *Automatic Export Control (AEC) ™ | *AEC Directory | *Command Line Programming (CLP) ™ | *Define Rules | Create Report | Exit | related functionality.

*The | Automatic Export Control (AEC) ™ | and | AEC Directory | menu items are <u>not</u> available or displayed, unless | OPT AEC ™ | is requested and licensed for the system.

*The | Command Line Programming (CLP) ™ | and | Define Rules | menu items are <u>not</u> available or displayed, unless | OPT CLP ™ | is requested and licensed for the system.

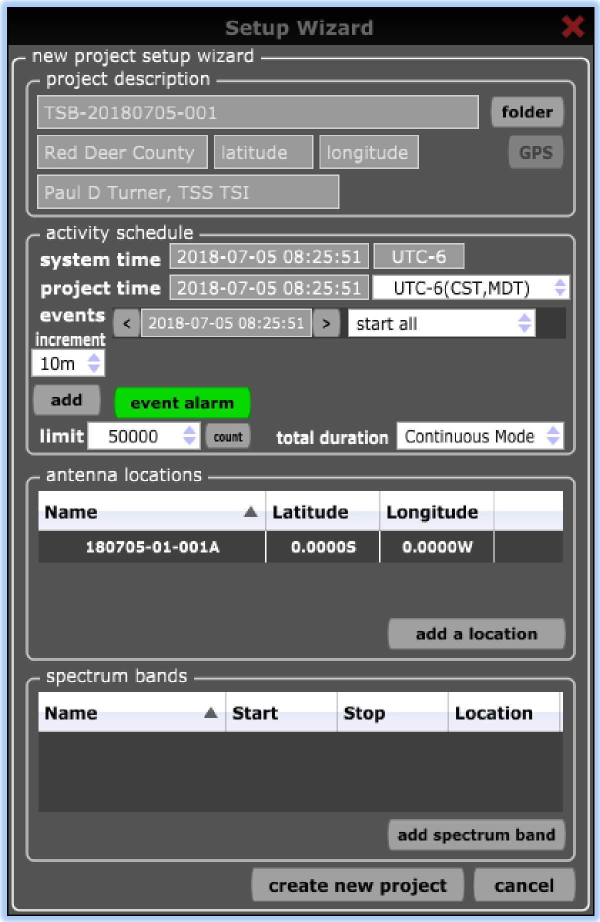
Please contact the Technical Support Group (TSG) at support@pdtg.ca for licensing information for the | OPT AEC ™ | feature.

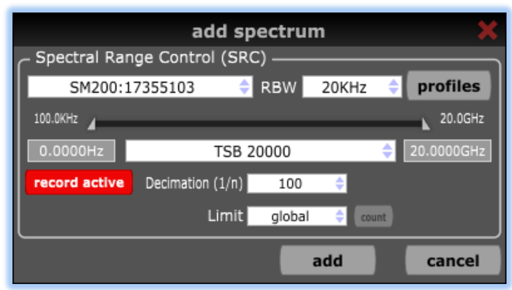


FILE Menu | v1.38xx

New Project

The | NEW PROJECT | SETUP WIZARD | allows the technical operator to define the project file structure, provide a master set of GPS coordinates, set a collection activity schedule, define an initial and additional (optional) antenna locations, select and create, delete or edit a spectral range utilizing the Spectral Range Control (SRC).





Setup Wizard | Add / Edit Spectrum | v1.38xx

Open Project

Historical project files that reside on the host computer or a network drive can be opened for either post analysis review, or for the purpose of continuing the collection process into the same project file by the technical operator; and for purpose of report generation.

This advanced functionality allows the technical operator to create reports either at the time the sweep is completed or during post analysis review, or at any time in the future.

Open (Read-Only) Project

Previously saved project files can be opened for post review and analysis in a |READ ONLY | mode.

Project files opened as |READ ONLY | are write protected and the technical operator cannot restart the data collection process in this mode.

This method of opening historical files provides a secure file preserve feature when reviewing files that might be considered evidence or for presentation in a civil or criminal action.

Close Project

When a project is currently running or open for post analysis review, the | CLOSE PROJECT | option allows the technical operator to close the current project and all associated spectral windows.

When the | CLOSE PROJECT | option is selected by the technical operator, the close command will take effect immediately following completion of any currently running sweep activity.

All spectral data is automatically saved during the runtime and close project process.

The technical operator does not need to save data prior to closing a project file or sweep session.

The Kestrel TSCM ® Professional Software automatically processes and saves all spectral related data during the collection process as part of a predictive logic fail-safe algorithm.

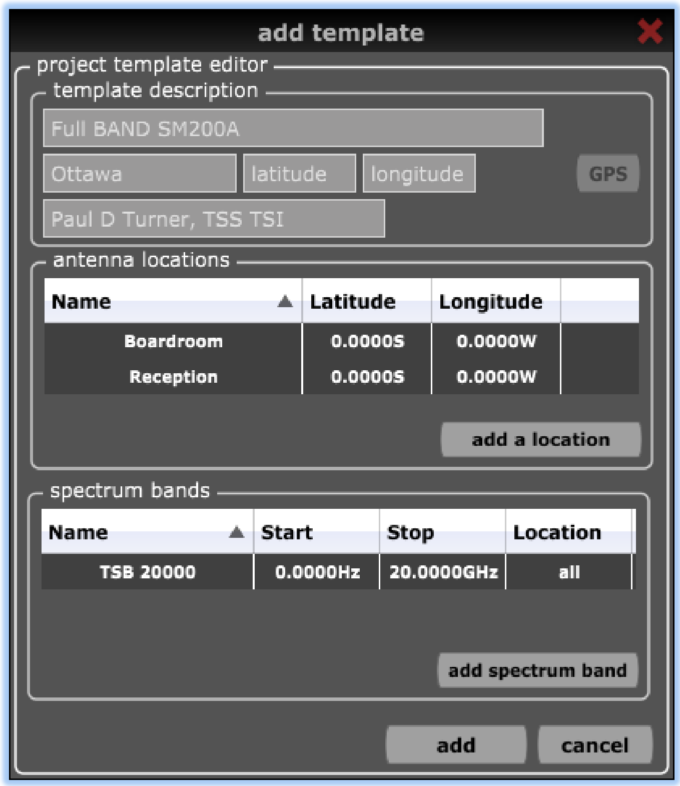
In the event of a computer malfunction or instability, it is typically possible to simply restart the host computer, open and restart the project file in an active collection mode, continuing the data collection process.

Save as Template

Allows the technical operator to save the current user-defined Kestrel Project File (KPF) as a template.

New Project Template

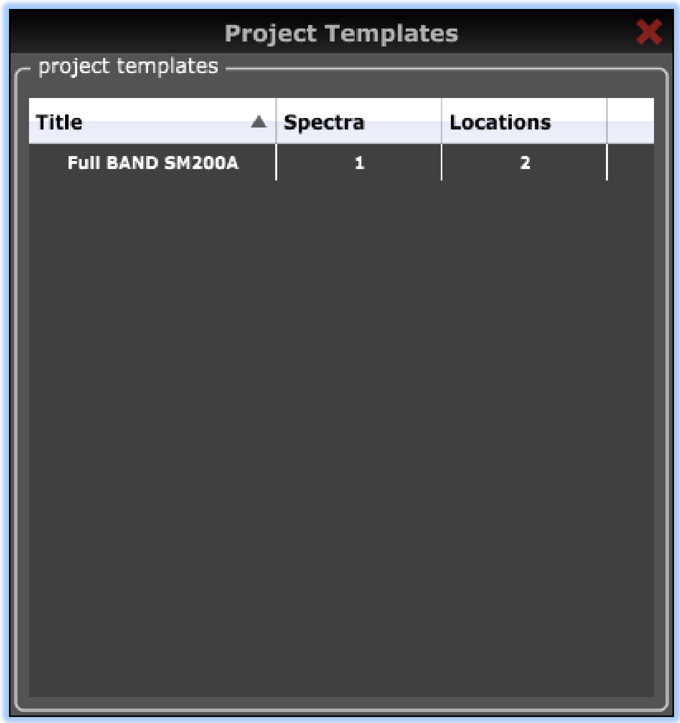
Allows the technical operator to define a new project template, which will appear in the | New Project | menu structure.



Add New Template | v1.38xx

Edit Project Template

Allows the technical operator to edit or delete existing project templates.



Edit Existing Template | v1.38xx

Settings Directory

The default | SETTINGS DIRECTORY | is the default installation directory unless changed during the installation process.

The technical operator can create and assign any directory location as the “new” default | SETTINGS DIRECTORY | including the use of an external flash drive other removable media card (not recommended).

This is an important security feature that allows the technical operator store multiple; customized (SpectralProfiles.spf) files separately while travelling or when sharing the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) within a sweep team environment.

Project Root

By default, the project file structure will be saved in the main installation directory unless changed during the installation process.

The technical operator can create a new project directory location on the host computer, a network drive or other external storage as may be required for operational or security reasons.

TIP: Due to the anticipated project file sizes; it is strongly recommended that a large capacity (1 TB Recommended) high speed hard-drive be utilized to meet extended deployment storage requirements.

IQ Files Root | Directory

The | IQ Files Root | menu option allows the technical operator to define a unique storage path specific to manually captured and | IQ Triggered | files independent of Automatic Export Control (AEC) files.

Export Signal List (CSV)

The ability to export any of the captured signal or threat lists is fully supported within the Kestrel TSCM ® Professional Software.

All of the threat / signal list files may be exported as common (.CSV) files.

Export All Signals (CSV)

Support for a single, signal list export is provided to combine all available signal list data as a CSV export.

Export CTM List (CSV)

The technical operator can export the | CTM LIST | data contained within the Automatic Threat List (ATL) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Export HST List (CSV)

The technical operator can export the | HST LIST | data contained within the Automatic Threat List (ATL) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Export MDA List (CSV)

The technical operator can export the | MDA LIST | data contained within the Automatic Threat List (ATL) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Export SOI List (CSV)

The technical operator can export the | SOI LIST | data contained within the Automatic Threat List (ATL) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Export SBL List (CSV)

The technical operator can export the | SBL LIST | data contained within the Automatic Threat List (ATL) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Export DAA List (CSV)

The technical operator can export the | DAA LIST | data contained within the Dynamic Alert Annunciator (DAA) structure for storage, viewing, analysis and advanced report generation, or for use in third party productivity applications such as word processors, spreadsheets, graphing and database applications.

Session Report Generator (SRG) ™

The | FILE | CREATE REPORT | is a major component of the Kestrel TSCM ® Professional Software application.

The ability to create, print and save presentation quality and dissemination ready; custom session reports in (PDF) file format or hard copy is perhaps one of the most essential functions for operational and legal reasons.

There are a number of essential and optional reporting elements that are typically included within a formatted Technical Surveillance Countermeasures (TSCM) deployment report.

Reporting elements include, a formatted cover page with default and custom import logo ability, session runtime details, project data, active locations, technical operator identification, date and time, collection duration, executive summary, document sensitivity labels, signal event details, harmonic relationships, spectrum plots and graphics including, RSD and WFD images and a variety of custom view and display options, all in a professionally formatted document is a very powerful tool.

Once a session report is created the technical operator can quickly view the formatted output of the report prior to saving or sending the document to the host computer email client, or physical printer.

See Chapter 17

Session Report Generator (SRG) ™

In the event that any changes to the report are required; the technical operator simply opens the Session Report Generator (SRG) ™ a second time and may adjust or fine tune any aspect of the report; prior to generating an updated version for final distribution.

The technical operator may simply over-write the original report or create an interim report, even during active deployment and the ability to generate multiple reports is fully supported.

The technical operator is prompted to automatically save the report in the default Project File Directory and the SRG dialog window remembers the content and settings for future reference and may be closed, or the report may be amended as necessary by the technical operator.

This provides the technical operator with an opportunity to check the report sensitivity label, wording, formatting, included content and perhaps most important, provides an opportunity to proof read the document.

A unique feature of the Session Report Generator (SRG) ™ is the ability of the technical operator to generate any number of different versions of the report for dissemination to the non-technical or technical individuals.

The ability to view and print a hard copy of the PDF report is accomplished from within a third-party PDF viewer that sends the compiled report to the print spooler for processing.

TIP: No special software is required on the host computer to generate or create the PDF session report; however, a copy of the free Adobe Reader TM is required to open, view and print the compiled document on the host computer and will be required by anyone authorized to view the report.

Once the print spooler window opens, the technical operator can select and send the document to any available printer.

The Session Report Generator (SRG) TM is capable generating a significant number of pages, including captured Automatic Threat List (ATL) details, full colour RF Spectral Display (RSD) and Waterfall Display (WFD) graphical images.

It is recommended that the technical operator avoid printing large session reports in favour of a secure PDF file for storage and dissemination.

Adobe Acrobat TM or other third-party application is required on the host computer to add security features to a session report.

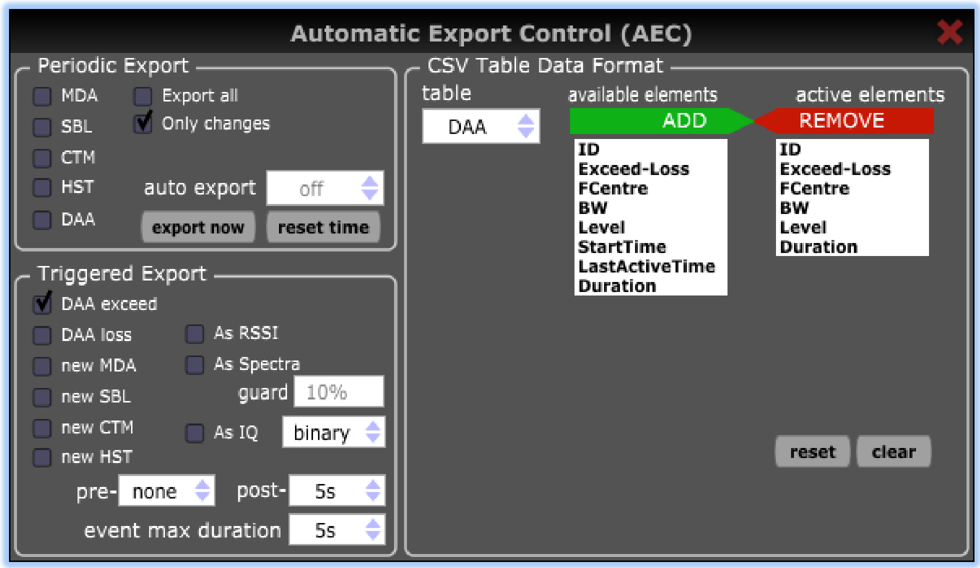
Automatic Export Control (AEC) TM

The | OPT AEC TM | is only available and displays on systems that are licensed to utilize the optional AEC TM feature.

AEC TM is typically utilized for Remote Spectrum Surveillance and Monitoring (RSSM) TM and provides both | Periodic | and | Triggered | event level export of operator defined, formatted | CSV | and | Kestrel IQ (KIQ) TM| data.

Configure Exports

The | AEC TM | feature is operator programmable via a menu driven configuration window.



OPT AEC ™ Programming Window| v1.38xx

AEC ™ Directory

The | AEC ™ Directory | menu option will not appear unless the | OPT AEC ™ | feature is enabled on the host computer.

By default, all | PERIODIC | and | TRIGGERED | files, including the | SPECTRA | and | RSSI | table files | CSV |, will be rendered (exported) to the | KESTREL ® DATA | directory.

Command Line Programming (CLP) ™

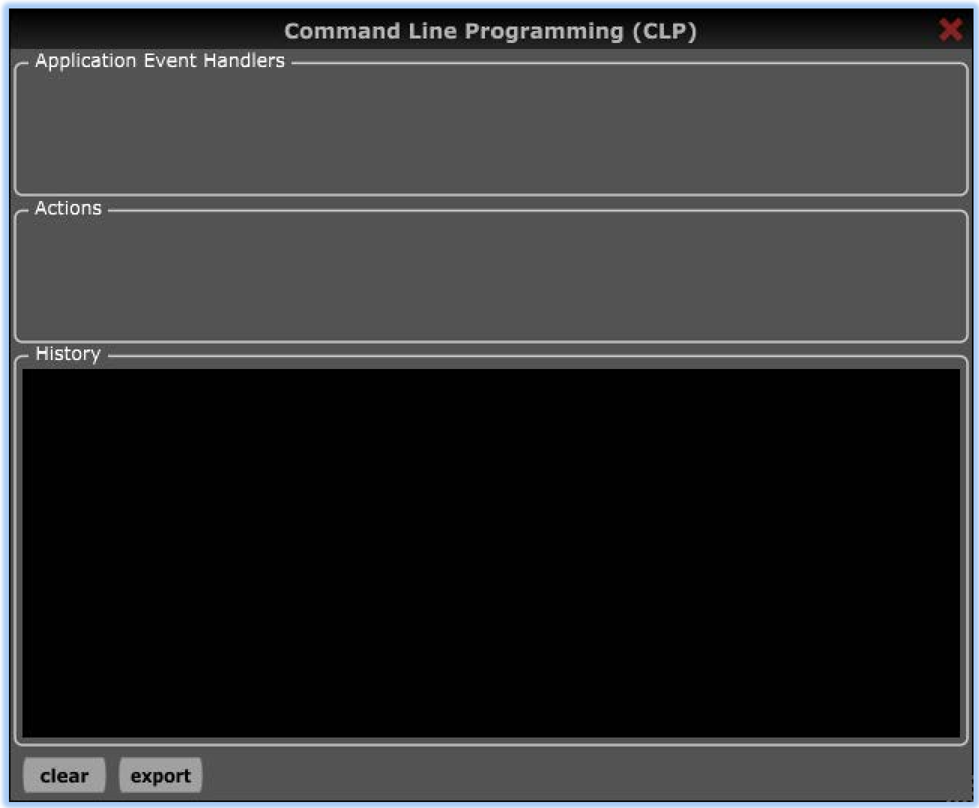
The | OPT CLP ™ | is only available and displays on systems that are licensed to utilize the optional CLP ™ feature.

CLP ™ is a next generation resource that allows the technical operator to define audio alerts, system actions, and email / SMS network alerting.

The ability to control third-party software and hardware is fully realized when the autonomous collection is required.

Define Rules

The | CLP ™ Directory | menu option will not appear unless the | OPT CLP ™ | feature is enabled on the host computer.



OPT CLP ™ Programming Window| v1.38xx

Selecting the define rules menu option displays the CLP ™ programming window, in which any number of event handlers and actions are defined by the technical operator.

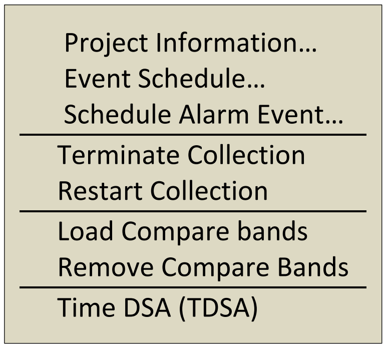
Exit

Exits the current Kestrel Project File (KPF) ™, if open and closes the application.

Provides the operator with a warning and opportunity to cancel the shut-down process, if initiated in error.

Project (Menu Option)

The project menu option contains the | PROJECT INFORMATION | EVENT SCHEDULE | EVENT ALARM SOUND | TERMINATE COLLECTION | RESTART COLLECTION | LOAD COMPARE BANDS | REMOVE COMPARE BANDS | menu options.



PROJECT Menu | v1.38xx

Project Information

The ability to display and edit the project information is fully supported utilizing the | PROJECT | PROJECT INFORMATION |dialog window.

The technical operator can edit the | PROJECT FILE NAME | PROJECT LOCATION | TECHNICAL OPERATOR | reference information.

This feature can be utilized to sanitize any identifying information fragments that may reside, within the actual proprietary, non-human readable project files.

This practice allows the technical operator to share Kestrel TSCM ® Professional Software project files without fear that client specific information fragments are lurking within the project file structure.

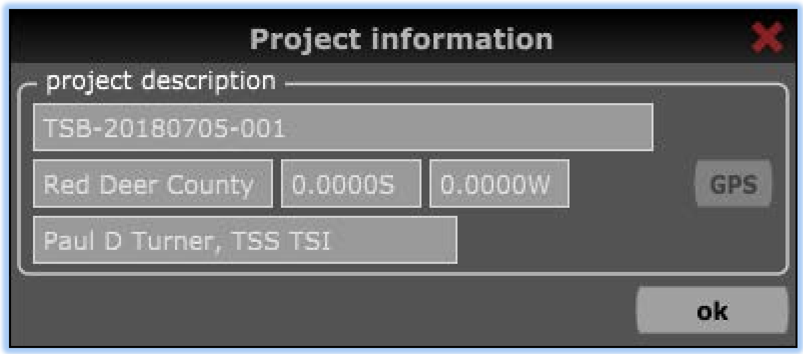
It is essential to understand that this tool will not change the actual Project File Directory or the individual Project Files Names.

The process only sanitizes hidden fragments or data contained within the Project File structure.

The technical operator can manually change the | Project Directory Name | and the affected Project File names.

It is essential to understand that the | Project Directory Name | and the Project Files with the file extensions (KPF) (KSI) (KSS) must have the same directory / file name.

When the directory file name is changed, the technical operator must update the (KPF) (KSI) (KSS) files names manually, or the project cannot be opened for post analysis review in the future.

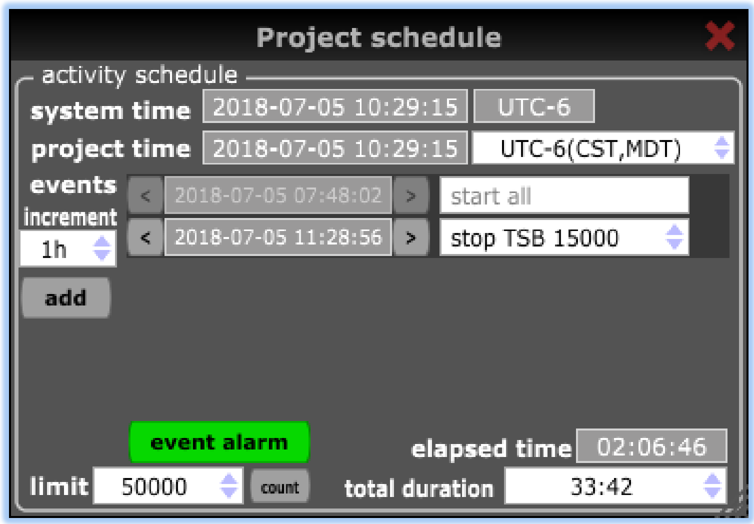


Project Information | v1.38xx

Event Schedule

The | EVENT SCHEDULE | dialog window provides the ability to view and edit the current project scheduling setup, the active time zone referenced to Universal Time Coordinated (UTC) and any number of active collection | START | and | STOP | events, including the ability to establish a Delayed Start Mode (DSM) ™ start time event.

The technical operator can also establish a Continuous Collection Mode (CCM) ™ runtime event allowing the application to run unattended for any period of time, equal to the media storage space available.

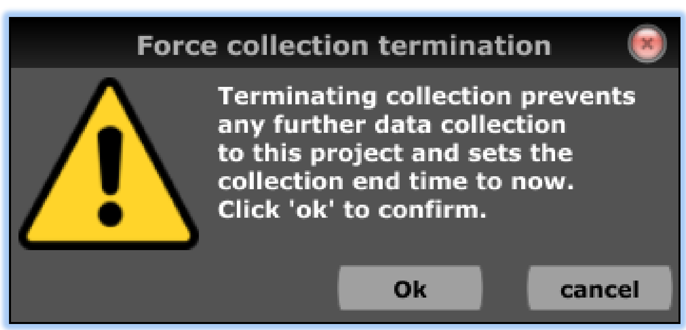


PROJECT Schedule | v1.38xx

Terminate Collection

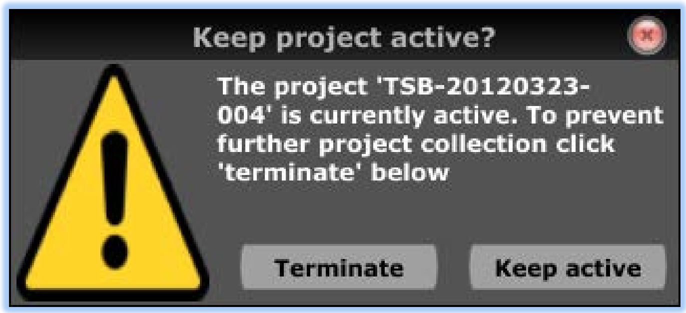
A menu option located in the | PROJECT | menu structure; that may be used to Terminate Collection and prevent any further data collection unless the technical operator selects the Restart Collection menu option.

When confirmed, this menu option will force the “Kestrel Project File” end time to be immediate and the total duration to be the difference from the original “Kestrel Project File” start time, to the time that the Force Collection Termination is confirmed by the technical operator.



Force Collection Termination Warning | v1.38xx

When the technical operator selects the | CLOSE PROJECT | menu option within the | FILE | menu structure, the “Keep Project Alive” dialog window will be displayed.



Terminate Project | v1.38xx

The | TERMINATE COLLECTION | and the | KEEP PROJECT ALIVE | features have the same operational effect by preventing a situation where closing and opening a historical project file causes the elapsed time to continue running, when the technical operator does not wish to restart collection for any reason and in-turn, prevents accidental corruption of historical trace data sources.

Restart Collection

The | RESTART COLLECTION | features allows the technical operator to restart the ability to access a previously terminated project.

Load Compare Bands

The | LOAD COMPARE BANDS | dialog window allows the technical operator to search for and load any available projects that contain comparative data for temporary import into the current project for Differential Signal Analysis (DSA) review.

Only bands of the same Spectral Range Control (SRC) name or Range of Interest (ROI) may be imported for comparative purposes.

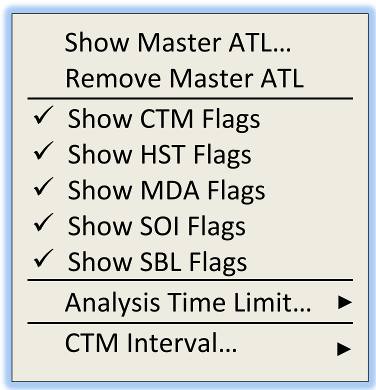
Remove Compare Bands

The | REMOVE COMPARE BANDS | dialog window allows the technical operator to selectively remove and any or all previously loaded comparative bands in the current project.

Closing the current project, automatically removes all previously loaded comparative bands from the project file structure.

Threats (Menu Option)

The threats menu option contains the | SHOW MASTER ATL | REMOVE MASTER ATL | SHOW CTM FLAGS | SHOW HST FLAGS | SHOW MDA FLAGS | SHOW SOI FLAGS | SHOW SBL FLAGS | ANALYSIS TIME LIMIT | CTM INTERVAL | functionality and sub-menu structure.

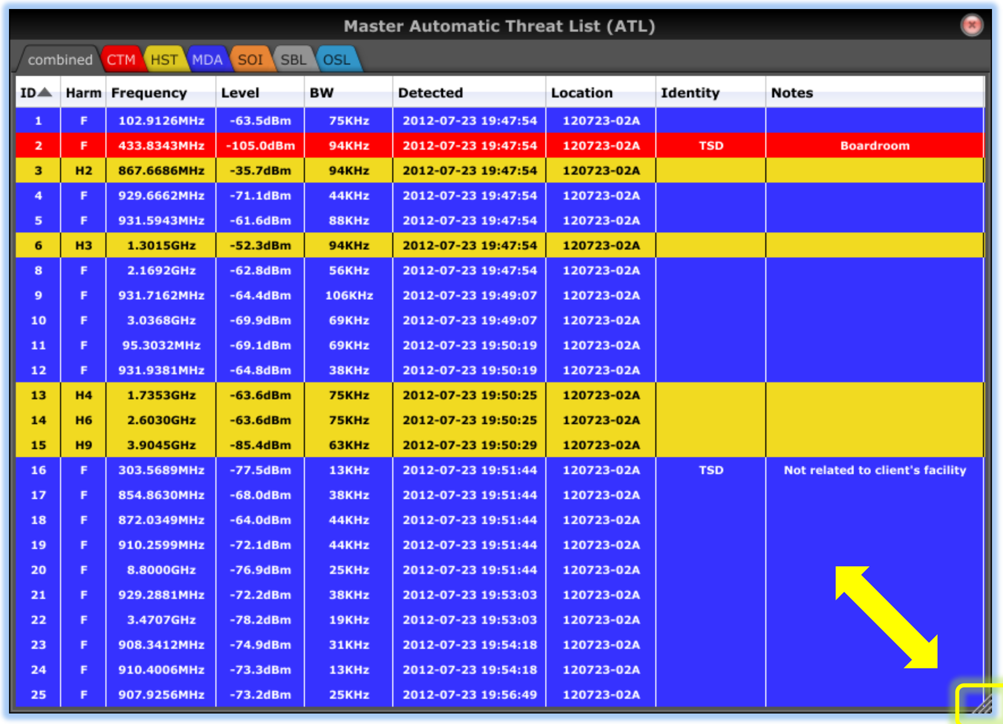


THREATS Menu | v1.38xx

Show Master ATL

The Show Master ATL menu option opens the Master - Automatic Threat List (ATL) as a floating window, column formatted table.

The technical operator will find detailed information relating to all detected and user added Signals of Interest (SOI) within a sophisticated full colour, TAB based chart structure.



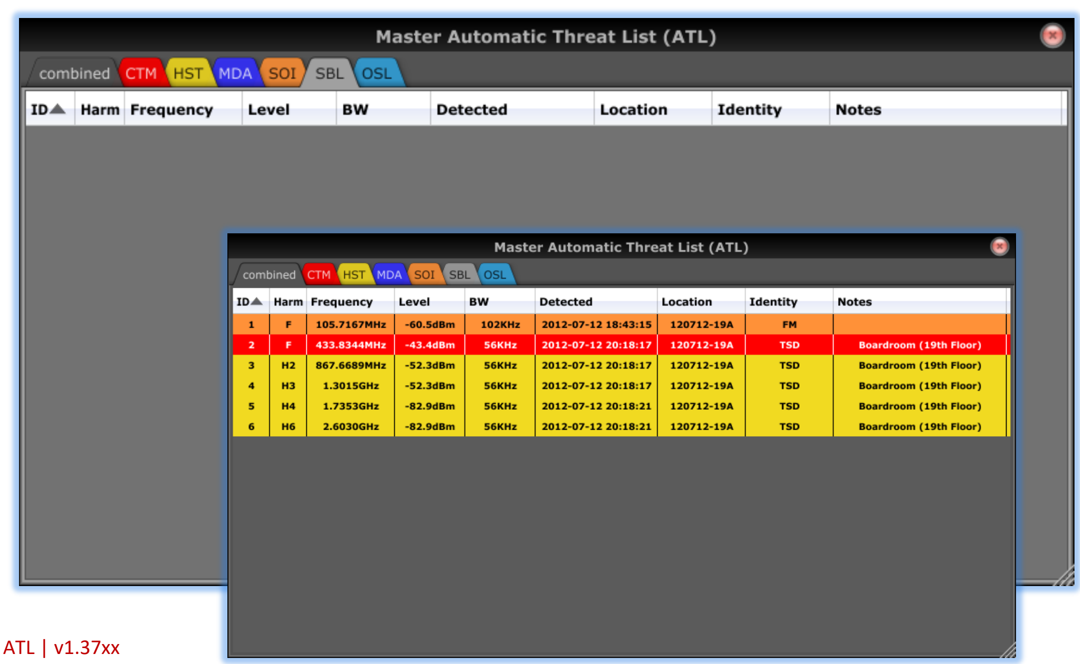
Master Automatic Threat List (ATL)

combined CTM HST MDA SOI SBL OSL

ID	Harm	Frequency	Level	BW	Detected	Location	Identity	Notes
1	F	102.9126MHz	-63.5dBm	75KHz	2012-07-23 19:47:54	120723-02A		
2	F	433.8343MHz	-105.0dBm	94KHz	2012-07-23 19:47:54	120723-02A	TSD	Boardroom
3	H2	867.6686MHz	-35.7dBm	94KHz	2012-07-23 19:47:54	120723-02A		
4	F	929.6662MHz	-71.1dBm	44KHz	2012-07-23 19:47:54	120723-02A		
5	F	931.5943MHz	-61.6dBm	88KHz	2012-07-23 19:47:54	120723-02A		
6	H3	1.3015GHz	-52.3dBm	94KHz	2012-07-23 19:47:54	120723-02A		
8	F	2.1692GHz	-62.8dBm	56KHz	2012-07-23 19:47:54	120723-02A		
9	F	931.7162MHz	-64.4dBm	106KHz	2012-07-23 19:49:07	120723-02A		
10	F	3.0368GHz	-69.9dBm	69KHz	2012-07-23 19:49:07	120723-02A		
11	F	95.3032MHz	-69.1dBm	69KHz	2012-07-23 19:50:19	120723-02A		
12	F	931.9381MHz	-64.8dBm	38KHz	2012-07-23 19:50:19	120723-02A		
13	H4	1.7353GHz	-63.6dBm	75KHz	2012-07-23 19:50:25	120723-02A		
14	H6	2.6030GHz	-63.6dBm	75KHz	2012-07-23 19:50:25	120723-02A		
15	H9	3.9045GHz	-85.4dBm	63KHz	2012-07-23 19:50:29	120723-02A		
16	F	303.5689MHz	-77.5dBm	13KHz	2012-07-23 19:51:44	120723-02A	TSD	Not related to client's facility
17	F	854.8630MHz	-68.0dBm	38KHz	2012-07-23 19:51:44	120723-02A		
18	F	872.0349MHz	-64.0dBm	44KHz	2012-07-23 19:51:44	120723-02A		
19	F	910.2599MHz	-72.1dBm	44KHz	2012-07-23 19:51:44	120723-02A		
20	F	8.8000GHz	-76.9dBm	25KHz	2012-07-23 19:51:44	120723-02A		
21	F	929.2881MHz	-72.2dBm	38KHz	2012-07-23 19:53:03	120723-02A		
22	F	3.4707GHz	-78.2dBm	19KHz	2012-07-23 19:53:03	120723-02A		
23	F	908.3412MHz	-74.9dBm	31KHz	2012-07-23 19:54:18	120723-02A		
24	F	910.4006MHz	-73.3dBm	13KHz	2012-07-23 19:54:18	120723-02A		
25	F	907.9256MHz	-73.2dBm	25KHz	2012-07-23 19:56:49	120723-02A		

Automatic Threat Level (ATL) | v1.37xx

The Master ATL can be resized manually, to fit the primary display monitor, or dragged to a secondary display monitor, if available.



Master Automatic Threat List (ATL)

combined CTM HST MDA SOI SBL OSL

ID	Harm	Frequency	Level	BW	Detected	Location	Identity	Notes

Master Automatic Threat List (ATL)

combined CTM HST MDA SOI SBL OSL

ID	Harm	Frequency	Level	BW	Detected	Location	Identity	Notes
1	F	105.7167MHz	-60.5dBm	102KHz	2012-07-12 18:43:15	120712-19A	FM	
2	F	433.8344MHz	-43.4dBm	56KHz	2012-07-12 20:18:17	120712-19A	TSD	Boardroom (19th Floor)
3	H2	867.6689MHz	-52.3dBm	56KHz	2012-07-12 20:18:17	120712-19A	TSD	Boardroom (19th Floor)
4	H3	1.3015GHz	-52.3dBm	56KHz	2012-07-12 20:18:17	120712-19A	TSD	Boardroom (19th Floor)
5	H4	1.7353GHz	-82.9dBm	56KHz	2012-07-12 20:18:21	120712-19A	TSD	Boardroom (19th Floor)
6	H6	2.6030GHz	-82.9dBm	56KHz	2012-07-12 20:18:21	120712-19A	TSD	Boardroom (19th Floor)

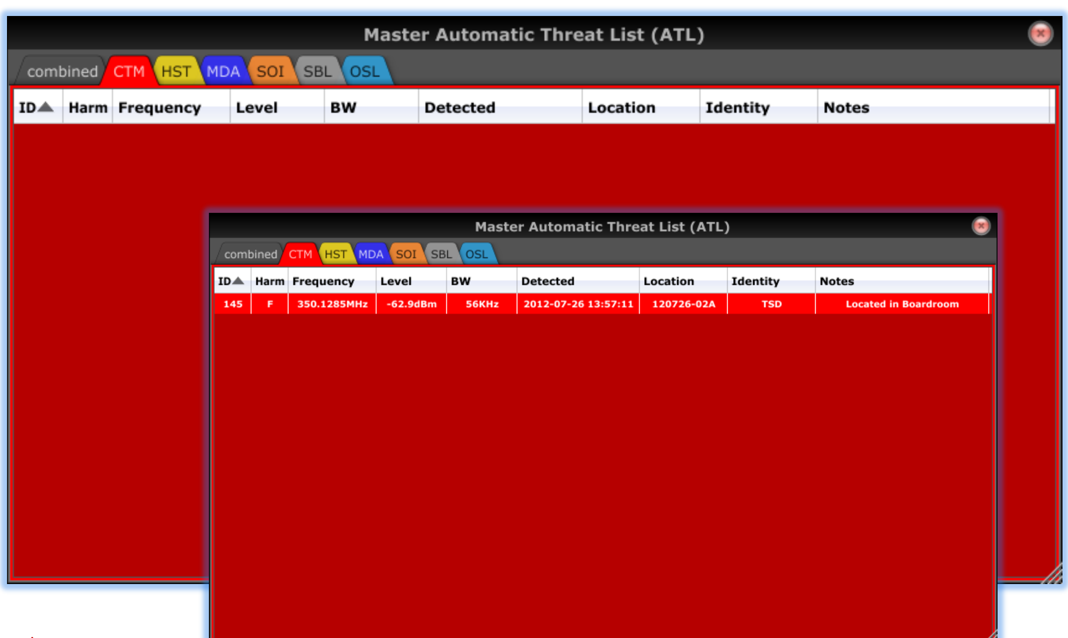
ATL | v1.37xx

The | MASTER ATL | TAB based display contains a complete colour coded list consistent with the TAB colour for each signal list category as represented in the following chart.

Master Automatic Threat List (ATL)		
Master ATL	Dark Gray	
CTM	Red	
HST	Yellow	
MDA	Blue	
SOI	Orange	
SBL	Gray	
OSL	Light Blue	

ATL Colour Reference Chart | v1.40xx

The Master ATL allows the technical operator to quickly review all signals easily in a floating window that can be displayed on the primary display monitor or dragged to a secondary display monitor for real-time monitoring, as the Master ATL dynamically updates during runtime.



ATL | v1.37xx

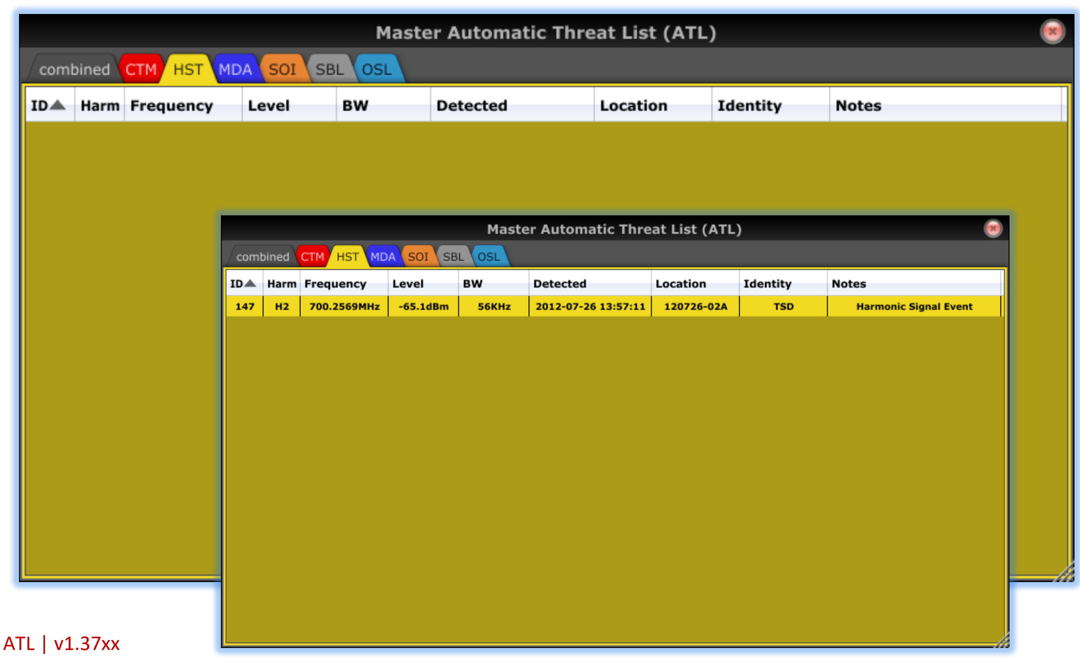
The | CTM | TAB displays a list of all signals that have been identified by the software threat detection algorithm as potentially hostile and containing target area room audio.

It is possible and normal for the CTM Mode to occasionally identify and flag false signals as RED spectral marker flags on the Graticule and add these to the threat list.

The Threat Detection Algorithm (TDA) is a sophisticated and complex software feature that by design, exhibits significant flexibility in the Probability of Detection (POD) of potentially hostile analog signals in a typically complex RF ambient spectral environment utilizing advance concept predictive logic and artificial intelligence.

When the HST feature is active in CTM Mode, signals identified by the software as having a direct harmonic relationship to a signal on the CTM list, may automatically transfer to the HST list and displayed as YELLOW spectral marker flags on the Graticule.

All | CTM | Signals of Interest (SOI) are displayed on both the GUI sidebar and the Master ATL and are available for review and analysis by the technical operator.



ATL | v1.37xx

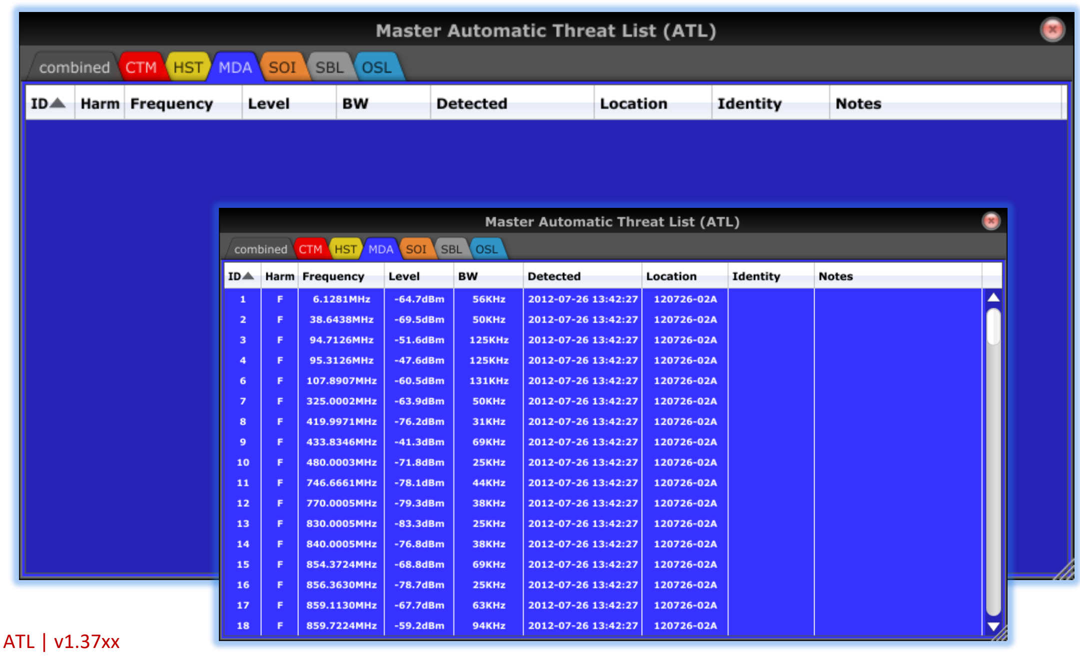
The | HST | TAB displays a list of all signals that have been identified by the software threat detection algorithm as containing target area room audio or a direct harmonic relationship to other identified signals.

There are two (2) harmonic detection modes available to the technical operator during active deployment.

The first is HST (CTM Mode) designed to search for harmonic relationships of only those signals that appear on the CTM list.

The second mode of operation is the HST Mode that is specifically designed to search for and identify harmonic relationships across the entire Range of Interest (ROI).

All | HST | Signals of Interest (SOI) are displayed on both the GUI sidebar ATL and the Master ATL and are available for review and analysis by the technical operator.



ID	Harm	Frequency	Level	BW	Detected	Location	Identity	Notes
1	F	6.1281MHz	-64.7dBm	56KHz	2012-07-26 13:42:27	120726-02A		
2	F	38.6438MHz	-69.5dBm	50KHz	2012-07-26 13:42:27	120726-02A		
3	F	94.7126MHz	-51.6dBm	125KHz	2012-07-26 13:42:27	120726-02A		
4	F	95.3126MHz	-47.6dBm	125KHz	2012-07-26 13:42:27	120726-02A		
6	F	107.8907MHz	-60.5dBm	131KHz	2012-07-26 13:42:27	120726-02A		
7	F	325.0002MHz	-63.9dBm	50KHz	2012-07-26 13:42:27	120726-02A		
8	F	419.9971MHz	-76.2dBm	31KHz	2012-07-26 13:42:27	120726-02A		
9	F	433.8346MHz	-41.3dBm	69KHz	2012-07-26 13:42:27	120726-02A		
10	F	480.0003MHz	-71.8dBm	25KHz	2012-07-26 13:42:27	120726-02A		
11	F	746.6661MHz	-78.1dBm	44KHz	2012-07-26 13:42:27	120726-02A		
12	F	770.0005MHz	-79.3dBm	38KHz	2012-07-26 13:42:27	120726-02A		
13	F	830.0005MHz	-83.3dBm	25KHz	2012-07-26 13:42:27	120726-02A		
14	F	840.0005MHz	-76.8dBm	38KHz	2012-07-26 13:42:27	120726-02A		
15	F	854.3724MHz	-68.8dBm	69KHz	2012-07-26 13:42:27	120726-02A		
16	F	856.3630MHz	-78.7dBm	25KHz	2012-07-26 13:42:27	120726-02A		
17	F	859.1130MHz	-67.7dBm	63KHz	2012-07-26 13:42:27	120726-02A		
18	F	859.7224MHz	-59.2dBm	94KHz	2012-07-26 13:42:27	120726-02A		

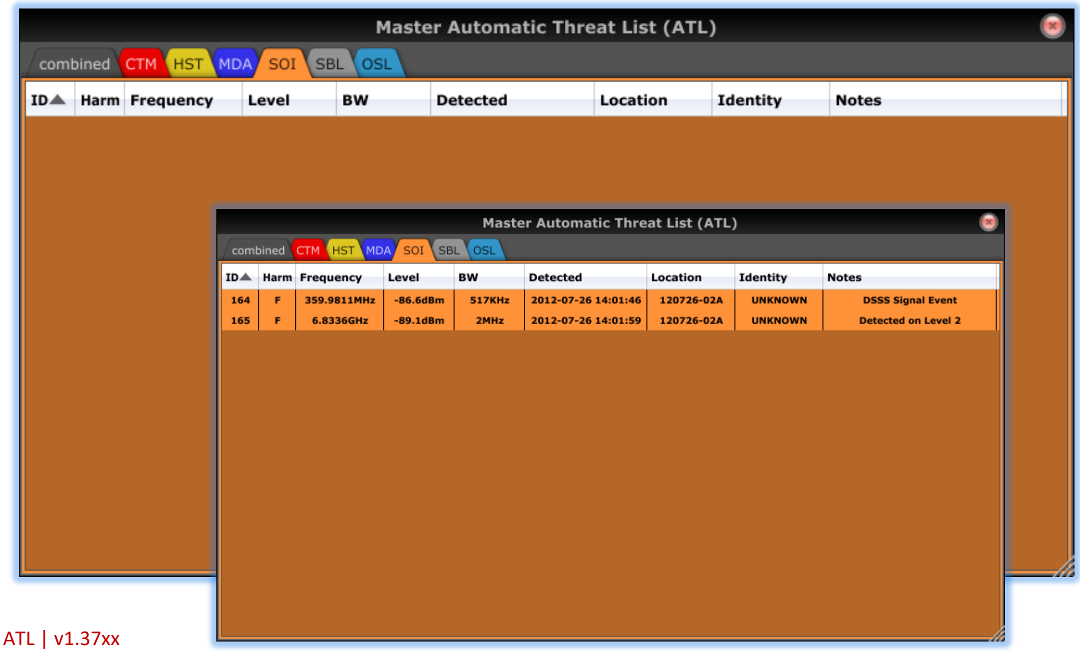
ATL | v1.37xx

The | MDA | TAB displays a list of all signals that have been identified by the software as meeting or exceeding the Minimum Detection Amplitude (MDA) level as established by the technical operator during the threat detection setup process.

Signals that are located on the MDA list will contain a mix of both friendly signals and any potentially hostile signals that are of a continuous or intermittent nature; that are active during the sweep and have met or exceeded the MDA level at some historical point in time.

TIP: It is important to understand that there is no active threat detection component of signals on the MDA list. Signals on the MDA list have simply met or exceeded the Minimum Detection Amplitude (MDA) value set by the technical operator either momentarily or continuously as can be confirmed within the Waterfall Display (WFD).

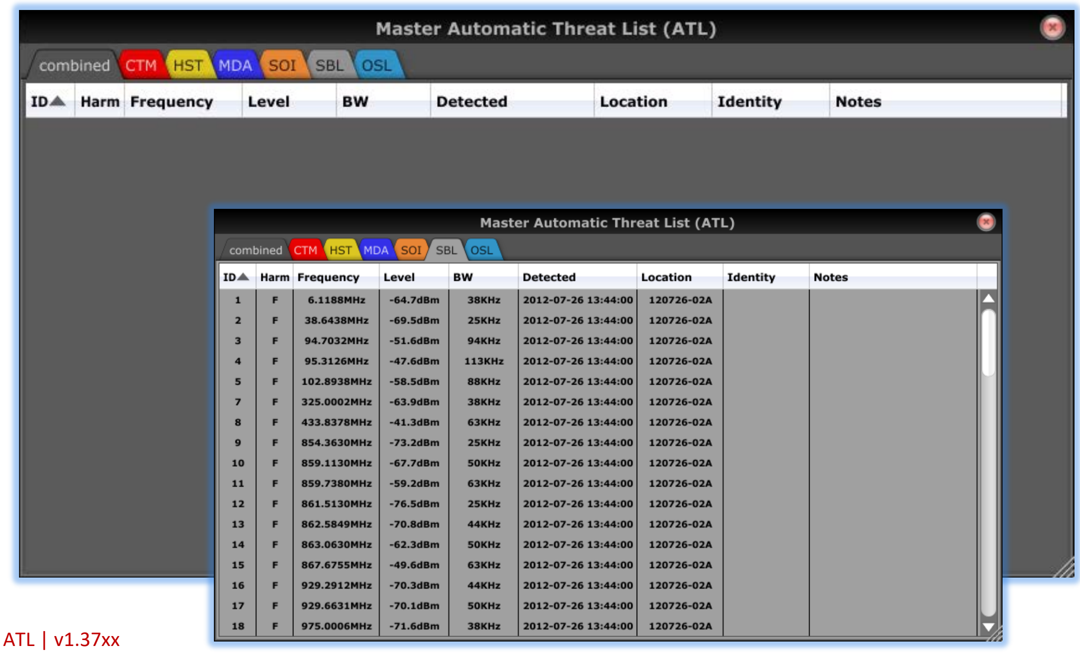
All | MDA | Signals of Interest (SOI) are displayed on both the GUI sidebar ATL and the Master ATL and are available for review and analysis by the technical operator.



ATL | v1.37xx

The | SOI | TAB displays a list of all signals that have been manually identified by the technical operator as Signals of Interest (SOI) and have been manually added to the SOI list.

All | SOI | Signals of Interest (SOI) that are manually added by the technical operator are displayed on both the GUI sidebar and the Master ATL and are available for review and analysis by the technical operator.



ATL | v1.37xx

The | SBL | TAB displays a list of all signals that have been identified as being above the Ambient Noise Floor (ANF) value determined and set by the technical operator.

The Spectrum Baseline Logging (SBL) feature is designed to capture all signals at any given level above the Ambient Noise Floor (ANF).

The default value is 15 dB above Ambient Noise Floor (ANF).

The technical operator can adjust the active detection level of the SBL feature between 3 dB and 40 dB above the Ambient Noise Floor (ANF).

The SBL and HST feature utilize the ANF level as part of the detection and signal identification strategy.

Detection sensitivity control is accomplished by adjusting an Ambient Noise Floor (ANF) averaging (smoothing) control located on the ANF sidebar control group.

The technical operator can manually adjust the ANF control between 100 kHz and 100 MHz as desired.

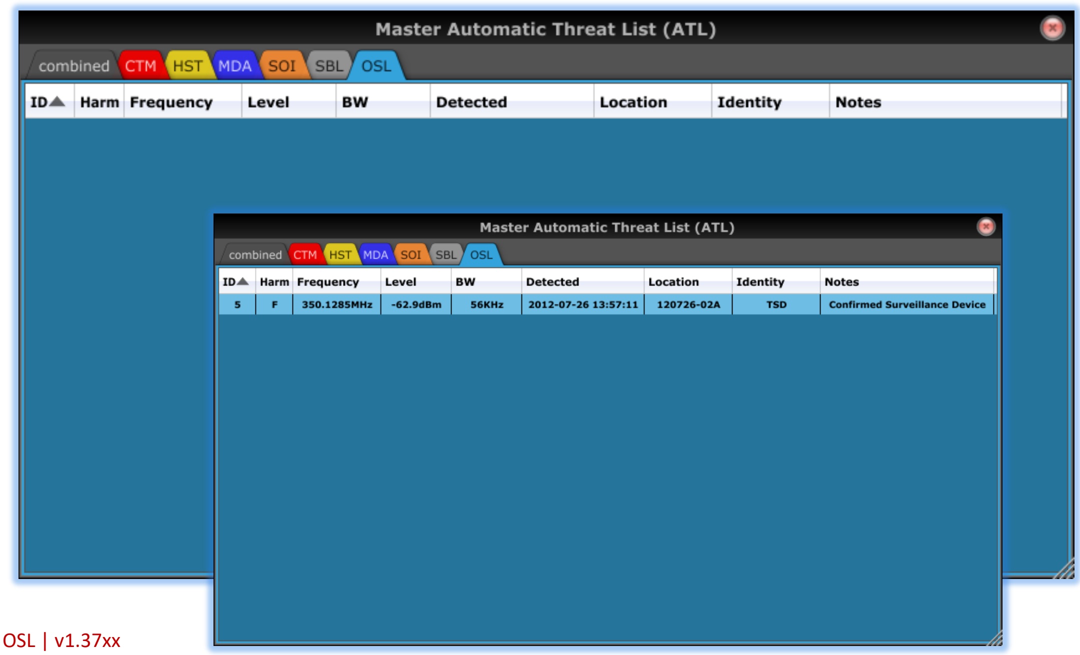
The setting for the Detection Sensitivity or averaging (smoothing) control is 1 MHz by default.

To decrease detection sensitivity the control can be adjusted to a lower value and to increase detection sensitivity the control can be adjusted to a higher value.

All | SBL |signal events are displayed on both the GUI sidebar and the Master ATL and are available for review and analysis by the technical operator.

The SBL signal list does not appear on the Master ALT list TAB as do the CTM, HST, MDA and SOI signal details.

The | OSL | TAB displays a list of all signals that have been manually added to the Operator Signal List (OSL) database by the technical operator and span multiple project files.



OSL | v1.37xx

The OSL signal list does not appear on the Master ALT list TAB as do the CTM, HST, MDA and SOI signal details.

Delete (ATL) Signal Events

Single or multiple list entries can be removed (deleted) by the technical operator from the Sidebar or Master ATL utilizing standard windows-based mouse and keyboard controls and functionality.

This functionality allows the technical operator to remove undesirable signal list entries when they have been added to the ATL and perhaps confirmed as friendly or identified as duplicates.

Once deleted, signal events would need to be either, detected and added to the list again by the Threat Detection Algorithm (TDA), or manually added as a Signal of Interest (SOI) by the technical operator.

Master Automatic Threat List (ATL) ™

The Master Automatic Threat List (ATL) ™ displays detailed signal related information that can be viewed, edited, deleted and reordered by the technical operator.

The Master ATL is dynamically populated and updated in real-time as new signal events occur and when the Threat Detection Algorithm (TDA) is running.

The Master ATL is a very powerful tool that significantly enhances the Probability of Detection (POD) during deployment, allowing the technical operator to, view, edit, reorder and delete individual signal details.

TIP: The sidebar ATL provides limited information relating to signal parameters and is designed for quick review and demodulation drag and drop functionality. The Master - ATL is a very powerful review and analysis feature that provides the technical operator with excellent situational awareness during the collection process.

The Master Automatic Threat List (ATL) ™ has been designed to significantly enhance technical operator workflow.

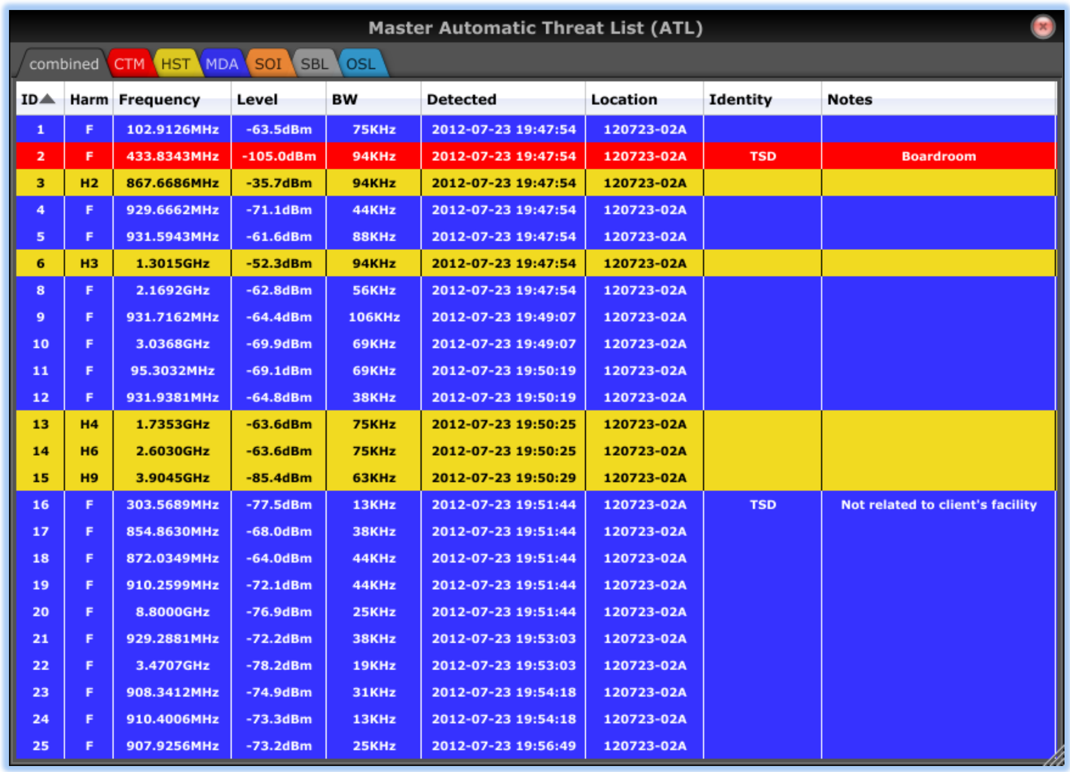
The technical operator is encouraged to utilize the Master ATL feature on a dedicated display monitor during real-time spectrum monitoring to significantly enhance the Probability of Detection (POD) of potentially hostile signal events as they occur.

Display (Optional) Table Columns

The | THREAT LIST | and | SOI LIST | have a “persist” checkable menu option.

Selecting this option will store / restore all changes to the table layout for any of the threat or signal lists between executions.

Each of the table types behaves independently, not a global feature.



ID	Harm	Frequency	Level	BW	Detected	Location	Identity	Notes
1	F	102.9126MHz	-63.5dBm	75KHz	2012-07-23 19:47:54	120723-02A		
2	F	433.8343MHz	-105.0dBm	94KHz	2012-07-23 19:47:54	120723-02A	TSD	Boardroom
3	H2	867.6686MHz	-35.7dBm	94KHz	2012-07-23 19:47:54	120723-02A		
4	F	929.6662MHz	-71.1dBm	44KHz	2012-07-23 19:47:54	120723-02A		
5	F	931.5943MHz	-61.6dBm	88KHz	2012-07-23 19:47:54	120723-02A		
6	H3	1.3015GHz	-52.3dBm	94KHz	2012-07-23 19:47:54	120723-02A		
8	F	2.1692GHz	-62.8dBm	56KHz	2012-07-23 19:47:54	120723-02A		
9	F	931.7162MHz	-64.4dBm	106KHz	2012-07-23 19:49:07	120723-02A		
10	F	3.0368GHz	-69.9dBm	69KHz	2012-07-23 19:49:07	120723-02A		
11	F	95.3032MHz	-69.1dBm	69KHz	2012-07-23 19:50:19	120723-02A		
12	F	931.9381MHz	-64.8dBm	38KHz	2012-07-23 19:50:19	120723-02A		
13	H4	1.7353GHz	-63.6dBm	75KHz	2012-07-23 19:50:25	120723-02A		
14	H6	2.6030GHz	-63.6dBm	75KHz	2012-07-23 19:50:25	120723-02A		
15	H9	3.9045GHz	-85.4dBm	63KHz	2012-07-23 19:50:29	120723-02A		
16	F	303.5689MHz	-77.5dBm	13KHz	2012-07-23 19:51:44	120723-02A	TSD	Not related to client's facility
17	F	854.8630MHz	-68.0dBm	38KHz	2012-07-23 19:51:44	120723-02A		
18	F	872.0349MHz	-64.0dBm	44KHz	2012-07-23 19:51:44	120723-02A		
19	F	910.2599MHz	-72.1dBm	44KHz	2012-07-23 19:51:44	120723-02A		
20	F	8.8000GHz	-76.9dBm	25KHz	2012-07-23 19:51:44	120723-02A		
21	F	929.2881MHz	-72.2dBm	38KHz	2012-07-23 19:53:03	120723-02A		
22	F	3.4707GHz	-78.2dBm	19KHz	2012-07-23 19:53:03	120723-02A		
23	F	908.3412MHz	-74.9dBm	31KHz	2012-07-23 19:54:18	120723-02A		
24	F	910.4006MHz	-73.3dBm	13KHz	2012-07-23 19:54:18	120723-02A		
25	F	907.9256MHz	-73.2dBm	25KHz	2012-07-23 19:56:49	120723-02A		

Master ATL | v1.37xx

ID Column

Each discrete signal is flagged with a unique numerical database reference ID number in the order of detection and is duplicated on the ATL sidebar list structure.

The ID column many be reordered from the lowest numerical value to the highest numerical value or from the highest numerical value to the lowest numerical value.

HARM Column

The HARM column flags each discrete signal as either the fundamental (F) frequency or associated harmonic (H).

Signals identified as harmonic in nature will be identified as (H2) (H3) (H4) (H5) (H6) (H7) (H9), etc.

It is essential to understand that signals not specifically identified by the Kestrel TSCM ® Professional Software as harmonics may well be flagged as CTM events and marked as fundamentals when the software is unable to verify a harmonic relationship.

This may occur as the result of modulation factors that cause the threat detection algorithm to see to separate signals that do not meet harmonic threat detection tolerance.

Oftentimes the technical operator will notice that a CTM signal is in-fact a harmonic of the same fundamental.

Consider the following runtime example chart:

CTM Vs HST Threat Detection Chart					
ID	**Frequency (MHz)**	**Threat List**	**Harmonic**	**Relationship**	✓
01	100.2100	CTM	F	F	✓
02	200.0001	CTM	F	H2 of 01	
03	200.1700	HST	H2	H2 of 01	✓
04	300.0002	HST	H2	H2 of 02	
05	300.2001	HST	H3	H3 of 01	✓

Threat Detection | v1.37xx

At first glance, analysis may appear a little confusing; however, once the technical operator understands the operational concept of the threat detection process, analysis will become second nature.

The chart above indicates that signal events (01), (03) and (05) are directly related as the fundamental (F), (H2) and (H3).

A review of the chart indicates this analysis is correct.

Where the confusion may arise is with signal events (02) and (04) that appear to be directly related as a separate fundamental (F) and (H2).

In reality, it is likely that minor variations in the modulation of signal event (01) caused a shift in the harmonic frequency (02) at the moment of capture and the threat detection algorithm identified and logged the signal as a unique signal event.

Frequency Column

The displayed Centre Frequency (CF) of the SOI is captured and displayed to the 4th decimal place in (Hz) (kHz) (MHz) (GHz).

The frequency column may be reordered from the lowest frequency to the highest frequency or from the highest frequency to the lowest frequency.

BW (kHz) (MHz) Column

The Bandwidth in (kHz) or (MHz) is captured and displayed.

The accuracy of the signal bandwidth is calculated, based on the actual instantaneous bandwidth at the moment of capture and may be affected by modulation characteristics.

For example, two (2) separate commercial FM broadcast signals might be instantaneously captured at different bandwidths within the channel allocation.

Bandwidth (BW) capture is based on a precise point in time at the moment of capture.

Level (dBm) Column

The Signal Amplitude in (dBm) for each captured signal event is displayed for technical operator review and analysis.

The displayed amplitude (dBm) will be the instantaneous amplitude level at the moment of capture.

The amplitude column may be reordered from the lowest amplitude (dBm) to the highest amplitude (dBm) or from the highest amplitude (dBm) to the lowest amplitude (dBm).

Detected (Date / Time) Column

The | **DATE** | **TIME** | that each Signal of Interest (SOI) is captured will be independently displayed for each discrete signal event.

The | **DATE** | **TIME** | column may be reordered to reflect the oldest to newest signals, or the newest signals to oldest signals.

The | **DATE** | **TIME** | default format is 2011-05-28 14:23:36

The | **DATE** | **TIME** | stamps are based on the host computer settings, and it is essential that the technical operator confirm that the host computer or time zone settings are correct.

dBc Column

The dBc column is populated when the threat detection and Harmonic Signature Threshold (HST) mode is active. Harmonic values are calculated and dBc referencing the harmonic value down from the instantaneous fundamental carrier amplitude.

dB ANF Column

The dB ANF column provides a convenient amplitude reference with respect to the calculated ambient noise floor.

Chirp Column

Provides an indicator of the chirp quality by way of a confident factor based on the signal metrics.

Chirp Hits Column

Provides an indicator of the percentage of CTM hits Vs CTM tests, for example 1 test = 100%.

Chirp Tests Column

Provides an indicator of the number of cycles or tests for any particular frequency.

Modified Time Column

Provides an indicator of the time the signal time stamp is modified.

Modified Location Column

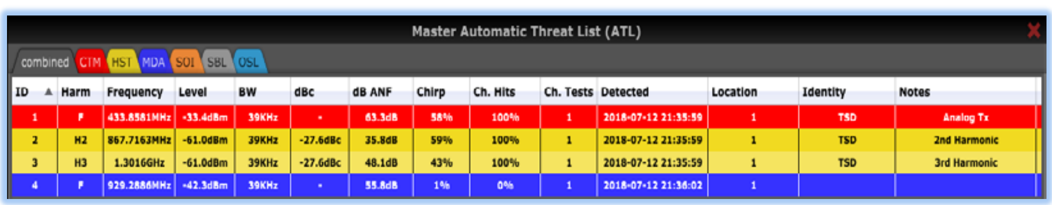
Provides metrics as to modifications to the location.

Location Column

The Location column is utilized to identify the precise location of collection for each signal on the Master ATL as identified by the technical operator during the initialization process, or during active deployment of the Differential Signal Analysis (DSA) feature.

The column will reflect the actual Antenna Location name annotation on a signal by signal basis during the collection process for each location.

It is recommended that short or abbreviated location names be utilized to ensure proper display on various visual status windows.


Master Automatic Threat List (ATL)

combined CIM HST MDA SOI SBL OSL

ID	Harm	Frequency	Level	BW	dBc	dB ANF	Chirp	Ch. Hits	Ch. Tests	Detected	Location	Identity	Notes
1	F	433.8581MHz	-33.4dBm	39KHz	-	63.3dB	58%	100%	1	2018-07-12 21:35:59	1	TSD	Analog Tx
2	H2	867.7163MHz	-61.0dBm	39KHz	-27.6dBc	35.8dB	59%	100%	1	2018-07-12 21:35:59	1	TSD	2nd Harmonic
3	H3	1.3016GHz	-61.0dBm	39KHz	-27.6dBc	48.1dB	43%	100%	1	2018-07-12 21:35:59	1	TSD	3rd Harmonic
4	F	929.2886MHz	-42.3dBm	39KHz	-	55.8dB	1%	0%	1	2018-07-12 21:36:02	1		

Master ATL | v1.38xx

Identity Column

The technical operator may optionally enter an identification text annotation flag to categorize any individual SOI by right mouse click on the SOI and selecting the Signal Profile Editor (SPE) menu option.

The technical operator can select and enter any number of unique identification text annotation flags.

This is an excellent way to create a searchable database category for specific signal types.

Each new text-based annotation flag option added by the technical operator during the sweep session is added to the identity selection box and therefore there is no need to enter the same identification flag category again should the technical operator need to utilize the same flag for other SOI during the session.

Notes Column

The technical operator may also enter a short text-based reference note or description for each individual SOI in the | NOTES | text input box utilizing a right mouse click on the SOI and selecting the Signal Profile Editor (SPE) menu option.

The ability of the technical operator to add a note for post analysis review, follow-up and report generation is extremely useful.

The technical operator can utilize the notes column to enter reference information about the signal event, action taken, or any other text-based information.

Table Column Control

The Kestrel TSCM ® Professional Software utilizes a wide range of table-based content for display, setup, control and analysis of data.

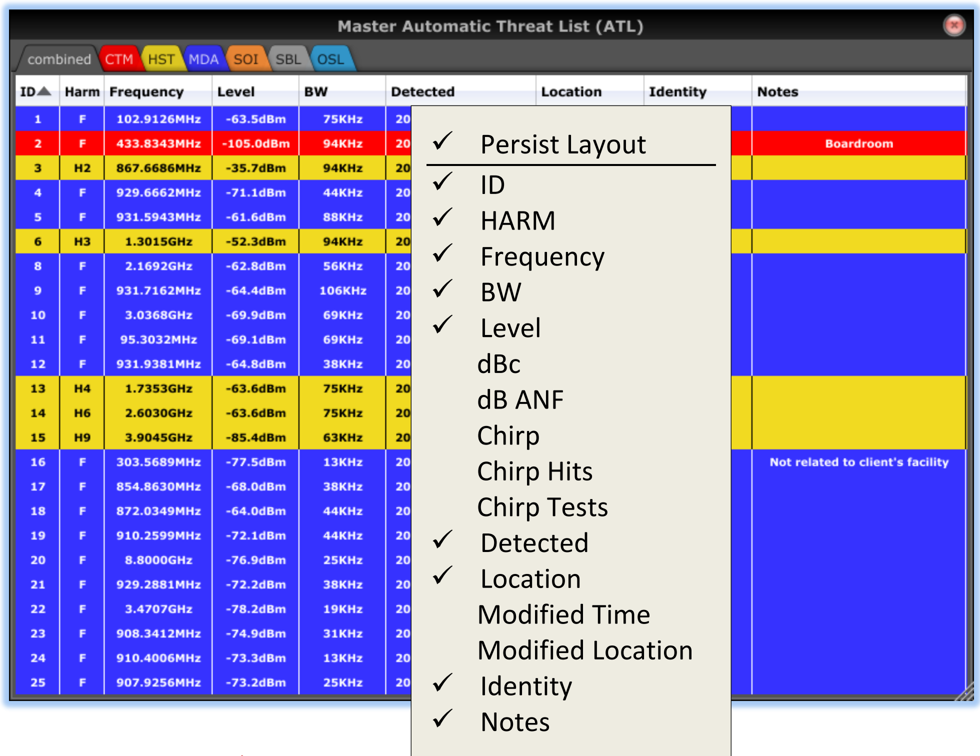
Due to the limited UI space, available, not all tables automatically display all of the available options.

The various tables throughout the software may contain additional display elements that are not selected by default.

The technical operator may select or remove any displayed or (optional) column element utilizing a right mouse click on the table column header to reveal a menu style list of currently selected and additional (optional) display elements.

For example; there are additional technical operator selectable options available for the Master and Side Bar Automatic Threat List (ATL).

Utilizing a right mouse click on the Master ATL table column header displays a menu dialog indicating currently selected column details, optional column detail and the ability to Auto Size individual or all columns currently displayed.

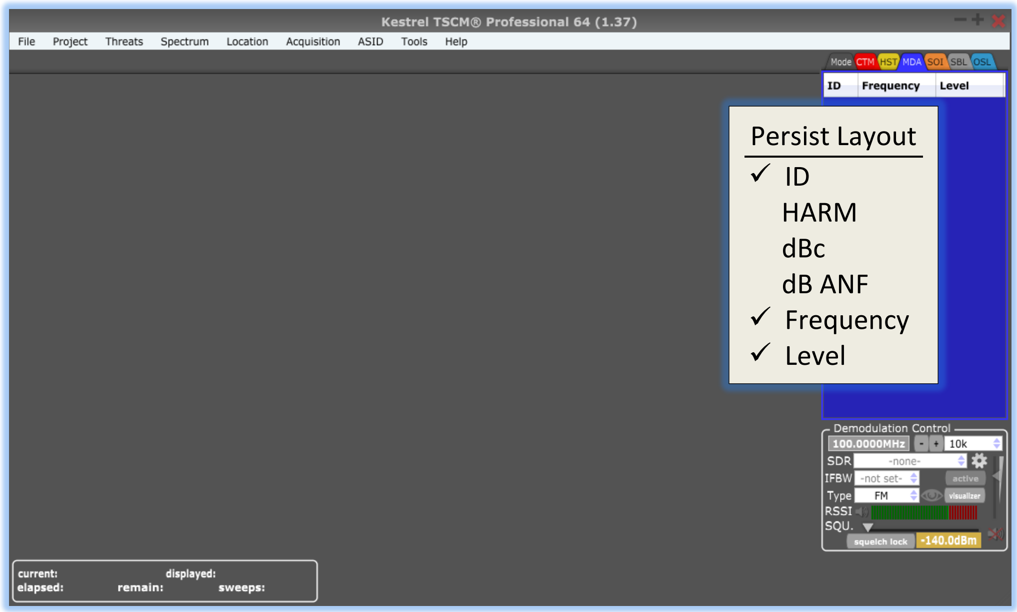


Master ATL Column Control | v1.38xx

Master ATL | Default Display Setting Vs Optional Available Columns		
Column	**Default**	**Optional**
ID	Yes	
Harm	Yes	
Frequency	Yes	
Level	Yes	
BW	Yes	
dBc		Yes
dB ANF		Yes | Recommended
Chirp		Yes
Ch. Hits		Yes
Ch. Tests		Yes
Detected	Yes	
Location	Yes	
Mod. Time		Yes
Mod. Location		Yes
Identity	Yes	
Notes	Yes	

Master ATL | v1.38xx

Utilizing a right mouse click on the Side Bar ATL table column header displays a menu dialog indicating currently selected column details, optional column detail, and the ability to Auto Size individual or all columns, currently displayed.



Side Bar ATL | v1.38xx

The Side Bar Automatic Threat List (ATL) is designed to provide quick access to detected signal details and make use of the "Drag-and-Drop" technology to navigate or demodulate signals of interest.

Side Bar ATL Default Display Setting Vs Optional Available Columns		
Column	**Default**	**Optional**
ID	Yes	
Harm		Yes
dBc		Yes
dB ANF		Yes | Recommended
Frequency	Yes	
Level	Yes	

Side Bar ATL | v1.38xx

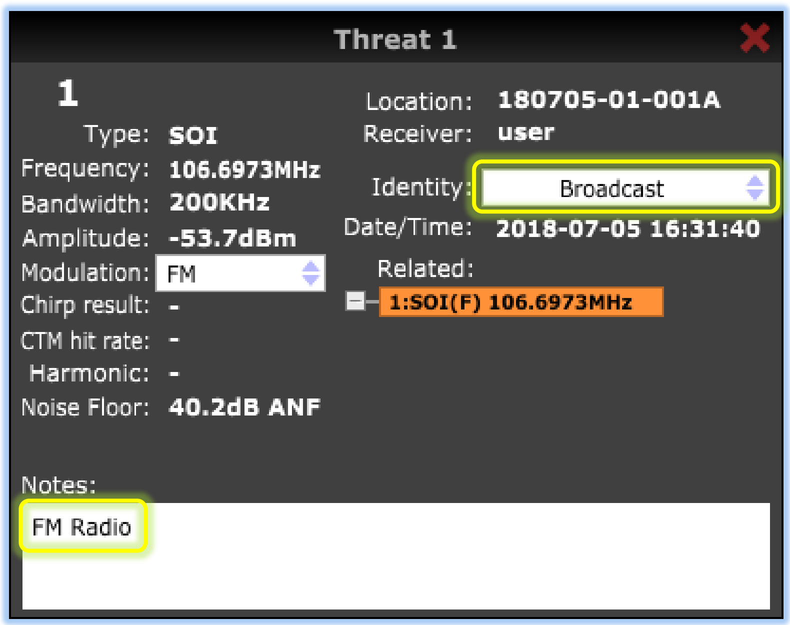
Signal Profile Editor (SPE) ™

The | Signal Profile Editor (SPE) ™ | feature is a powerful tool that provides significant detail for each discrete signal detected, identified and / or processed by the Kestrel TSCM ® Professional Software.

The example below illustrates the power of the SPE feature.

The technical operator has entered a text-based annotation flag, "Broadcast" for the Signal of Interest (SOI).

The technical operator has also added “FM Radio” in the | NOTES | text box as a reference.



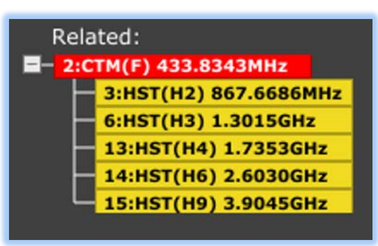
Signal Profile | v1.38xx

The following Signal Profile Editor (SPE) Chart describes the signal detail available within the SPE dialog window.

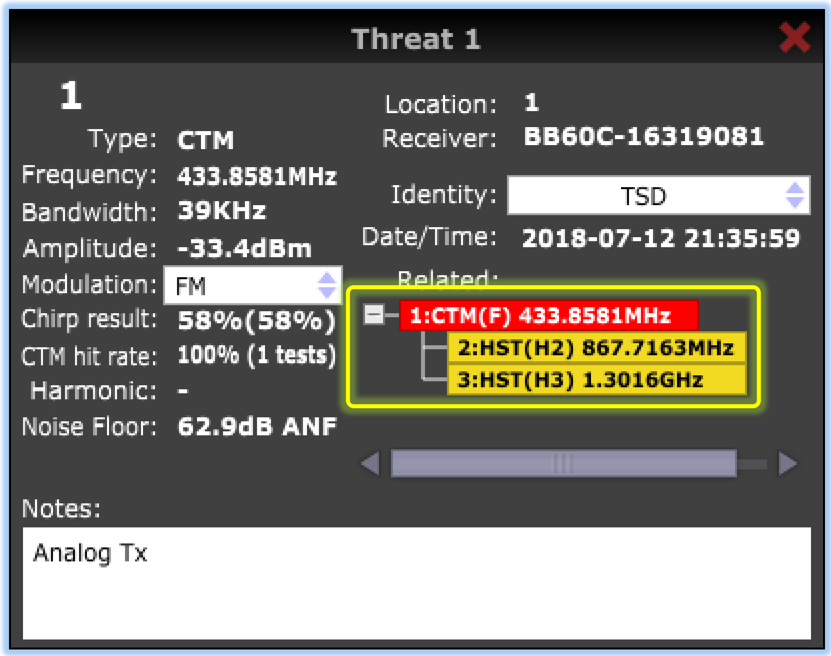
Signal Profile Editor (SPE) Chart	
Threat:	Displays a unique numeric database entry identifier
Type:	CTM, HST, MDA, SOI and SBL
Frequency:	Displays the captured Centre Frequency (CF)
Bandwidth:	Displays the instantaneous captured signal bandwidth
Amplitude:	Displays the instantaneous captured signal amplitude
Modulation:	Displays modulation type AM and FM
Chirp Result:	Displays the current chirp (%) + last chirp (%)
CTM Hit Rate:	Displays the hit rate (%) + Number of CTM Tests
Harmonic:	Displays the harmonic level of the signal
Noise Floor:	Displays the level above the noise floor
Notes:	Text input box for a short comment or note
Location:	Displays the DSA antenna location
Identity:	Text input option box for operator selected category
Date / Time:	Displays the date and time of capture
Relation:	Displays the hierarchy and harmonic signal relationship

Signal Profile Editor (SPE) | v1.38xx

When the technical operator manually adds, a text-based identity or category, it is automatically added to the option list and may be selected again during the same session, if required for other signal events without the need to type the identity or category again.



Signal Profile | v1.39xx



Signal Profile | v1.39xx

The technical operator can include a brief text-based comment or note for the signal event.

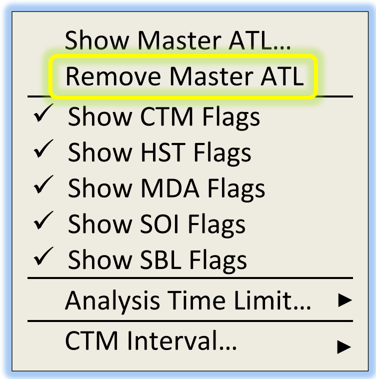
The technical operator may also enter the Identity and Notes directly from the Master Automatic Threat List (ATL).

The Identity and Notes also display as part of the mouse over text annotation pop-up when the technical operator moves the cursor over the Graticule and RF Spectrum Display (RSD).

TIP: The technical operator can review and edit some of the signal profile parameters during the active collection process and during post analysis review. However, no changes are permitted in the event that the technical operator opens a historical project file as read only.

Remove Master ATL

The Remove Master ATL menu option closes the Master Automatic Threat List (ATL) window formatted table.



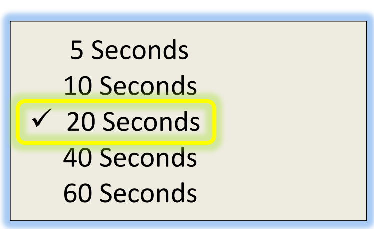
Show | Remove MATL | v1.39xx

There is no need or requirement to save any changes prior to closing the Master ATL as this function is completed automatically during the collection process.

The Master ATL may be opened again at any time as required, or may be dragged to a secondary display monitor, if available.

Analysis Time Limit

When the Threat Detection Algorithm (TDA) is active, the Kestrel TSCM ® Professional Software will sweep the spectrum band allocation or Range of Interest (ROI) as selected by the technical operator.



Default Analysis Time Limit | v1.39xx

At the completion of each sweep cycle the application will begin the analysis cycle for each detected signal event that has met or exceeded the Minimum Detection Amplitude (MDA) or other established threat criteria.

Depending on the actual number of signals that need to be analyzed during the current cycle; it is essential to understand that the software is not actively sweeping the ambient spectrum during the analysis cycle; unless operating in a Dual Receiver Operation (DRO) ™ or Multiple Receiver Operation (MRO) ™.

The technical operator has the ability to set and limit the actual analysis cycle time and force the software to sweep the ROI more frequently based on the selected Analysis Time Limit specified by the technical operator.

Should the analysis cycle compete in less than the (20 sec) default setting; or the modified technical operator setting of (5 sec) (10 sec) (20 sec) (40 sec) (60 sec); or the analysis cycle not be required, the application will immediately begin the next sweep cycle.

Analysis Time Limit (Options) Chart	
5 Seconds	Maximized Sweep Priority
10 Seconds	Sweep Priority
20 Seconds	***Optimal Default Setting (Recommended)***
40 Seconds	Analysis Priority
60 Seconds	Maximized Analysis Priority

Analysis Time Limit | v1.38xx

Should the software require (30 seconds) to complete the analysis cycle and the technical operator has set the Analyze Time Limit to (10 seconds), the following chart illustrates the active sweep and analysis cycle.

The active analysis cycle will terminate when either the Analysis Time Limit as selected by the technical operator is reached; or in the event that there are no hold-over or new signal events to be analyzed and will result in the start of the next sweep cycle.

The software will begin the next analysis cycle at the point where it was interrupted during the previous cycle unless all signals scheduled for analysis were analyzed during the previous cycle.

In practice, the first few sweeps will result in the largest number of discrete signals that need to be analyzed for the first time.

As the additional sweep cycles progress and all continuous signal events have been analyzed, only new signal events will result in analysis cycle activity.

Sweep / Analyze Cycle Chart - Analyze Time Limit = 10 Seconds		
Active Sweep / Analyze Cycle	**Sweep Time (1GHz = 7 sec)**	**Sweep / Analyze Cycle Result**
Sweep (DC to 1000 MHz)	Sweep = 7.2 Sec	20 new SOI = 20 Sec (Analyze Time)
Analyze Limit (10 sec)	Analyze = 10 Sec	Analysis Interrupt = 10 Sec
Sweep (DC to 1000 MHz)	Sweep = 7.1 Sec	15 new SOI = 15 Sec (Analyze Time)
Analyze Limit (10 sec)	Analyze = 10 Sec	Analysis Interrupt = 10 Sec
Sweep (DC to 1000 MHz)	Sweep = 7.0 Sec	5 new SOI = 5 Sec (Analyze Time)
Analyze Limit (10 sec)	Analyze = 5 Sec	Analysis Interrupt = 5 Sec
Sweep (DC to 1000 MHz)	Sweep = 7.1 Sec	0 new SOI = 0 Sec (Analyze Time)
Analyze Limit (10 sec)	Analyze = 0 Sec	Analysis Interrupt = 0 Sec

Sweep and Analysis Profile | v1.38xx

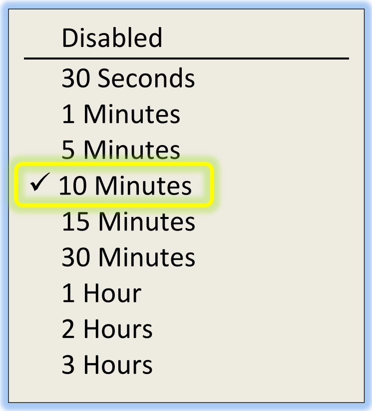
Any new signal events meeting or exceeding the Minimum Detection Amplitude (MDA) will be chirped for analog audio and analyzed for harmonic content when the Chirp Threat Mode (CTM) and Harmonic Signature Threshold (HST) are active.

This process can vary significantly and is based on the complexity of the ambient RF signal environment and the number of new signal events occurring within the ambient signal environment.

CTM Interval

There is another important feature that allows the Threat Detection Algorithm (TDA) to rescan all previous signals, initially flagged as meeting the Minimum Detection Amplitude (MDA).

This important feature allows the technical operator to force the CTM analysis of all signals previously flagged as MDA and those signal events that may have been previous flagged by the MDA, CTM or HST analysis cycle.



CTM Interval | v1.39xx

This step is necessary, to detect possible new hostile signal events that might occur on the same frequency of a previous friendly signal event and flagged as a normal MDA event.

This feature allows the application to automatically rescan and analyze all signals periodically, as defined by the technical operator.

This provides the ability to identify new instances of signal events that might appear on the same frequency as a previously cleared signal event by the software.

The following chart provides the CTM Interval control group setting available to the technical operator.

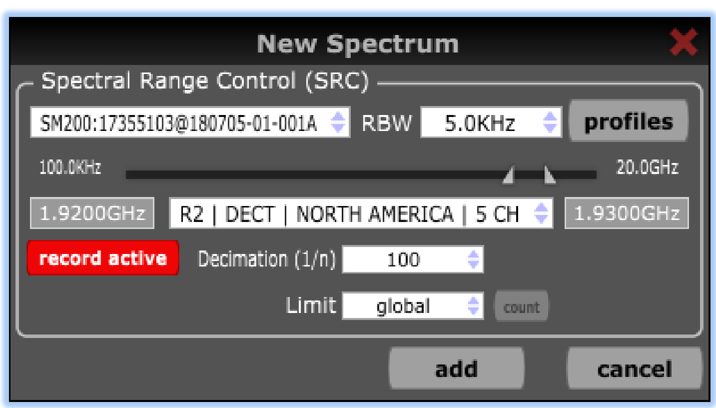
Chirp Threat Mode (CTM) Options Chart	
Disabled	Never Rescan and Analyze
30 Seconds	Fast Rescan and Analyze
1 Minute	Fast Rescan and Analyze
5 Minutes	Fast Rescan and Analysis
10 Minutes	***Default Setting (Recommended)***
15 Minutes	Medium Rescan and Analyze
30 Minutes	Medium Rescan and Analyze
1 Hour	Slow Rescan and Analyze
2 hours	Slow Rescan and Analyze
3 Hours	Slow Rescan and Analyze

CTM Options | v1.35xx

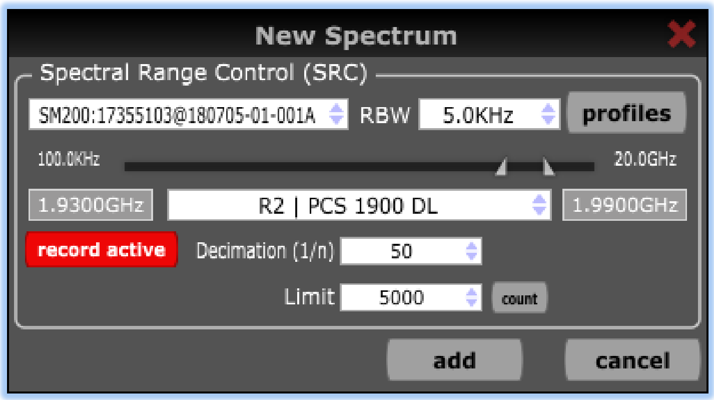
Spectrum (Menu Option)

To add a new active spectral window, the technical operator can select the | SPECTRUM | NEW SPECTRUM | option from the main menu to display the New Spectrum input box.

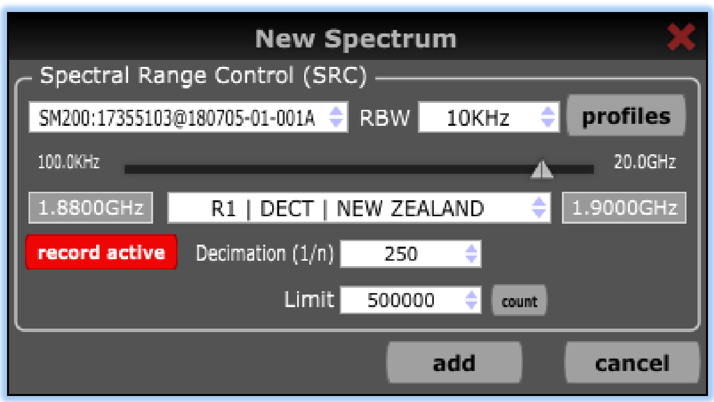
The Spectral Range Control (SRC) and / or Spectral Profile Editor (SPE) are utilized to establish the parameters of the new band or Range of Interest (ROI).



Spectral Range Control (SRC) | v1.38xx



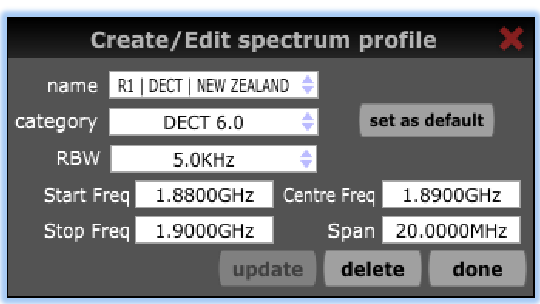
Spectral Range Control (SRC) | v1.38xx



Spectral Range Control (SRC) | v1.38xx

Spectrum Profile Editor (SPE)

The | SPECTRUM | SPECTRUM PROFILE EDITOR | dialog window option provides the ability access the SPE feature directly from the main menu.



Spectrum Profile Editor | v1.38xx

Spectral Range Control (SRC)

The Spectral Range Control (SRC) allows the technical operator to setup or select a specific Range of Interest (ROI) and access to the Spectral Profile Editor (SPE).

Frequency Set | Slider Bar

The frequency set slider bar allows the technical operator to quickly set a rough | START | and | STOP | frequency.

Start Frequency

Direct entry is possible for the Start frequency for any value within the range of the currently selected search receiver or analyzer.

The technical operator can select the text input box and type the desired value follow by (h = Hz) (k = kHz) (m = MHz) (g = GHz).

Stop Frequency

Direct entry is possible for the Stop frequency for any value within the range of the currently selected search receiver or analyzer.

The technical operator can select the text input box and type the desired value follow by (h = Hz) (k = kHz) (m = MHz) (g = GHz).

Spectral Profile List

The technical operator may select any default or custom Spectral Profile available.

Spectral Profiles are stored in a settings file that may be stored, transported by the technical operator, providing an additional layer of operational security and to prevent the need to create specific spectral profiles on other host computers.

Resolution bandwidth (RBW)

There are a variety of (legal value) RBW settings available based on the radio hardware capabilities and the current operator defined Range of Interest (ROI).

SPAN	Signal Hound (SM200A) Resolution Bandwidth (RBW) Legal Values										
20 GHz	2.5 MHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	---	---	---
15 GHz	2.5 MHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	---	---	---
10 GHz	2.5 MHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	---	---
5 GHz	2.5 MHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	---
2 GHz	2.5 MHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz
1 GHz	1.0 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz
500 MHz	500 kHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz
250 MHz	250 kHz	200 kHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz
100 MHz	100 kHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz
50 MHz	50 kHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz
25 MHz	25 kHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz
20 MHz	20 kHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz
10 MHz	10 kHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz	10 Hz
5 MHz	5 kHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz	10 Hz	5 Hz
2.5 MHz	2 kHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz	10 Hz	5 Hz	2.5 Hz
2 MHz	1 kHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz	10 Hz	5 Hz	2.5 Hz	2 Hz
1 MHz	500 Hz	250 Hz	200 Hz	100 Hz	50 Hz	25 Hz	20 Hz	10 Hz	5 Hz	2.5 Hz	2 Hz	1 Hz

Signal Hound (SM200A) RBW | v1.38xx

SPAN	**Signal Hound (BB60C) Resolution Bandwidth (RBW) Legal Values**											
6 GHz	5 MHz	2.5 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	---	---	---
3 GHz	5 MHz	2.5 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	---	---
2 GHz	5 MHz	2.5 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	---
1 GHz	5 MHz	2.5 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz
500 MHz	2.5 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz
200 MHz	1.3 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz
100 MHz	631 kHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz
50 MHz	316 kHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz
20 MHz	157 kHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz	77 Hz
10 MHz	79 kHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz	77 Hz	39 Hz
5 MHz	40 kHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz	77 Hz	39 Hz	19 Hz
2 MHz	20 kHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz	77 Hz	39 Hz	19 Hz	9.6 Hz
1 MHz	9.9 kHz	4.9 kHz	2.5 kHz	1.2 kHz	616 Hz	308 Hz	154 Hz	77 Hz	39 Hz	19 Hz	9.6 Hz	4.8 Hz

Signal Hound (BB60C) RBW | v1.38xx

SPAN	Signal Hound (USB-SA124B) Resolution Bandwidth (RBW) Legal Values										
12.4 GHz	102 kHz	---	---	---	---	---	---	---	---	---	---	---
10 GHz	102 kHz	51 kHz	26 kHz	---	---	---	---	---	---	---	---	---
1 GHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	---	---	---	---	---	---	---
250 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	---	---	---	---	---	---
100 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	---	---	---
50 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	---	---
25 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	100 Hz	---
12 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	100 Hz	50 Hz

Signal Hound (USB-SA124B) RBW | v1.38xx

Resolution Bandwidth (RBW) is a key factor in determining the Kestrel Project File (KPF) file size.

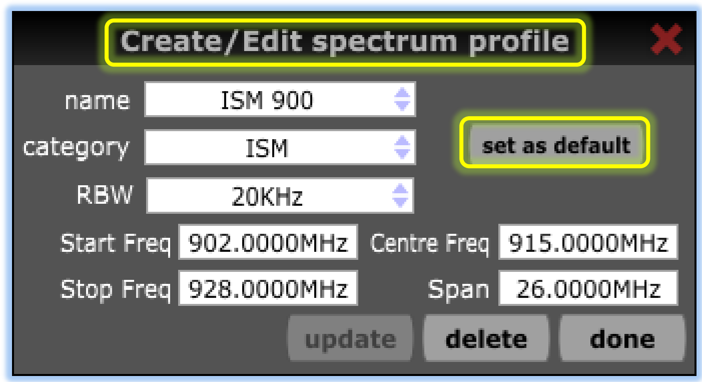
SPAN	Signal Hound (USB-SA44B) Resolution Bandwidth (RBW) Legal Values											
4400 MHz	102 kHz	51 kHz	26 kHz	---	---	---	---	---	---	---	---	---
1000 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	---	---	---	---	---	---	---
250 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	---	---	---	---	---	---
100 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	---	---	---
50 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	---	---
25 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	100 Hz	---
12 MHz	102 kHz	51 kHz	26 kHz	13 kHz	6.4 kHz	3.2 kHz	1.6 kHz	800 Hz	400 Hz	200 Hz	100 Hz	50 Hz

Signal Hound (USB-SA44) RBW | v1.38xx

Spectral Profile Editor (SPE)

The technical operator has the ability to program and set any of the spectral profiles as the active default value during the initialization process utilizing the Spectral Profile Editor (SPE).

The technical operator may select any currently available spectral profile or create a new spectral profile and once selected, the operator can open the Spectral Profile Editor (SPE) and press the | Set as Default | button.



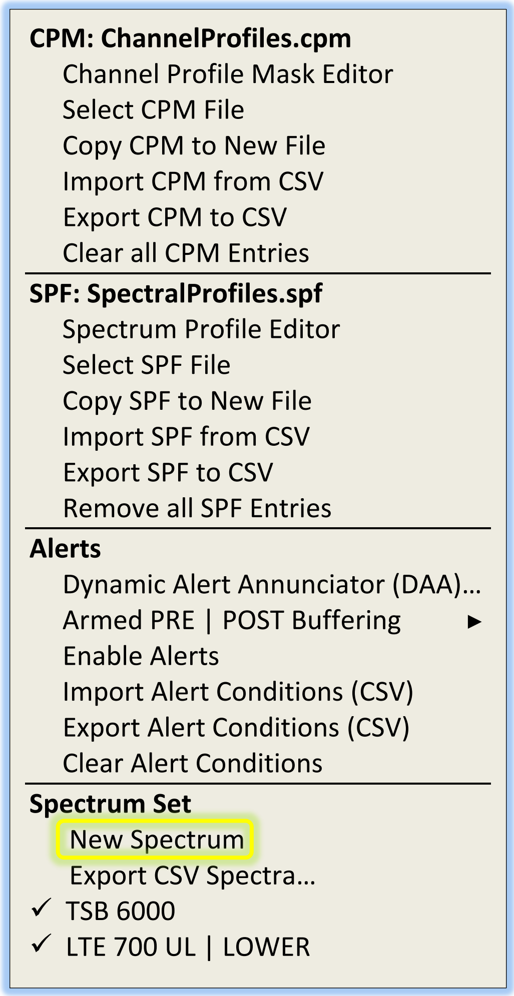
Spectral Profile Editor (SPE) | v1.38xx

This action causes the selected profile to appear as the default spectral profile within the | SETUP WIZARD | in the future, until a new default is selected.

The recommended method of building a functional SPF database is to create a master CSV file and import the file into the software as changes are made. The Spectral Profile Editor (SPE) ™ is useful for quick in the field data entry, provided the operator remembers to export the SPF to the CSV master file.

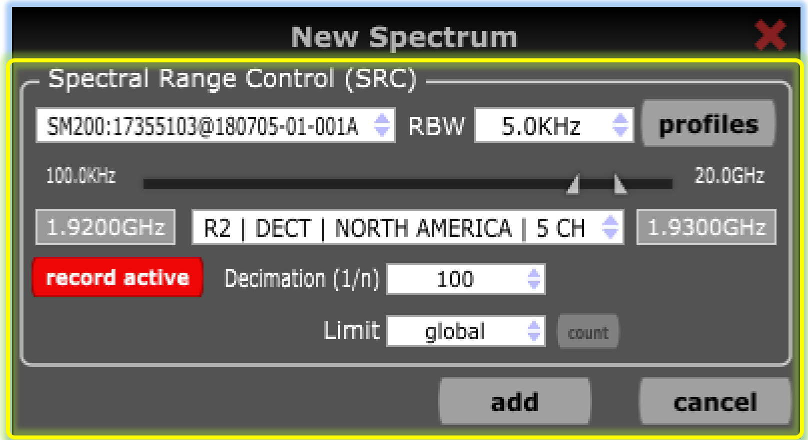
New Spectrum

The | SPECTRUM | NEW SPECTRUM | menu option opens the new spectrum dialog window.



New Spectrum Menu | v1.38xx

The technical operator can add a new spectrum window at any time during active deployment utilizing the | Spectral Range Control (SRC) | located within the | New Spectrum | dialog window.



Spectral Range Control (SRC) | v1.38xx

The technical operator can select a spectral profile of select a unique search Range of Interest (ROI).

Add Button

Pressing the ADD button causes the new spectrum to be displayed as a tab window on the Graticule.

By default, only the initial spectrum window will run immediately unless the Activity Scheduler is active, any new spectrum windows are automatically paused and will not begin sweeping the RF spectrum until the technical operator presses the | START | button.

Once active, the new spectrum will be added to the sweep collective.

New spectrum windows may be any Start / Stop, Range of Interest (ROI), or selected Spectral Profile.

Cancel Button

The CANCEL button may be utilized to close the New Spectrum setup dialog without initializing a new spectral window.

Display | Hide Active Spectrum Bands

The | SPECTRUM | menu displays a list of currently open, active spectrum bands or custom Range of Interest (ROI) settings selected by the technical operator.

Spectrum bands or ranges with displayed check marks are currently displayed on the UI.

Spectrum bands or ranges without displayed check marks are currently not displayed on the UI.

This functionality provides the ability to hide active spectrum bands or ranges that may be background paused or actively collecting data while hidden from view by the technical operator.

Checking and / or unchecking any displayed band or range causes the spectrum band or range display or remain hidden from view.

There is a quick Hide button located on the UI to hide the currently displayed spectrum window.

The hidden spectrum window may be restored by the technical operator at any time by selecting the | SPECTRUM | menu and placing a check mark next to the band of interest.

Spectrum Band TAB Order

Another powerful feature is the ability to reorder the spectrum TAB assignments by unchecking and rechecking any active spectrum band or range displayed in the spectrum menu option list.

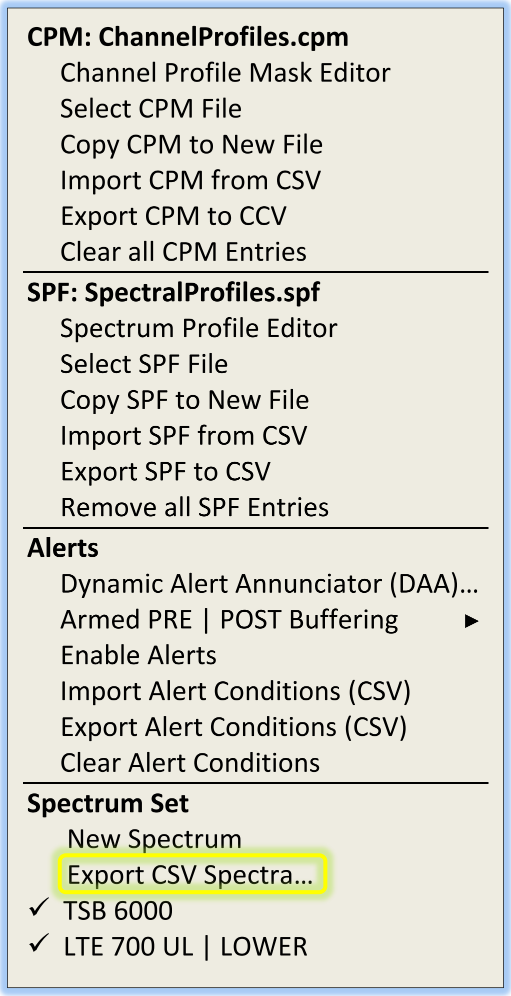
This action causes the TAB to relocate to the first TAB position on the GUI.

This procedure may be repeated until all spectrum band TABS are ordered as desired.

Export (CSV) Spectra

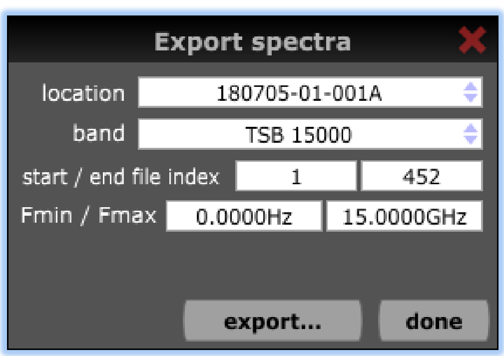
To aid technical operators in a more detailed analysis of raw trace level data, the ability to export operator defined | SPECTRA | is supported.

The feature as accessed via the | SPECTRUM | EXPORT CSV SPECTRA | menu option.



Export CSV Spectra Menu | v1.38xx

The technical operator can export raw trace level Spectra to a CSV file, based on the | LOCATION | and | BAND | and select the | START | and | END | trace number export sequence, filter criteria.



Export CSV Spectra Dialog Window | v1.38xx

This tool can export small operator selected, customized amounts of manageable spectrum data to CSV files, based on what the operator needs to analysis, making this a very powerful feature.

However, it must be understood that it is also possible export extremely large CVS data files, which may prove difficult to manage, and therefore technical operators are advised to export only the required data, rather than all data.

This feature can be used during runtime collection, or during post event analysis and review.

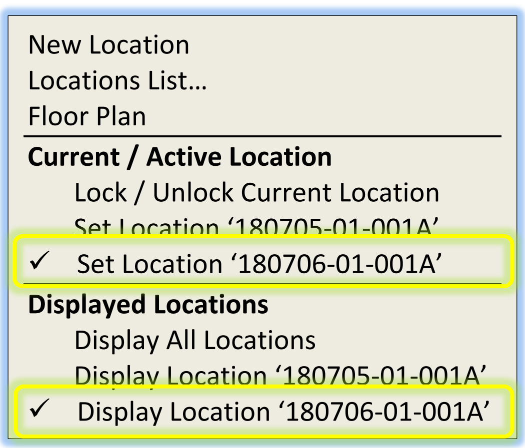
Third party productivity software such as Microsoft Excel is required to open and correctly display CSV files and likewise, additional equipment resources and / or software supporting CSV import maybe required to process and analyze the exported Spectra data.

Upon export the CSV files are automatically rendered with a File Naming Convention (FNC) and placed in the Kestrel Project File (KPF) directory.

Location (Menu Option)

The | LOCATION | NEW LOCATION | LOCATIONS LIST | FLOOR PLAN | menu options are an integral component of the Differential Signal Analysis (DSA) feature in identifying, selecting and displaying the precise Antenna Location.

The technical operator maintains the unique ability to establish any number of active and standby "New Location" labels for inclusion within the Differential Signal Analysis (DSA) comparative analysis project file.

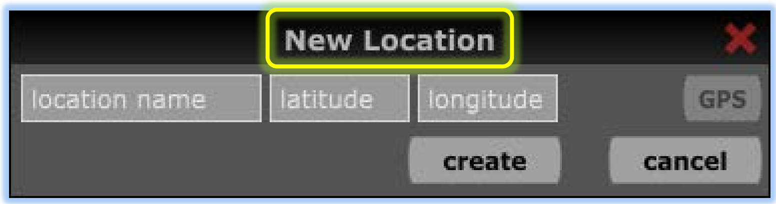


Set Location Menu | v1.38xx

The recommended method of an effective | ANTENNA LOCATION | naming convention is to utilize a date / location identifier such as 180705-01-001A which translates into 2018-JULY-05-LEVEL-01-ROOM-001-ROOM LOCATION-A for very precise reference details and to allow consistency across multiple dates and locations over time.

This format makes it possible to import comparative trace information from other Kestrel Project Files (KPF) and directly compare traces by date and location.

The ability to add new locations, allows the technical operator to compare spectral data and identify precisely where any signal added to the Master – Automatic Threat List (ATL) was originated.



New Location Dialog Window | v1.38xx

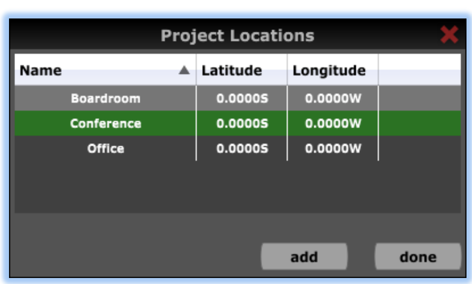
The New Location dialog window also allows the technical operator to set a location for collection and display and / or review historical trace data from another location.

The menu example below demonstrates a total of three (3) DSA antenna locations.

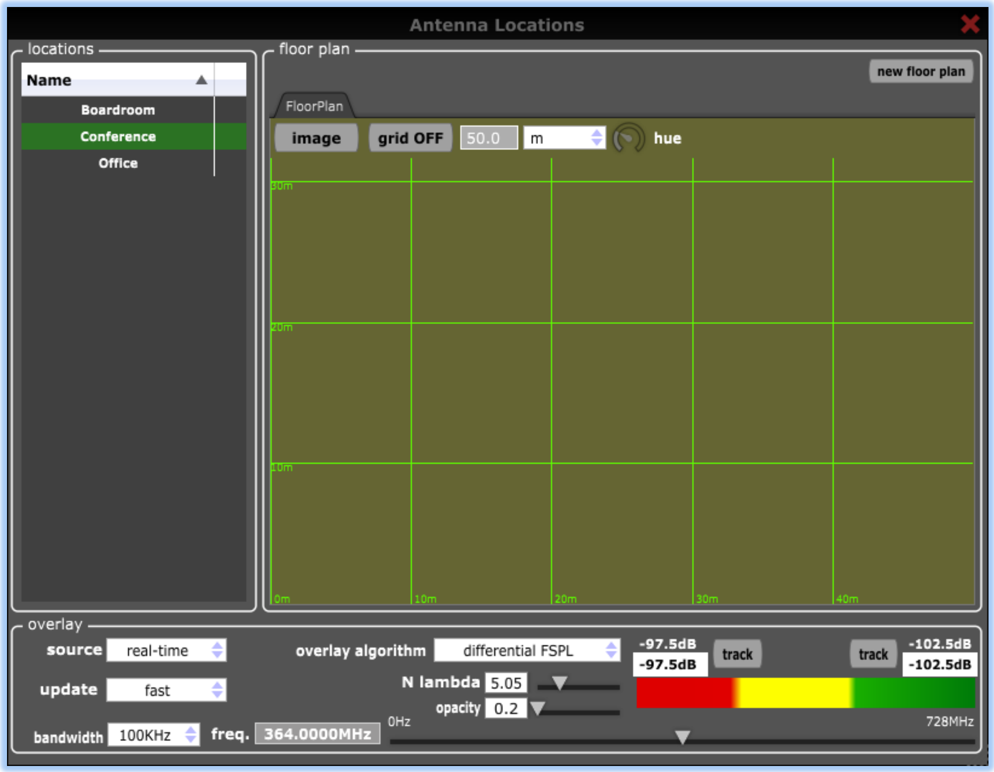
In the first example, the technical operator is both collecting and displaying the real-time trace data relating to the "Conference Room".

In the second example the technical operator is actively collecting spectral trace data from the "Office" and is reviewing historical trace data from the "Boardroom".

Location information is duplicated on the Project Locations list and Floor Plan Antenna Locations list and can be utilized to create, select as current, or edit location information.



Project Locations | v1.39xx

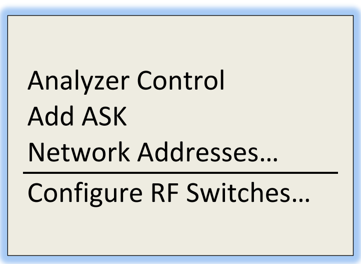


Floor Plan Antenna Locations and Multiple Spectrum Overlay Heat Map Display | v1.39xx

The multiple Receiver Differential Signal Analysis (RDSA) feature allow the technical operator to produce a heat map of the energy across two (2) or more radios, such as internal and external, or level 4 and Level 5, or east and west, etc.

Acquisition (Menu Option)

The | ACQUISTION | menu provides access to the |ANALYZER CONTROL | ADD ASK | NETWORK ADDRESSES | menu options.



Acquisition Menu Options | v1.39xx

Analyzer Control

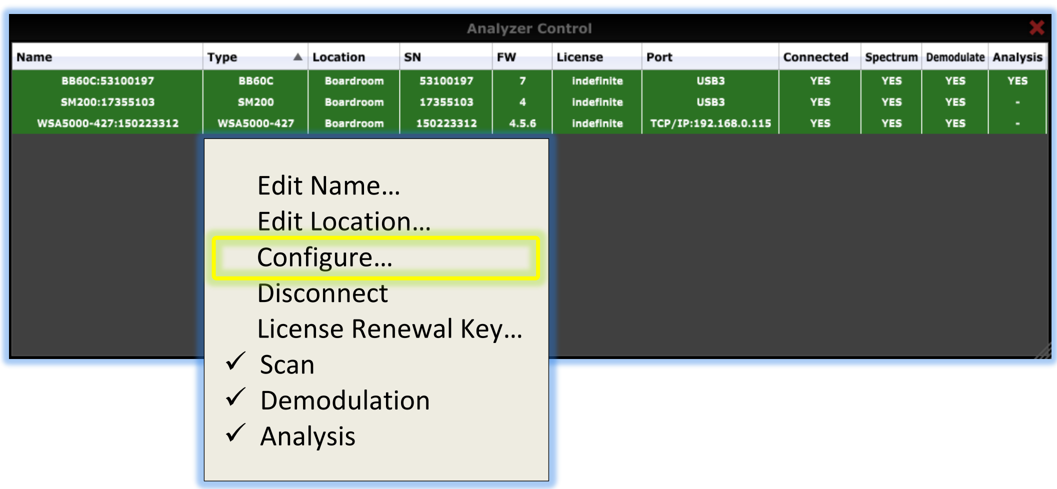
When the technical operator opens a historical project file for review or report generation, it is not necessary to connect or initialize a search receiver or analyzer.

Live View Analysis (LVA) ™ is fully supported when working with real-time or historical project files.

In the event that the technical operator wishes to continue active data collection or utilize the demodulation functionality, the receiver must be connected and initialized.

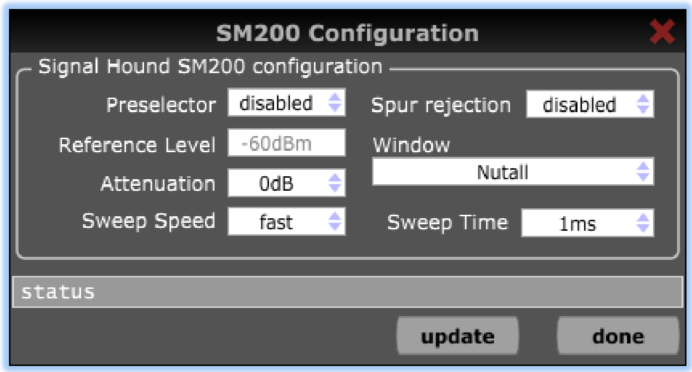
This may be accomplished from within the Kestrel TSCM ® Professional Software application utilizing the | ANALYZER CONTROL | scan / rescan feature to search for and initialize and connected search receivers or analyzers.

The technical operator can configure the search receiver or analyzer utilizing the | ACQUISITION | ANALYZER CONTROL | CLICK TO CONFIGURE | dialog box for each selected receiver or analyzer.

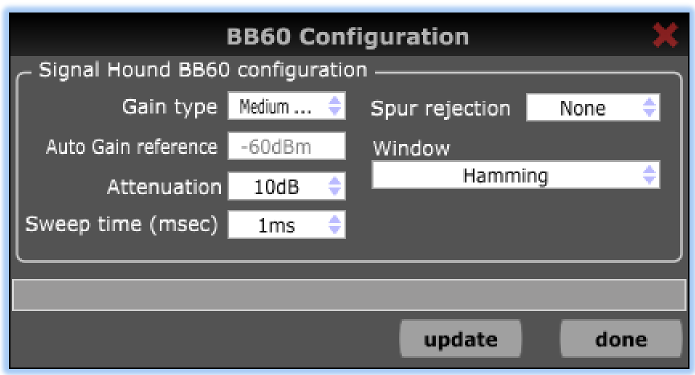


Analyzer Control Radio Configuration | v1.38xx

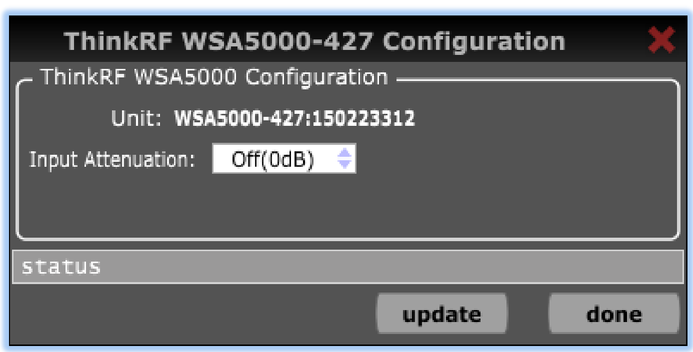
Radio level programming must be confirmed during the initialization process before exiting the | Analyzer Control | group to validate all settings.



SM200A Configuration | v1.38xx



BB60C Configuration | v1.38xx



WSA5000-427 Configuration | v1.38xx

Each radio provides hardware specific programming settings and vary depending on the hardware manufacturer.

It is essential to understand that the software handles all hardware differences internally allowing dynamic hand-off and spectrum coordination.

Add ASK

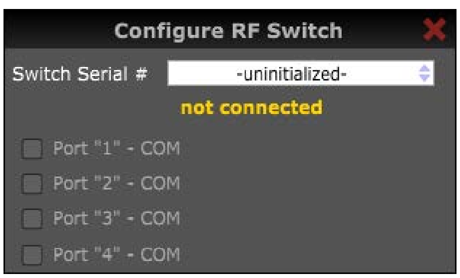
The | ADD ASK | menu option permits one (1) or more Activate Security Keys (ASK) to enable hardware, optional features and transfer to replacement computer hardware, or SDR radios.

Network Addresses

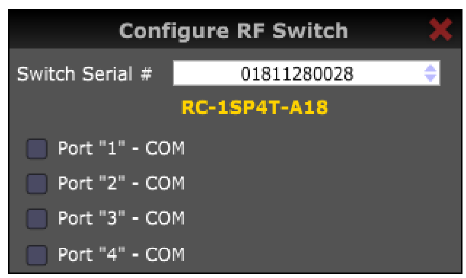
The ability to | ADD NETWORK ADDRESSES | for Ethernet-based SDR hardware and to facilitate Command Line Programming (CLP) ™ network activity setup.

Configure RF Switches (Mini-Circuits)

Support for external | RF ANTENNA SWITCH | hardware manufactured by Mini-Circuits can exponentially provide significant system wide scaling for managed Remote Spectrum Surveillance and Monitoring RSSM ™ systems.

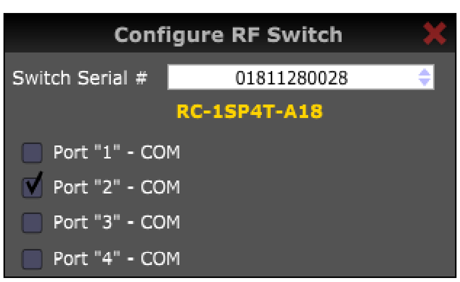


RF Switch | Hardware Not Initialized | v1.39xx

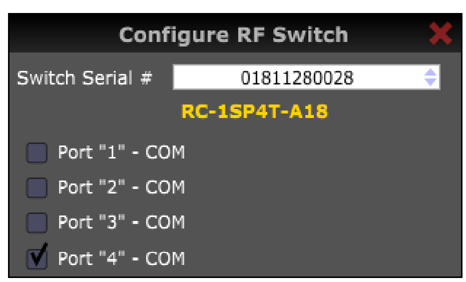


RF Switch | Hardware Initialized | v1.39xx

The ability to support one (1) or more external hardware-based RF antenna switches can be operator controlled from within the Kestrel TSCM ® Professional Software by simply selecting independent “initialized” RF antenna switches by the hardware serial number.



RF Switch | Port 2 Enabled | v1.39xx



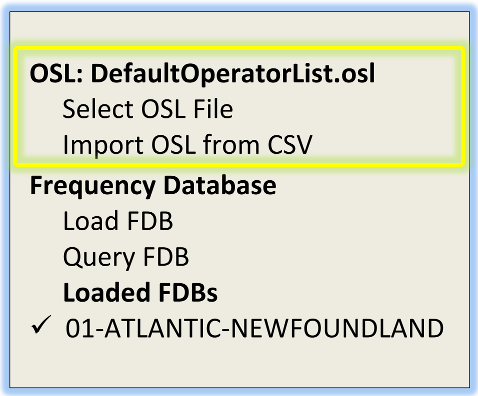
RF Switch | Port 4 Enabled | v1.39xx

This powerful capability extends field deployment options.

OSL Database (Menu Option)

The Operators Signal List (OSL) ™ is an operator defined frequency / signal database that resides within the application and not the project level.

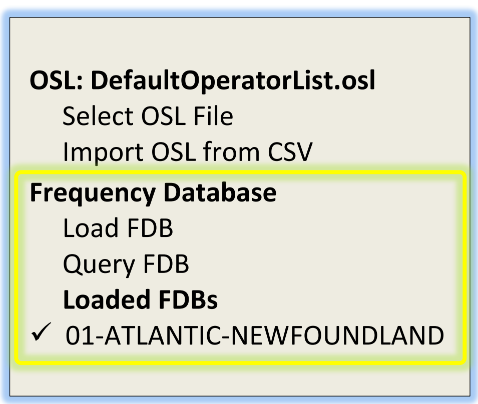
Therefore, the database can span any number of projects and take on the form of multiple mission specific databases.



OSL Configuration | v1.38xx

ASID (Menu Option)

The Advanced Signal Intelligence Database (ASID) ™ is accessed with the | ASID | menu and provides the ability to both | LOAD DATABASE | QUERY | any available Frequency Database (FDB) file.



Frequency Database Configuration | v1.38xx

The FDB files are in a proprietary file format and are updated periodically.

The current release of the FDB files are maintained and available for download from the Technical Support Group (TSG) ™ Resource Centre by authorized technical operators.

These files cannot be altered or edited by the technical operator.

FDB files provide a reference overlay to identify potentially unknown signal events that may be of a friendly nature.

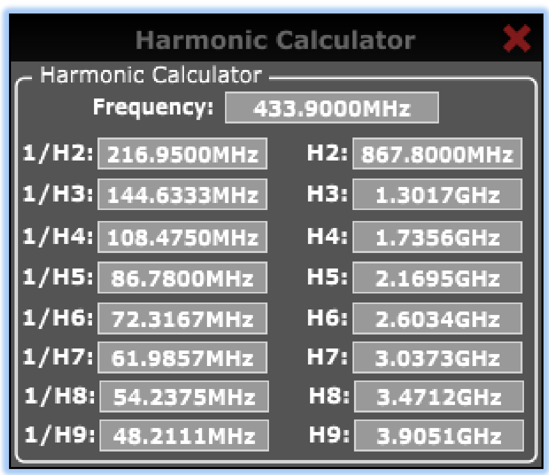
The Kestrel TSCM ® Professional Software | Advanced Signal Intelligence Database (ASID) ™ includes a standard | QUERY | capability.

Tools (Menu Option)

The | TOOLS | menu option provides direct access to several essential tools, calculators and other resources.

Harmonic Calculator Tool (HCT)

The | HARMONIC CALCULATOR | is accessed from the tools menu and provides the technical operator with the ability to dynamically generate key sub-harmonic | 1/H2 | 1/H3 | 1/H4 | 1/H5 | 1/H6 | 1/H7 | 1/H8 | 1/H9 |values for any fundamental frequency entered by the technical operator.



Harmonic Calculator Tool | v1.38xx

The | HARMONIC CALCULATOR | tool also generates a list of key harmonic values | H2 | H3 | H4 | H5 | H6 | H7 | H8 | H9 | for any fundamental frequency entered by the technical operator.

The harmonic calculator tool is totally independent and may be utilized whenever the application is open and does not require a runtime project to first be established.

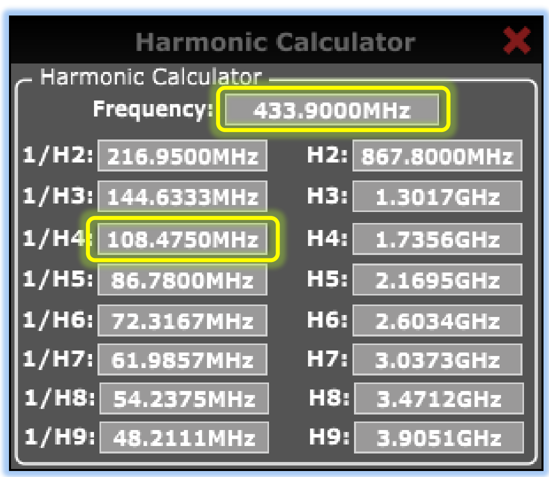
The Kestrel “drag-and-drop” technology is fully supported and permits the technical operator to “drag-and-drop” any of the signal list and / or threat list entry directly to the Harmonic Calculator Tool (HCT) and from the Harmonic Calculator Tool (HCT) to either the Graticule or Demodulator Control Group frequency dialog window.

When a frequency entry is moved to the Graticule utilizing our “drag-and-drop” technology, the Signal of Interest (SOI) is immediately displayed at the centre of the Real-Time Spectrum Display (RSD) at a 20x zoom factor.

The Harmonic Calculator Tool (HCT) is an essential operator centric innovation developed specifically for the Kestrel TSCM ® Professional Software, utilized during review and signal analysis, to help quickly explain or confirm possible relationships for unknown signals that may have a harmonic relationship.

The HCT may be utilized to identify and navigate to any Sub-Harmonic or Harmonic value, simply by dragging or typing an SOI CF to the | FREQUENCY | input box.

The resulting display may reveal the Signal of Interest (SOI) as perhaps being an H2, or H3, harmonic value, or a Sub-Harmonic value as illustrated below.



Harmonic Calculator Tool | v1.38xx

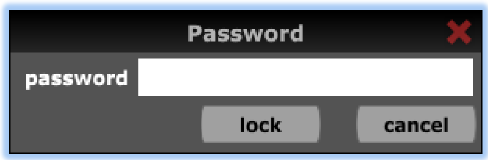
The technical operator has observed an unknown signal event at 433.9000 MHz with room audio present during the demodulation process.

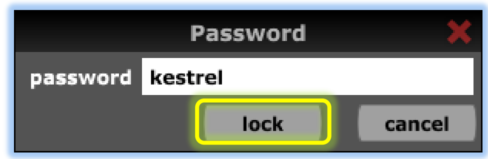
The technical operator utilized the “drag-and-drop” feature to enter the captured SOI to the Harmonic Calculator Tool (HCT).

Stealth Screen Mode

The | ENTER STEALTH MODE | menu option is also accessed from the | TOOLS | menu and provides a means for the technical operator to hide and lock the current runtime session or an open historical project file.

Selecting the | ENTER STEALTH MODE | menu option opens the password dialog window.





Password Dialog Window | 1.38xx

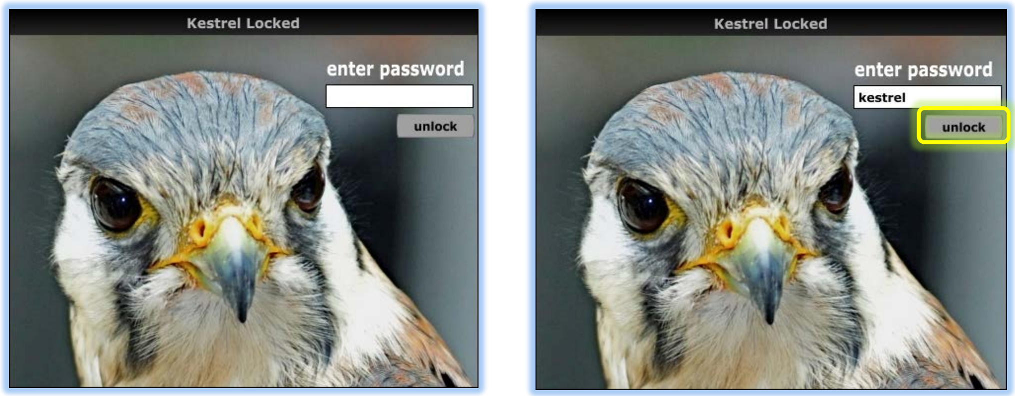
The technical operator can enter between 1 and 15 characters as a "one-time password" consisting of case sensitive numbers, letters and / or characters to secure and hide the runtime environment.

Stealth Screen Mode also supports the ability to hide the runtime environment by simply pressing the | LOCK | button without entering a "password" and then pressing the | UNLOCK | button to display return to the runtime environment.

Pressing the | LOCK | button closes (hides) all windows and secures the application and the current operation until a valid password is entered and the | UNLOCK | button is pressed by the technical operator.

The software continues to collect data in the last programming state in the background, hidden from view and the Kestrel TSCM ® Professional Software application is protected against prying eyes and tampering when locked.

The technical operator may enter the same familiar password each and every time the feature is utilized or enter a different password each time the feature is activated.



Password Dialog Window | v1.39xx

When the program is locked, the | KESTREL LOCKED | Stealth Mode logo window is displayed on the host computer desktop and permits access to the desktop and all other computer functionality.

The Stealth Screen logo window by default is positioned at the center of the desktop and may be moved to another location if required.

Once a valid password is entered, pressing the | UNLOCK | button restores the application.

Password Reset

In the event that the technical operator forgets the password, it will not be possible to restore the current runtime session.

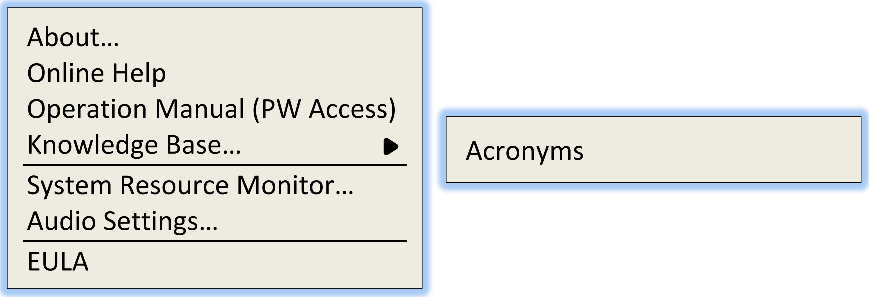
Shutting down or rebooting the host computer will exit the Stealth Mode feature, reset the password and restore the application to an unlocked normal runtime state.

The Kestrel Project File (KPF) ™ can then be reopened and the collection process may be restarted, however, this method is not recommended as a routine procedure, as shutting down the host computer during the data collection process may result in loss of data or data file corruption and is offered as an emergency password reset method only.

This feature is designed to offer a reasonable level protection against casual prying eyes and low-level system tampering only.

Help (Menu Option)

The | HELP | menu provides direct access to several important informational resources, including the software Splash Screen, a link to the Kestrel TSCM ® Professional Software website, a link to the Software Programming and Operation Manual (SPOM) ™ (PW Access), information about the End User License Agreement (EULA) and our | System Resource Monitor (SRM) ™ | tool and a Kestrel ® Acronym list.



Help Menu Options | v1.40xx

About

When the | ABOUT | menu option is selected, the Kestrel TECM ® Professional Software | SPLASH SCREEN | dialog window is displayed and provides the technical operator with the software version, build, release data and time and copyright related information.

The splash screen also displays the receiver name and serial number during the initialization process during application start-up and will scan all ports for supported and connected receivers and analyzers.

About | Splash Screen | v1.40xx

The | Splash Screen | also displays the Kestrel installed options list and indicates which options are available vs licensed.

The start-up audio alert is a validation of the host computers ability to produce audio within the application.

It is possible to disable the start-up audio by unchecking the splash audio checkbox during the application start-up or by navigating to the | HELP | ABOUT | menu option.

Online Help

The | ONLINE HELP | menu option provides a direct link the main home page and Technical Support Group (TSG) website at www.kestreltscm.com when the host computer has an active Internet connection.

Operator Manual (PW Access)

The | Software Programming and Operation Manual (SPOM) ™ | is not installed during the installation process due to the large file size, the technical operator can view or download the SPOM from the Technical Support Group (TSG) Resource Centre website, utilizing the provided "Username" and "Password" issued at the time the software license was originally purchased.

Adobe Reader ™ or other third-party software application is required to open any view the file contents of the user manual.

An active Internet connection is required to access the Technical Support Group (TSG) Resource centre website.

TIP: The Software Programming and Operation Manual is licensed to the end-user under provisions of the EULA and is proprietary and original copyrighted information; the SPOM may **not** be distributed, posted or copied; or provided to any third-party in whole or in part for any reason without specific written authorization from the copyright holder.

End User License Agreement (EULA)

The EULA is a resident PDF file located in the default software installation directory and may be accessed for review at any time from the | **HELP** | **EULA** | menu option.

The EULA is an important legal document that must be applied by the end-user of the software at all times.

Always check for updates and amendments to the software EULA with each new release, patch or update.

Kestrel TSCM ® Professional Software
Kestrel ® Central Visualizer

End User License Agreement (EULA)

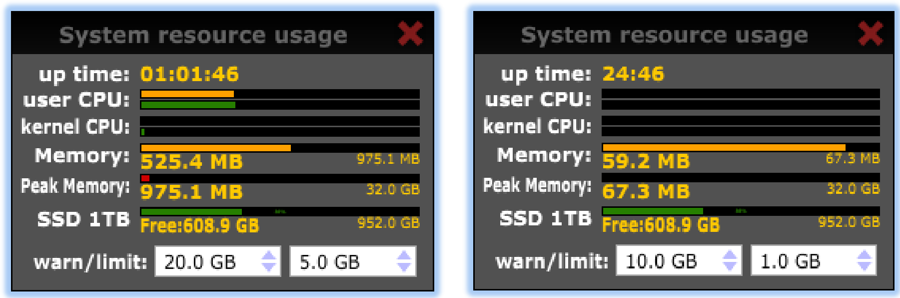
Professional Development TSCM Group Inc. (PDTG)
"Innovation is Simply the Beginning…"

Legal Agreement
IMPORTANT – READ CAREFULLY: This EULA is a legal agreement between you, either an individual or a single entity end-user, (the Customer) and Professional Development TSCM Group Inc. This EULA applies to all electronic media, features, functionality, terminology, files and proprietary structural format and the Graphical User Interface (GUI), which includes the Kestrel TSCM ® Professional Software development source code, also referred to as the Signal Intelligence Support System (SISS) TM (collectively called the Software) and associated digital media, printed materials, and online or electronic format documentation. An amendment or addendum to this EULA may accompany optional software modules or newly released versions of the Software and are binding on this agreement. The Customer agrees to be bound by the terms of this EULA by accepting for use, downloading, installing, or otherwise utilizing the software application, coding, modules, database contents and components, application programming interface and technical documentation, without exception.
NOTE: IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS EULA, DO NOT ACCEPT, OR INSTALL THE SOFTWARE. INSTALLING THE SOFTWARE IS YOUR ACCEPTANCE OF ALL TERMS, CONDITIONS, AND RESPONSIBILITIES OUTLINED IN THIS EULA AND OTHER RELATED SUPPLEMENTAL DOCUMENTATION.

Excerpt EULA | v1.40xx

System Resource Monitor (SRM) ™

The Kestrel TSCM ® Professional Software includes a System Resource Monitor (SRM) ™ and HDD / SSD write storage status dialog window to provide the technical operator with an indication of the CPU load and both the current and peak memory usage, as well as the physical storage space available for use by the Kestrel TSCM ® Professional Software.



System Resource Monitor (SRM) ™ | v1.40xx

The SRM ™ utility can be accessed from the | HELP | RESOURCE MONITOR | menu option and provides an indication of the efficiency of the host computers ability to provide the necessary processing and memory allocation for stable operation of the Kestrel TSCM ® Professional Software.

The System Resource Monitor (SRM) ™ remains on top of other active windows when displayed.

Storage Drive Monitor

The System Resource Monitor (SRM) HDD / SSD storage status display's the current amount of available storage space during runtime.

This feature is essential when deploying the Kestrel TSCM ® Professional Software during continuous long-term deployment and / or when utilizing the latest high-speed search receivers and analyzers, which tend to generate very large data file sets.

The technical operator can define a | LOW DISK | warning message annotation when the runtime storage capacity reaches the "reporting" value selected by the technical operator.

The technical operator can either select a value provided by the drop-down menu or utilize the text input box to use a custom defined value.

This feature allows the technical operator to take the necessary corrective action by manually stopping collection before the host computer storage drive runs out of storage space, at a defined minimum storage level.

The second programming feature is a minimum storage cut-off | LIMIT | setting that automatically terminates active collection without the need for technical operator intervention, preventing the host computer from running out of available storage space, which can occur relatively quickly when utilizing the latest high-speed search receivers and analyzers.

This setting parameter ensures that there will be sufficient storage space available for the normal operation of computer.

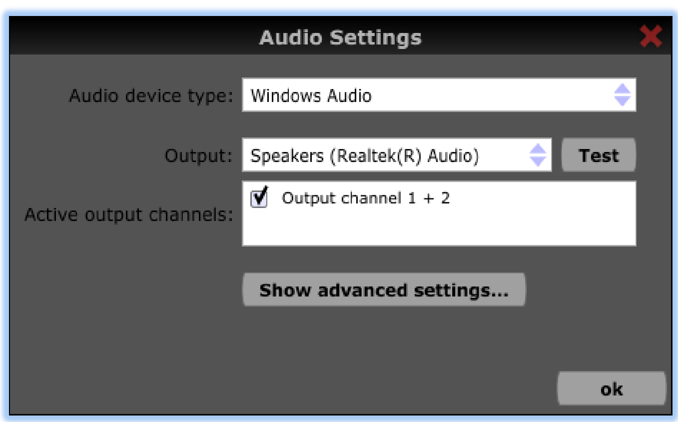
When data is being written to the primary host computer storage drive containing the Operating System (OS), running low on disk space can result in a number of problems effecting normal operation.

Should the runtime operation of the current Kestrel Project File (KPF) is automatically stopped (paused) by the System Resource Monitor (SRM), due to the low disk space limit, the technical operator can manually over-ride the stopped (paused) condition, by simply adjusting the "warning" / "limit" values and | RESTARTING | collection.

Audio Settings

The host computer handles the bulk of the audio processing, however, on some computer configurations, the audio sub-system may not allow audio source switching requiring the application to take control of the audio sub-system and provide the technical operator with some audio control capability.

The | HELP | AUDIO SETTINGS | control group provides considerable operator control with respect to the source audio.



Audio Control | v1.40xx

Spectral Range Windows

Unlike traditional spectrum analyzers the Kestrel TSCM ® Professional Software is specifically designed to permit any number of multiple spectral range windows or band allocations during deployment, across any number and type of supported search receivers or analyzers.

Spectral (Band) Tabs | v1.39xx

Spectral (Band) Tabs | v1.39xx

Spectral (Band) Tabs | v1.39xx

Spectral (Band) Tabs | v1.39xx

Our colour coded tab system makes it easy for the technical operator to quickly determine the status of each spectrum band window.

| RED | Radio (Not Assigned | Check SDR Status)

| YELLOW | Band Paused (Not Sweeping | Standby | Select TAB Press Restart)

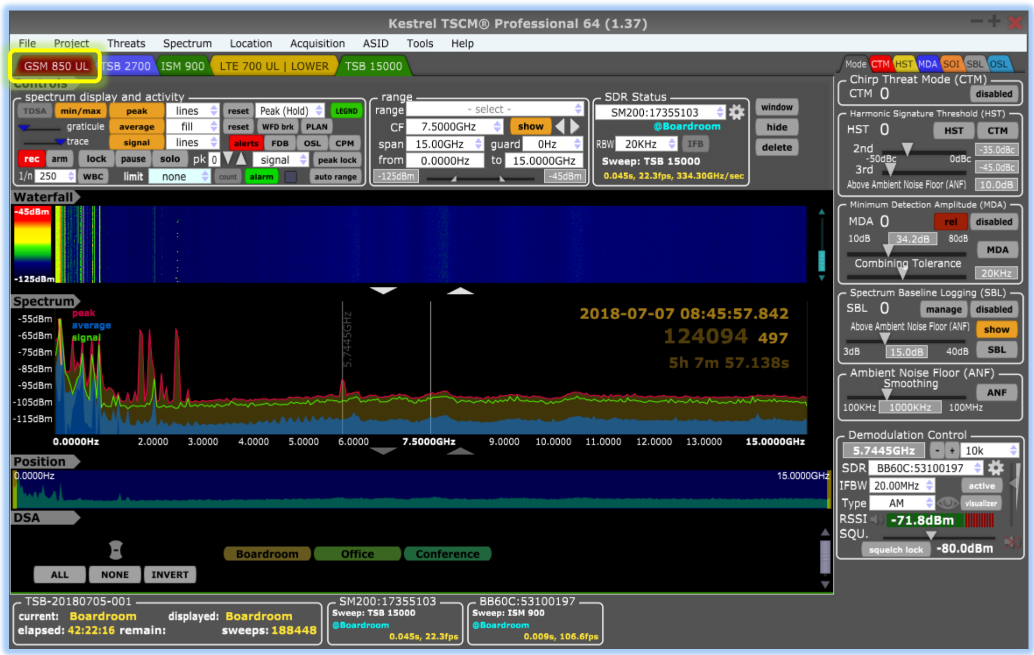
| GREEN | Band is Active (Sweeping | Press Pause to Stop Runtime)

| BLUE | Band is Locked (Trace Control Limit | Time | Reached)

| GRAY | SOLO Mode Active (Band Locked Out on Priority)

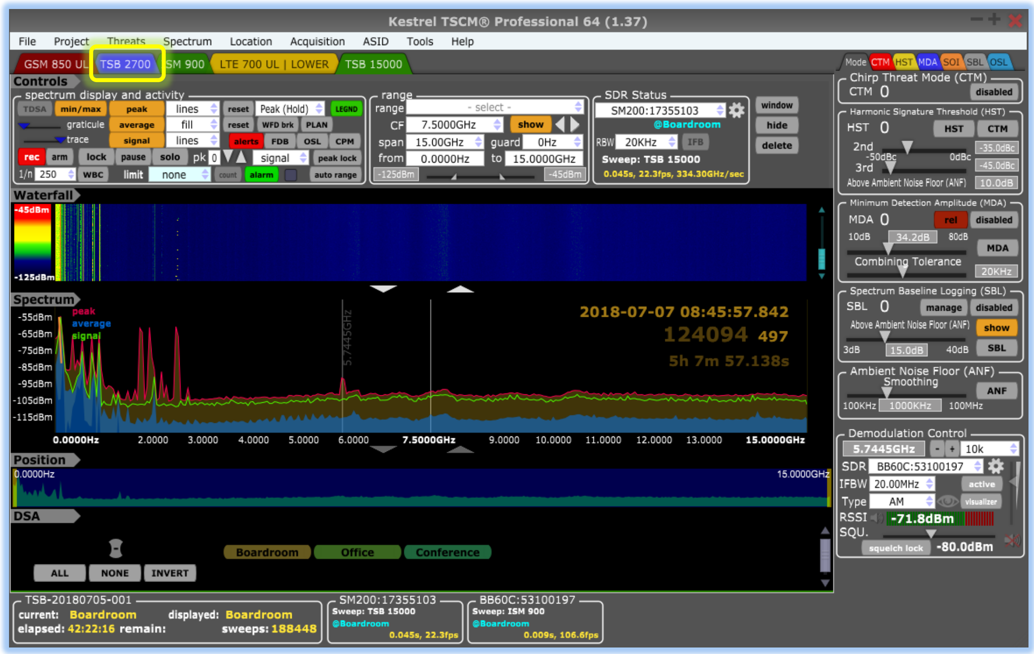
A spectrum band locked out on reaching the operator defined (Trace | Time) limit settings must first increase the | LIMIT | by either trace count or collection time, before the operator can restart the collection, if desired.

The following examples illustrate the tremendous potential of have the equivalent of multiple dedicated spectrum bands or ranges operating across any number of radios.



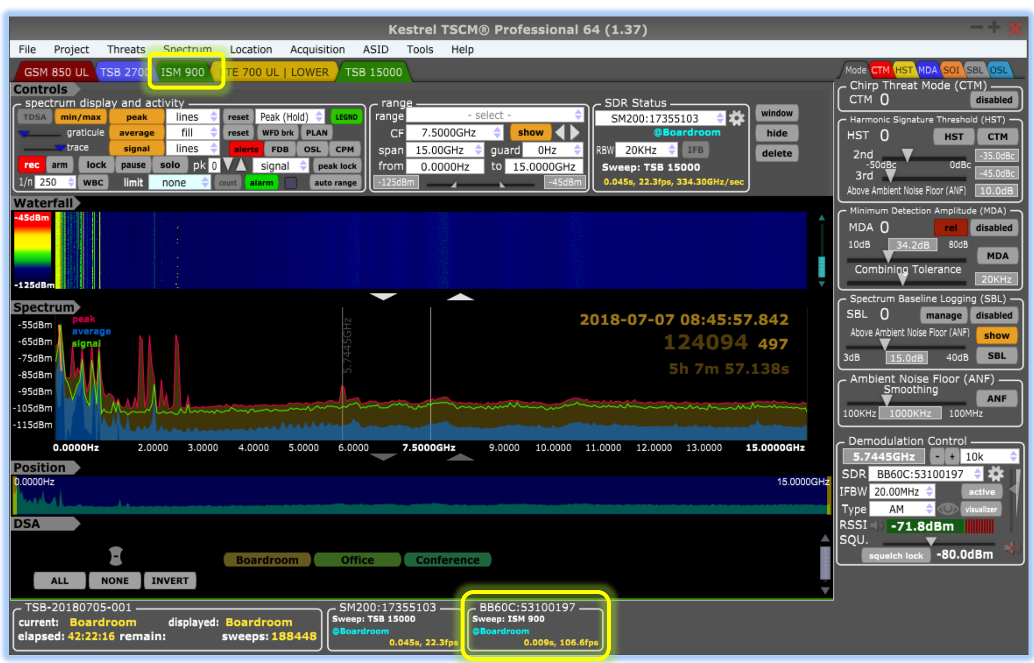
Unassigned Radio Spectrum TAB | v1.37xx

The | GSM 850 UL | band currently has no radio assigned and is therefore not running or capable of running until the operator selects a radio and confirms the desired RBW settings.



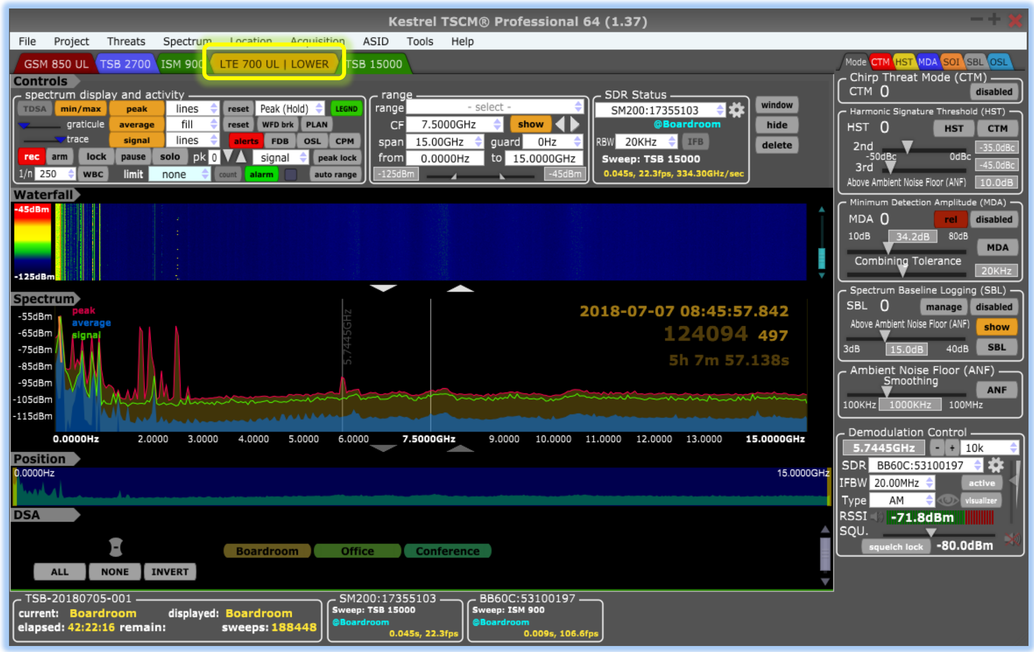
Spectrum Band Trace Limit Lockout | v1.37xx

The above spectrum band has reached the operator defined trace count and has stopped collection pending operator interaction.



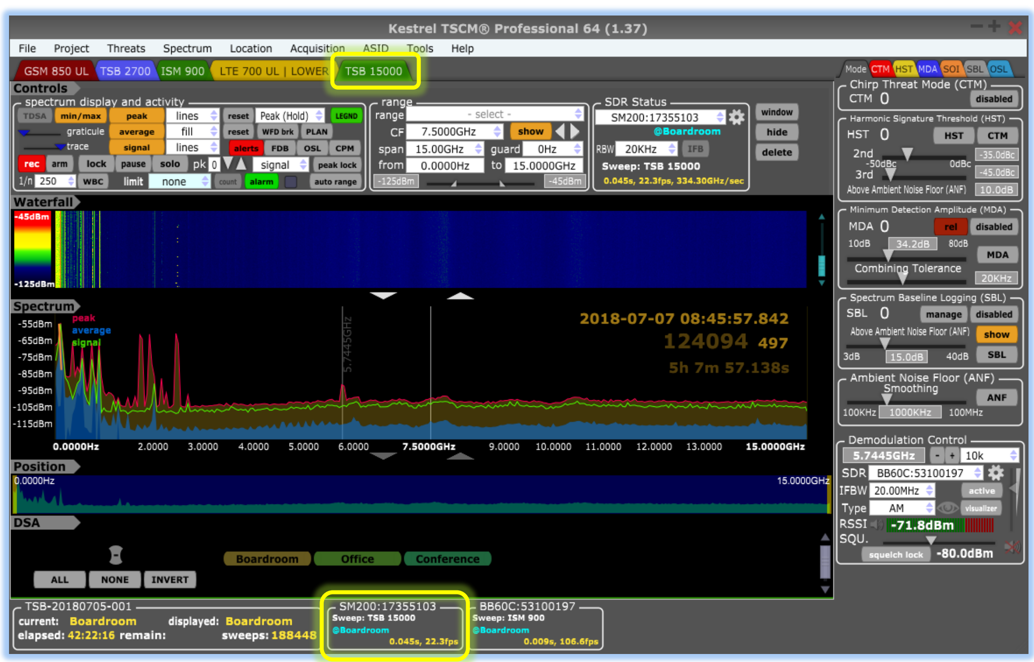
Spectrum Band (Runtime Collection) | v1.37xx

The above band is currently operating in a runtime collection mode on radio BB60C:53100197.



Spectrum Band (Radio Assigned | Paused) | v1.37xx

The above band is | PAUSED | pending operator | RESTART |.



Spectrum Band (Runtime Collection) | v1.37xx

The above band is currently operating in a runtime collection mode on radio SM200:17355103.

RF Spectral Band windows can be initialized, displayed, hidden and / or deleted in real-time by the technical operator and our dynamic “on-the-fly” spectrum “hand-off” is fully supported.

Whenever a spectral window is active all data relating to that window is automatically saved as part of the overall project file structure without technical operator intervention unless recording is disabled by the technical operator.

The operator for example, may have initialized the search receiver to view the GSM UL (824 MHz – 849 MHz) band allocation and may also wish to sweep the PCS UL (1850 MHz – 1910 MHz) band allocation in a separate spectral window or on another radio entirely.

The technical operator may have initialized the VHF (30 MHz – 300 MHz) band allocation and would also like to see the commercial FM Broadcast band in a separate window (87.5 MHz – 108 MHz) or add each of the additional spectrum bands on separate radios.

In-fact, the technical operator can easily establish <u>any</u> number of spectral windows with our TAB based User Interface (UI) as a mission specific requirement.

Each open spectral window is considered to be independent from a collection and display standpoint, with the exception of several global display and threat detection parameters.

TIP: The above examples of this very powerful mission specific display feature, as developed specifically for the Kestrel TSCM ® Professional Software, is the equivalent of lining up four (4) or more separate search receivers or spectrum analyzers.

The global parameters include various active and passive threat detection features such as the ANF, MDA, HST and CTM functionality.

There are a number of default global display settings that can be customized once a Spectral Window has been initialized.

The | Graticule | and | Trace | dimmer controls are considered to be global in nature and affect all open spectral window tabs.

The ability to setup, and maintain different trace viewing parameters and independent RBW settings is fully supported within the Kestrel TSCM ® Professional Software.

Spectrum and demodulation hand-off are accomplished, virtually seamlessly, “on-the-fly” during runtime.

New spectrum windows are added to the continuous sweep time collective and become part of the overall sweep cycle, as well as the threat detection and analysis process.

TIP: New Spectrum windows are paused by default and must be manually started by the technical operator to begin the collective sweep process for that specific spectral window.

As new spectral windows are opened, each will appear in a separate window-based TAB on the UI.

The technical operator must press the | START / RESTART | button, which will appear in RED within the | CONTROL | group for the new spectral window.

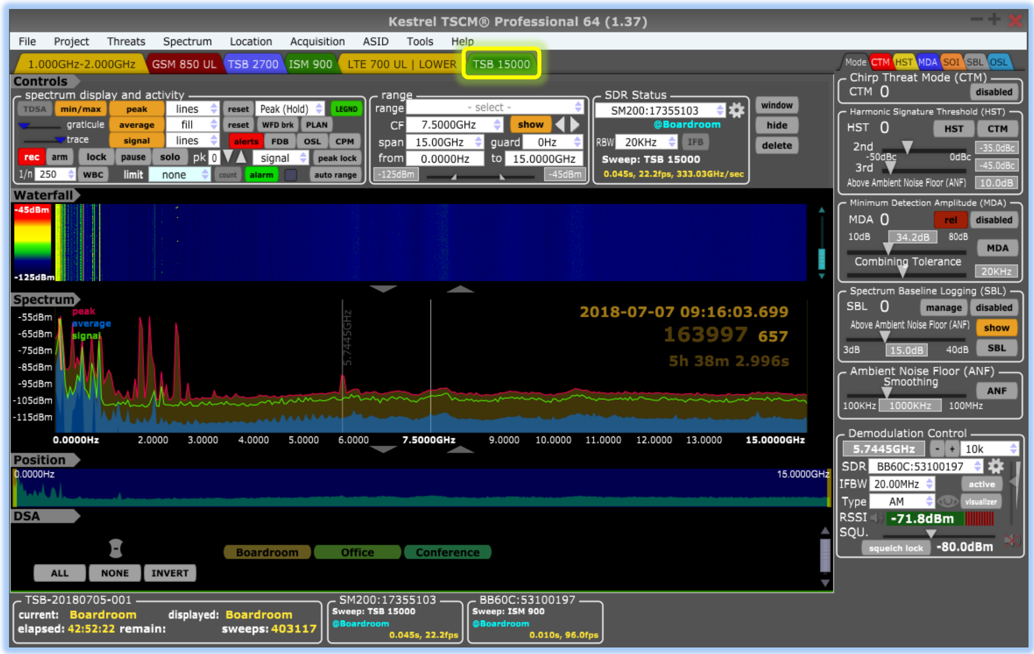
Spectral Windows

A key feature of the Kestrel TSCM ® Professional Software is the unique ability of the technical operator to open any number of independently controlled spectral range or band allocation windows.

Our spectral windowing feature permits any number of specific spectrum band allocations or Ranges of Interest (ROI), to be initialized by the technical operator and each window is totally independent.

The example UI below shows the power of the Kestrel TSCM ® Professional Software advanced windowing and spectrum TAB ability.

The technical operator has defined a manually selected start and stop frequency 1 GHz to 2 GHz and selected spectral profiles | GSM 850 UL | TSB 2700 | ISM 900 | LTE 700 UL LOWER | and | TSB 15000 |.



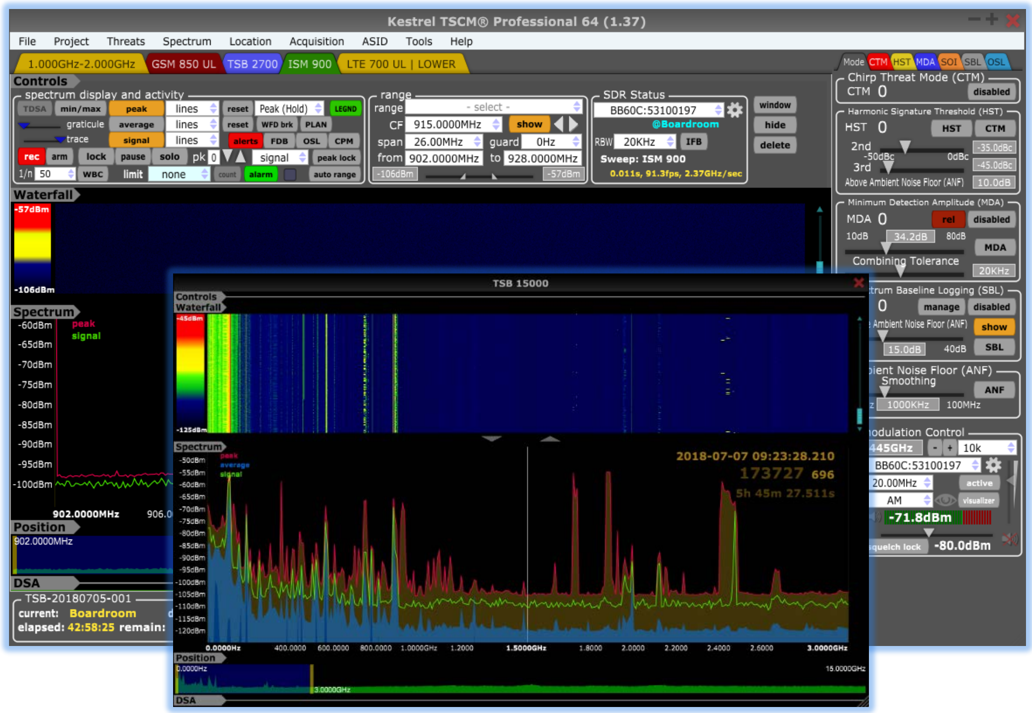
Advanced Windowing Band TABS | v1.37xx

The ability of the technical operator to sweep individual and totally independent, spectral Range of Interest (ROI) TABS is a technological achievement specifically developed for the Kestrel TSCM ® Professional Software.

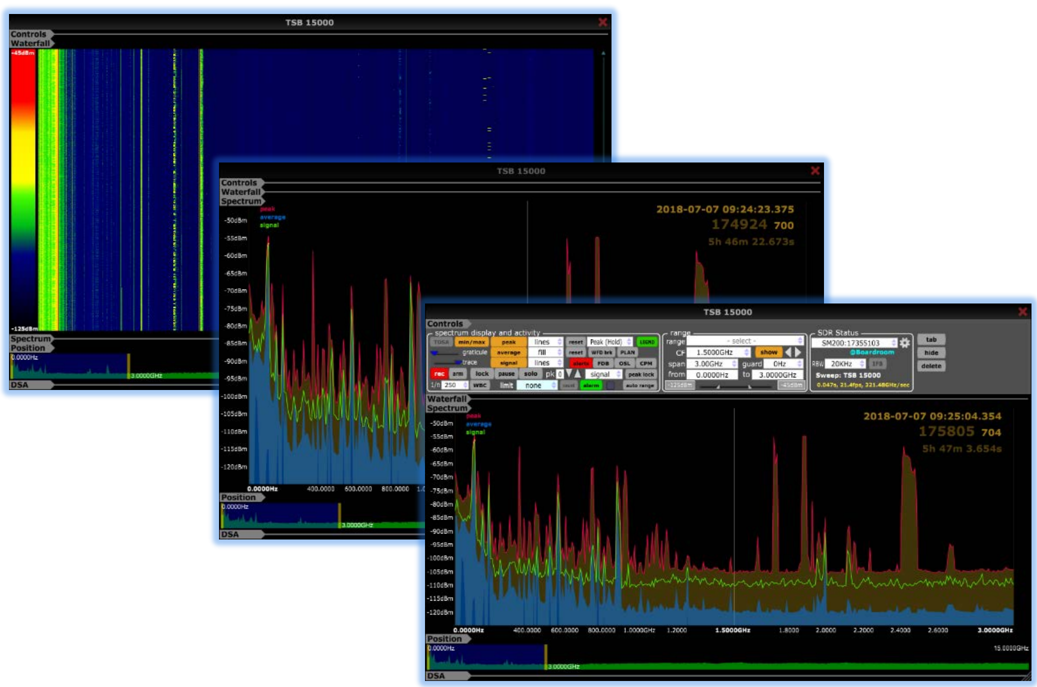
The ability to open any active spectral range TAB as a separate floating window allows the technical operator to move any or all of the independent spectral windows to a secondary display monitor.

The UI example above shows the | TSB 15000 | band seated as a standard TAB window and is currently selected for technical operator review.

The UI example below is the same | TSB 15000 | band displayed as a separate floating window that may be dragged and resized to fit another display monitor.



Advanced Windowing Band TABS | v1.37xx



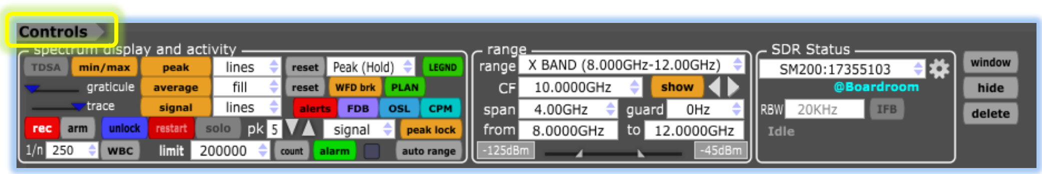
Multiple Windowing Display Options | v1.37xx

Any number of spectral windows may be selected for view on a single display monitor, seated within the user interface, or may be opened as a separate floating window and dragged to a second or even third display monitor for dedicated viewing and analysis.

When the technical operator “windows” one (1) or more of the available (active) spectrum tabs using the | WINDOW | button and then utilizes the | TAB | button to re-seat the window of interest, it will automatically reposition to the first tab position on the UI.

Controls Window

The | CONTROLS | window, by default, is located at the top of the user interface and may be displayed or hidden by double mouse click on the | CONTROLS | tab.



Controls Group | v1.37xx

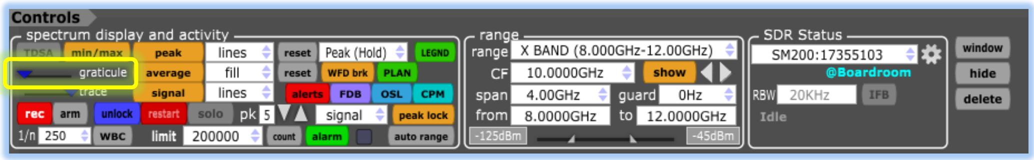
The ability to Display / Hide the Control Group is independently controlled for each active spectral window, when the technical operator presses the Window button.

The new floating window will have a separate control group which can be independently controlled.

The control window can also be relocated to any vertical position within the GUI spectral window structure based on operator preference.

Graticule Control Group

The Graticule control allows the operator to dim the Graticule reference grid, including the amplitude and frequency annotations.



Graticule Dimmer Control | v1.37xx

This feature is useful during extended monitoring and enhances the technical operator's attention and focus on the spectral traces rather than Graticule screen clutter.

The | Graticule Dimmer Control | range extends from full brightness to totally off and may be adjusted by the technical operator, as desired.

The | Graticule Dimmer Control | is a global setting that affects all active spectral window TABS.

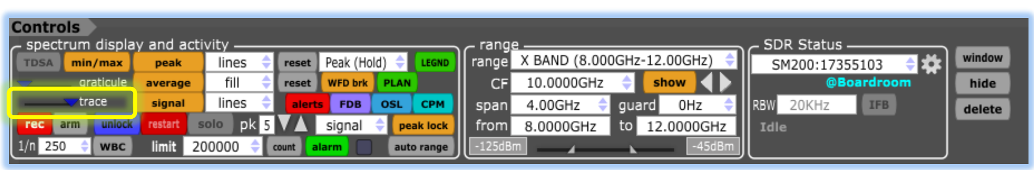
The | Graticule Dimmer Control | is easily accessed and can be adjusted "on-the-fly" as required by the technical operator.

The | Graticule Dimmer Control | default setting is 50% and may be adjusted up or down by the technical operator.

The reference level and frequency annotations remain active, regardless of the position of the | Graticule Dimmer Control | slider bar.

Trace Control Group

The | TRACE | control allows the technical operator to dim the spectral trace display.



Trace Dimmer Control | v1.35xx

The | Trace Dimmer Control | is a global setting that effects all active spectral windows and universally affects the brightness of the Real-Time Event Trace (RTE), the Peak Envelope Capture (PEC) trace and the Spectral Average Trace (SAT).

The | Trace Dimmer Control | is easily accessed and can be adjusted on the fly as desired by the technical operator.

TIP: The trace dimmer control by unique design, does not affect any displayed Spectral Marker Flags, and dimming the active spectral traces allows the technical operator to focus attention on any SOI, MDA, SBL, CTM, HST, OSL spectral marker flag (if displayed) and present.

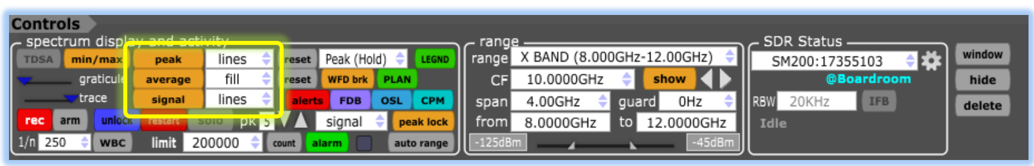
This feature is a milestone in workflow management and can significantly enhance the technical operators Probability of Detection (POD) of new hostile signals appearing on the Graticule as flagged by the Kestrel TSCM ® Software as a potentially hostile Signal of Interest (SOI).

The | Trace Dimmer Control | group allows the operator too partially dim or turn-off the RTE, PEC and SAT completely, placing operator focus and emphases on the Spectral Marker Flags.

Spectral Trace Control Group

There are three (3) spectral trace combinations display options that allow the technical operator to select | LINES | POINTS | FILL|, to adjust the currently displayed spectral window.

Spectral trace controls are independent and allow the technical operator to set different preferences for each active spectral window as desired.

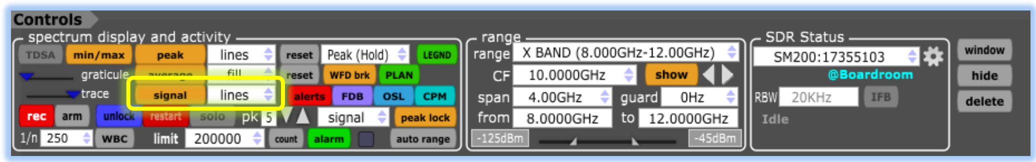


Spectral Trace Controls | v1.37xx

TIP: It is important to understand that enabling or disabling the signal, peak and average traces, do not have any effect on active data collection. These display controls alter the technical operators viewing preference only.

Real-Time Event (RTE) Trace (Signal) - Enable

The RTE trace is the main spectral trace commonly displayed on the Graticule and provides the technical operator with a real-time representation of the ambient RF environment in both near-field and far-field.

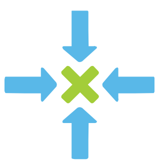


RTE Controls | v1.37xx

This trace may be selected ON or OFF at any time during collection without interrupting the collection process.

Turning off the RTE trace allows the technical operator to focus on the PEC trace and / or Spectral Average Trace (SAT) (if currently active).

The technical operator may select the trace view as | LINES | POINTS | FILL | as desired.



TIP: Turning off the RTE trace has an important design function when the threat detection algorithm is active. The Spectral Marker Flags associated with signal identification and threat detection will continue to be display, focusing attention only on SOI and potential threats that have met the Minimum Detection Amplitude (MDA) or active threat criteria including CTM and HST.

By default, the Real-Time Event (RTE) trace is enabled when an initial or new spectrum window is opened.

The technical operator may | ENABLE | or | DISABLE | the RTE trace at any time during capture without affecting data collection.

Peak Envelope Capture (PEC) - Enable

The Peak Envelope Capture (PEC) trace feature is a very powerful tool with specific TSCM functionality that allows the technical operator to capture and identify intermittent, burst, periodic, and pulsed signal events identified over time.

The | PEAK HOLD | ability is a common trace mode that is found on virtually every professional level spectrum analyzer, and many of the TSCM specific equipment resource available.

The Kestrel TSCM ® Professional Software utilizes peak amplitude hold as a separate trace to maximize the detection of intermittent and periodic signal events that may be too fast or infrequent, to be viewed by the technical operator in real-time.

We utilize this same methodology within our Differential Signal Analysis (DSA) feature.

The | Peak Envelope Capture (PEC) | trace can develop a very accurate picture of what has occurred within the ambient signal environment over a period of time regardless of the sweep rate or Range of Interest (ROI) selected, often developing a peak of signal events over time that may not be observable within the Real-Time Event (RTE) trace, during runtime.

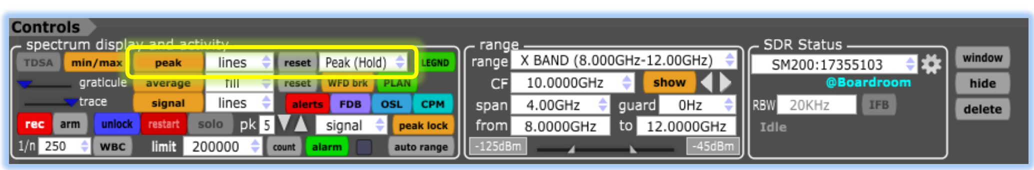
The | Peak Envelope Capture (PEC) | trace allows the Kestrel TSCM ® Professional Software to capture periodic, intermittent, burst, frequency hopping and spread spectrum signals that may not be easily detected within, or just above the noise floor, or otherwise may not be identified in real-time by the software or technical operator.

The Probability of Intercept (POI) and Probability of Detection (POD) for intermittent and other illusive signal events, including intermittent, Electro-Magnetic Interference (EMI) or Radio Frequency Interference (RFI) can be significantly increased and often easily captured using Kestrel TSCM ® Professional Software | Peak Envelope Capture (PEC) | trace | Waterfall Display (WFD) | and the | Real-Time IF Spectral Density | plot located within the Demodulation Visualizer.

Each signal event causes the peak capture trace to “hold” the maximum (peak level) of the signal event.

The resulting trace clearly indicates areas of the ROI where signal activity or events have occurred.

The technical operator may select the PEC trace view as | LINES | POINTS | FILL | as desired.



PEC Controls | v1.37xx

The PEC trace may be | RESET | and | RESTORED | by the technical operator to allow a fresh PEC trace to be established.

When the technical operator wishes to use the DSA comparative feature, after selecting the | PEAK RESET | option, it is essential that the | PEAK RESTORE | option must be selected to ensure accurate DSA representation.

The | CONTROL | button provides direct access to the | RESET | and | RESTORE | menu options.

The default setting for the PEC trace is | PEAK (HOLD) | and this setting locks the peak value and displays the result on the Graticule.

There are three (3) additional control settings available within the PEC dialog box, including | ECHO (SLOW) | ECHO (MEDIUM) | ECHO (FAST) |.

The ECHO mode causes the | Peak Envelop Capture (PEC) | trace to decay (reset) to the Ambient Noise Floor (ANF) at a slower rate that the RTE trace.

This delay or persistence allows the technical operator to observe signals that may be a fast bursting, intermittent or periodic in nature.

The ECHO mode causes the peak trace to automatically decay at a slower rate than instantaneous real time signal events allowing the technical operator to observe the location of signals that have already terminated.

The ECHO mode is utilized with the Differential Signal Analysis (DSA) feature to achieve a real-time DSA comparative.

There are three (3) settings that may be selected by the technical operator depending on the desired decay rate and the current ROI selected.

TIP: The ECHO mode is most effective when the ROI is limited to less than a 100 MHz SPAN and may be utilized to observe signal modulation characteristics or observe the location of intermittently appearing signals within the spectral environment.

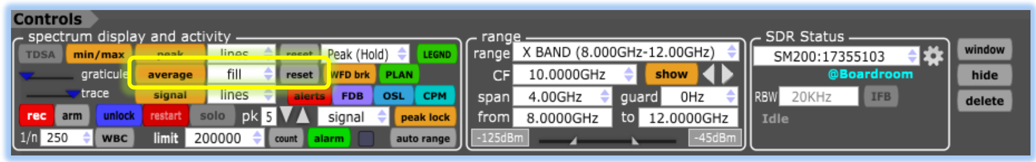
By default, the PEC trace is enabled when a new spectrum window is opened and the technical operator may enable or disable the PEC trace at any time during capture.

Spectral Average Trace (SAT) - Enable

The technical operator may enable the SAT and select one (1) of three (3) display parameters including | LINES | POINTS | FILL |.

There is a | RESET | button that allows the technical operator to reset the spectral average trace if desired during capture.

When the | PEAK | button is presses, the number of traces that make up the current peak are displayed and an option to reset the peak is also available.



SAT Controls | v1.37xx

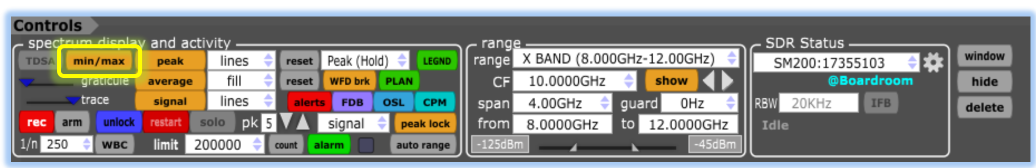
By default, the SAT trace is disabled when a new spectrum window is opened.

The technical operator may enable or disable the SAT at any time during capture without interrupting data capture.

In-fact, data capture occurs even though the SAT trace is by default not displayed.

MIN | MAX REFERENCE

The | MIN | MAX | reference trace provides a total energy picture over time and integrates with any combination of other trace display options, including the EHCO mode decay feature.



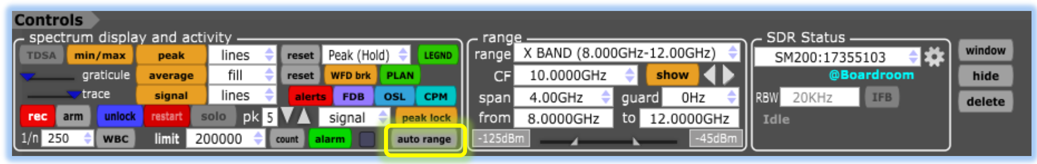
MIN-MAX REF Controls | v1.37xx

The | MIN | MAX | reference trace is accessed by pressing the | MIN | MAX | button located in the spectrum display and activity control group.

Reference Level | Auto Range

A single press of the Reference Level – Auto Range button results in the currently displayed spectral window "auto ranging" for optimal viewing within the Graticule.

The Auto Range adjustment is based on the average and peak signal levels for the current window and best results are obtained after several traces have been established during initialization of a new spectrum window.



AUTO RANGE Controls | v1.37xx

The Auto Range control may be utilized by the technical operator at any time to adjust the Graticule display for optimal viewing.

TIP: For example; should a high amplitude, real-time signal event occur within the currently displayed ROI, displayed spectral zoom range, or when the positional zoom control causes any given spectral range to have an apparent lower noise floor that does not display optimally on the Graticule, the technical operator may press the auto range control.

Pressing the Auto Range button causes the trace to center on the Graticule (10 dB) below the top of the Graticule spectral display window and (5 dB) from the bottom of the Graticule spectral display window.

This may not necessarily result in the best or optimal setting for viewing all signals on the WFD and simply ensures that all signal spikes and noise floor clutter is more or less centered on the Graticule.

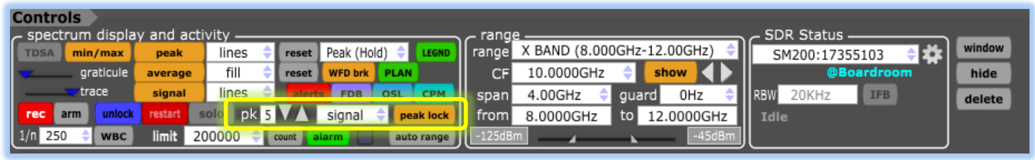
Peak Seeking Marker (PSM) | + | - |

The technical operator may activate up to five (5) Peak Seeking Marker (PSM) annotations on the currently displayed Graticule.

Pressing the | + | places a peak marker and text annotation on the strongest signal currently displayed on the Graticule window.

Signal events that are off screen will be ignored by the Peak Seeking Markers (PSM).

The marker will display the peak frequency (MHz) and amplitude (dBm) annotations and will dynamically update during each sweep cycle.



PSM Controls | v1.37xx

Pressing the | **+** | a second time will activate a second Peak Seeking Marker (PSM) and place it on the next strongest signal currently displayed on the Graticule window.

There is a total of up to five (5) Peak Seeking Markers (PSM) available and pressing the | **-** | removes the PSM in reverse order.

The technical operator can select the PSM priority as | SIGNAL | PEAK | AVERAGE | utilizing the | Marker Priority |selection box.

The technical operator can also select the PSM numerical value and utilizing the keyboard, manually enter a numerical value of 1, 2, 3, 4 or 5 to display the selected number of Peak Seeking Markers (PSM) on the currently displayed Range of Interest (ROI).

The Peak Seeking Marker (PSM) feature allows the technical operator to set the PSM to respond and display on the Real-Time Event (RTE) trace when a signal event is currently active or on the Peak Envelope Capture (PEC) trace when the signal event is not currently active.

The Kestrel TSCM ® Professional Software also supports the ability of the technical operator to select the Peek Seeking Marker (PSM) set to respond to the Spectral Average Trace (SAT) as a marker priority.

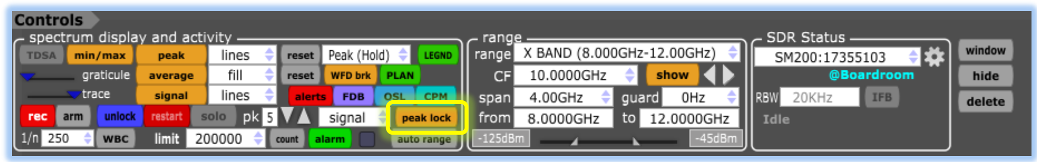
Each active PSM will follow the strongest signal event in succession as currently displayed on the Graticule and will dynamically update and display the selected number of PSM against the strongest signal events present.

The PSM feature will hold position on a specific signal if that signal event is the strongest signal event displayed on the Graticule and remains the strongest signal event during each sweep.

Otherwise, the PSM will dynamically follow and move to another higher amplitude signal event on subsequent sweeps.

Peak Seeking Marker (PSM) | Signal Lock

The Peak Seeking Marker | PEAK LOCK | button is located on the spectrum display and activity control group and prevents the normal dynamic PSM updating from occurring during each subsequent sweep once the technical operator determines the marker is on the desired Signal of Interest (SOI).



PSM Lock | v1.37xx

The nature of the Peak Seeking Marker (PSM) ™ is to dynamically seek and identify the strongest signal events as the spectrum is updated during each successive sweep.

The peak seeking marker lock is utilized when the technical operator wants to focus attention on a particular signal event or events and does not want the PSM to over to another higher amplitude signal event.

Pressing the |PEAK LOCK | button results in all displayed markers locking at the current position and dynamically updating with instantaneous amplitude changes, that might occur during each successive sweep event.

Pressing the | PEAK LOCK | button a second time restores normal marker operation.

PSM | Session Report Generator (SRG)

When one (1) or more Peek Seeking Markers (PSM) ™ are active during the report generation process, the actual number of PSM will display, identifying up to five (5), Peek Seeking Markers (PSM) across the entire Range of Interest (ROI) regardless of the number of spectral plots selected.

This allows up to five (5) of the highest amplitude signal events to be flagged within the report.

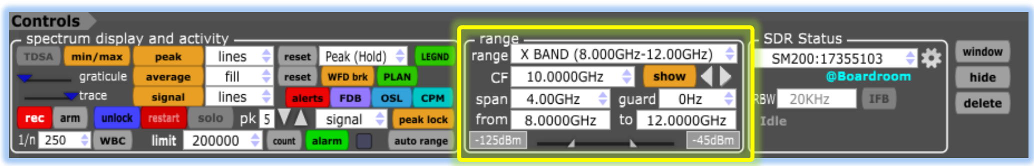
When the “Add Full ROI Plot” option is selected, all five (5) Peak Seeking Markers (PSM) will be displayed; each of the PSM will also display on individual narrow band spectrum plots.

TIP: When signal events are closely spaced; Peak Seeking Markers (PSM) may not display correctly as multiple closely spaced PSM will display on top of other PSM annotations; therefore; it is recommended that only the minimum number of PSM be utilized for the purpose of report generation.

Spectral Range | Navigation Control Group

The ability of the technical operator to navigate the entire spectral range allows a detailed real-time or post event review of the any active spectral window.

This control group is dynamically linked to the Positional Zoom Control (PZC) functionality and displays the correct values and is fully integrated to allow the technical operator significant versatility.



SRC Controls | v1.37xx

When the technical operator wishes to step through the spectrum at a specific SPAN during analysis the Spectral Range Control Group is utilized to setup stepping preferences.

Horizontal Range Control (HRC) ™

The HRC ™ control, provides high precision zoom control for any existing band located within Spectrum Profile File (SPF) ™ database to allow the operator to quickly establish band level zoom factors.

HRC Controls | v1.37xx

The HRC provides a precision band oriented or Range of Interest (ROI) navigational display capability that is based on the operator defined Spectrum Profiles Files (SPF) database.

This method of direct navigation can be used to display any existing SPF database profile.

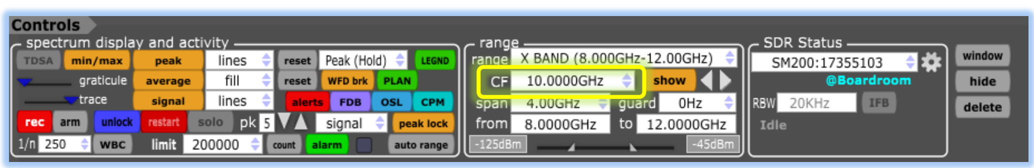
All normal navigation functions remain active and available, and any operator navigational input will immediately override the HRC selection, maximizing navigational options.

To add navigation options to the HRC selection window, the technical operator must add, delete, or edit the | Spectrum Profile Database (SPF) | and will automatically display as HRC options.

Center Frequency (CF) Control

When a positional zoom factor is applied to the ROI, the technical operator may enter a CF value.

The software will move the CF to the center of the Graticule, or as close as possible (ROI and SPAN dependent).



CF Control | v1.37xx

When in FULL SPAN, the CF will be displayed, based on the ROI.

The technical operator should first adjust the SPAN, if the Graticule is currently in FULL SPAN prior to adjusting the CF.

Whenever the SPAN is set to a value less than the ROI range, the technical operator may select a CF value from the selection box or type a value into the text box to the same effect.

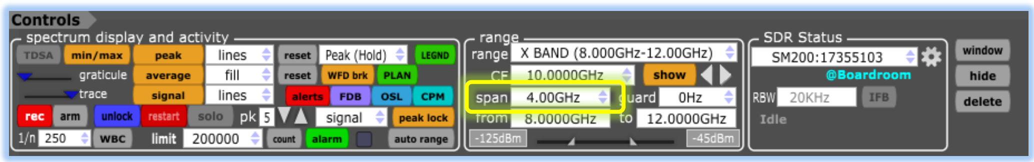
Only a legal value will be accepted and the software will immediately move the new CF to the center of the Graticule based on the current SPAN setting.

Depending on the actual SPAN setting, the CF selection box is dynamically populated with a variety of CF values to assist the technical operator in quickly choosing the best setting.

The technical operator has full control of the CF functionality and may manually enter a value into the CF text box for precise frequency control.

Horizontal Range | Frequency Span Control

The technical operator can enter a custom SPAN (MHz) setting up to the maximum ROI bandwidth referred to as Full SPAN by selecting and typing in a legal SPAN value.



SPAN Control | v1.37xx

Alternatively, the technical operator may select a dynamically generated SPAN from the pull-down selection option box and depending on the current Range of Interest (ROI).

Dynamically populated SPAN options will be available to the technical operator for each spectrum band for selection.

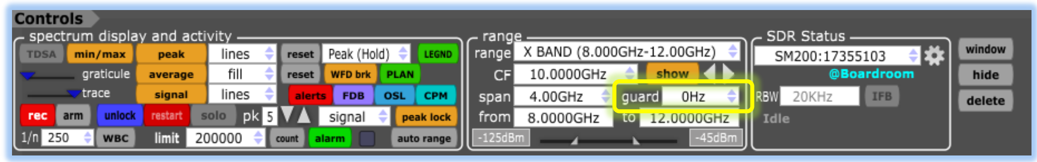
The SPAN options list will dynamically update based on the current Center Frequency (CF) in multiples of 100, 50, 25 and 10, down to 5% of the current or full SPAN Range of Interest (ROI).

For example, if the current spectrum band or range is 25 MHz, the SPAN option list will allow direct selection of 25 MHz, 10 MHz, 5 MHz and 1 MHz.

Guard Band Control

The | Guard Band | control is a display option and is an essential TSCM specific display element utilized extensively when the technical operator is stepping UP or DOWN the spectrum during a real-time or post event review.

The technical operator can enter a specific | GUARD BAND | value that displays as a fixed shaded area on the RIGHT and LEFT side of the Graticule.



GUARD BAND Controls | v1.37xx

When the FULL ROI is displayed, no additional spectral trace information will be displayed above or below the maximum ROI value.

Activating the | GUARD BAND | will not display any additional information when in FULL SPAN display mode.

When a guard band value is active (where a positional zoom factor is currently applied), the technical operator will not only be able to view the current active window SPAN as selected, but also the added guard band value.

This feature allows any possible signal activity that would normally be lurking just off the display (either above or below) that perhaps otherwise would not be observed by the technical operator when a narrow band signal spike is on, or near the upper or lower step edges of the Graticule.

When a guard band value is entered, or selected from the selection box, a shaded area appears on the left and right side of the Graticule equal to the guard band value, but does not affect the actual STEP value.

This increases the actual window bandwidth to allow the technical operator to observe and review any signal events that appear within the defined guard band.

The SPAN will remain as set and the guard band will also display, increasing the overall displayed bandwidth or ROI.

For example, for a SPAN of 25 MHz and a guard band of 1 MHz, the actual display window bandwidth will be 27 MHz.

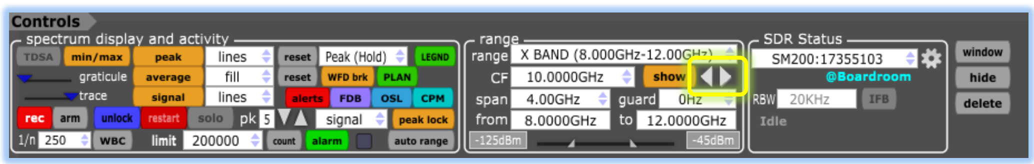
Pressing the | STEP UP | STEP DOWN | arrow buttons will result in a 25 MHz STEP, plus an additional 1 MHz to the RIGHT and LEFT of the display.

Navigational Step Control

The frequency navigation | UP | DOWN | arrow buttons located within the Range control group allow the technical operator to either step | UP | or | DOWN | frequency based on the currently displayed zoom factor.

For example, if the current Range of Interest (ROI) is 6 GHz (DC to 6 GHz) and the currently displayed SPAN is 25 MHz, the technical operator is able to step UP or DOWN frequency in 25 MHz steps from the absolute START frequency to the absolute STOP frequency.

The technical operator is able to set the STEP value by entering a CF + SPAN or START + STOP frequency within the Horizontal Range control group, or by utilizing the Positional Zoom Control (PZC) to set the desired SPAN.



STEP Controls | v1.37xx

Pressing the UP / DOWN arrow button once (with a left mouse click), results in a single step UP or DOWN.

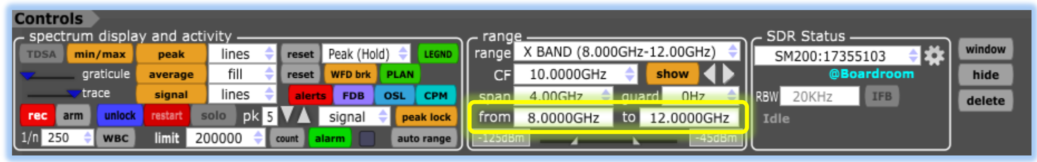
Pressing at holding the (left mouse click and hold to accelerate stepping) UP / DOWN arrow button, results in repeat continuous stepping UP / DOWN throughout the entire Range of Interest (ROI).

Start / Stop Frequency Control

The | START | and | STOP | input boxes are dynamically populated automatically based on the ROI, CF and SPAN settings.

The technical operator may enter a specific | START | and | STOP | frequency (MHz) and the CF and SPAN boxes will automatically and dynamically populate.

The technical operator can select any | START | and | STOP | frequency within the ROI of the currently selected window.



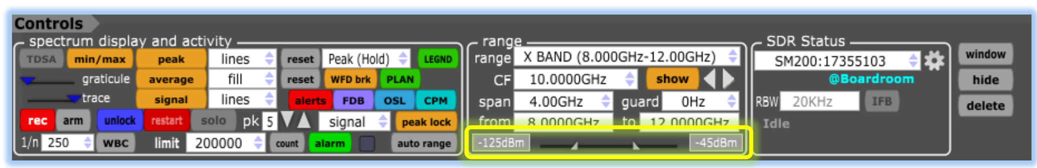
MANUAL RANGE Controls | v1.37xx

This feature provides precise control of the spectral window ROI.

Reference Level Slider (RLS)

This control group allows the technical operator full and unrestricted manual control of the spectral display reference level within a range of (-180 to +20 dBm).

Adjusting the RLS control affects the position of the spectral traces for optimal display on the Graticule.



RANGE Control | v1.37xx

Changing the position of the RLS also causes the Waterfall Display (WFD) colour palette to adjust to the new reference level.

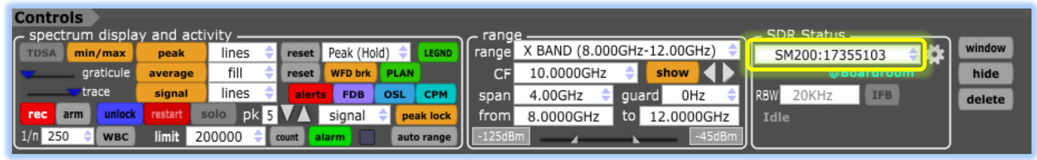
The RLS is an important control element during real-time and post event analysis, as it is possible that not all signals will be equally visible within the WFD at any given reference level setting.

Oftentimes adjusting the reference level will allow the technical operator a more detailed and accurate analysis utilizing the WFD utilizing the RLS to determine the optimal display setting for any given SOI.

SDR Status Control Group

The SDR Status control group provides spectrum “hand-off” capability for all initialized search receivers or analyzers.

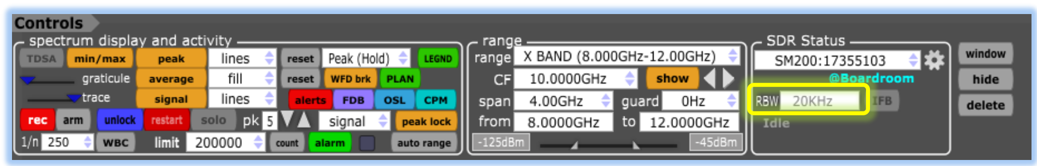
Each search receiver or analyzer that has been designated as “Spectrum” in the Analyzer Control will appear in SDR selection option list for real-time “on-the-fly” spectrum “hand-off”.

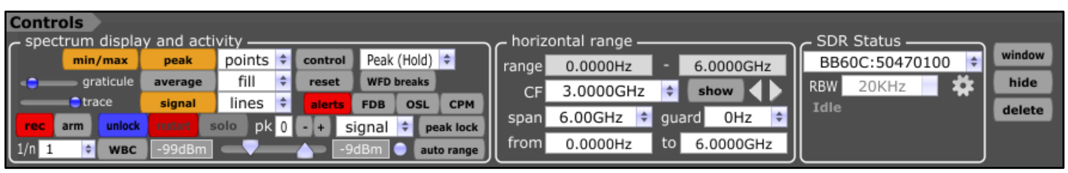


SDR HAND-OFF Controls | v1.37xx

Resolution Bandwidth (RBW) Control

The control group Resolution Bandwidth (RBW) option box allows the technical operator to change the RBW at any time during the actual collection process.





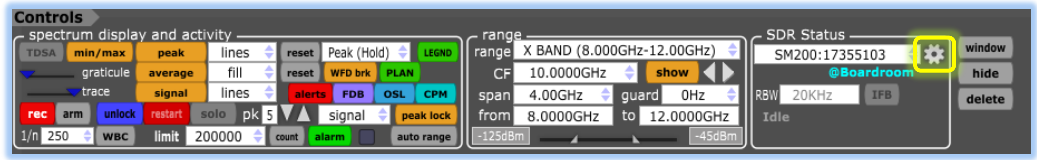
RBW Controls | v1.37xx

Normally the technical operator will select the RBW during the set-up process, however, changing the RBW during runtime is fully supported.

The RBW option list is not global in nature and only affects the active Spectral Window.

Display Analyzer Control Group

Pressing the quick display button, invokes the display | ANALYZER CONTROL | without the need to navigate the menu structure. This allows access to the | GAIN | ATTENTUATION | and other available receiver or analyser level controls.



Probability of Intercept (POI) | Calculator

The ability to determine the Probability of Intercept (POI) across the entire runtime bandwidth is an essential operational value in the Signals Intelligence (SIGINT) community in determining the minimum signal duration that can be captured with any given certainty.

The problem is that there are many factors that have a direct and indirect effect on the POI value achieved in real-time.

POI calculations are often misinformed, misleading by design and simply wrong leading the technical operator to the wrong conclusions.

There is simply no place for theoretical POI values that are based only on the generally limited IF Bandwidth (IF BW) of the receiver or even search speed.

For example, the host computer capability, threat detection algorithms, digital signal processing, command and control and a wide range of additional runtime factors dramatically affect the Probability of Intercept (POI) values in real-time.

Theoretical and mathematical POI models fail to account for many variables in practice resulting in significantly lower performance than is expected by the technical operator.

Since POI is generally not a visibly verifiable value, the ability of the technical operator to fully comprehend the real POI performance is an unknown.

The Kestrel TSCM ® Professional Software includes a real-time, runtime POI calculator that displays the minimum signal duration required for 100% POI at any given point in time by determining the processor loading, memory allocation, hardware performance, digital signal processing, write performance, etc., and renders a dynamic on-the-fly real-time POI value.

The POI display provides first and for most, the minimum signal duration required for a 100% Probability of Intercept (POI) across the entire mission specific search bandwidth selected by the technical operator.

This feature is accessed during runtime by mouse click on the SDR status window displaying the current runtime status, which displays the runtime sped in seconds, frames per second, and Gigahertz (GHz) per second.

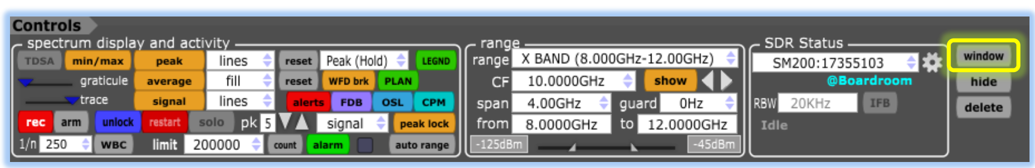
The POI table will appear as a pop-up window and provide the current signal duration for a 100% POI and other reference values.

Closing the window and opening the POI calculator, dynamically resets the calculation to the present moment, providing the POI value given any changes in the performance.

POI calculation in real-time is the minimum acceptable standard in attaining a positive mission-based performance characterization.

Spectral Window Button

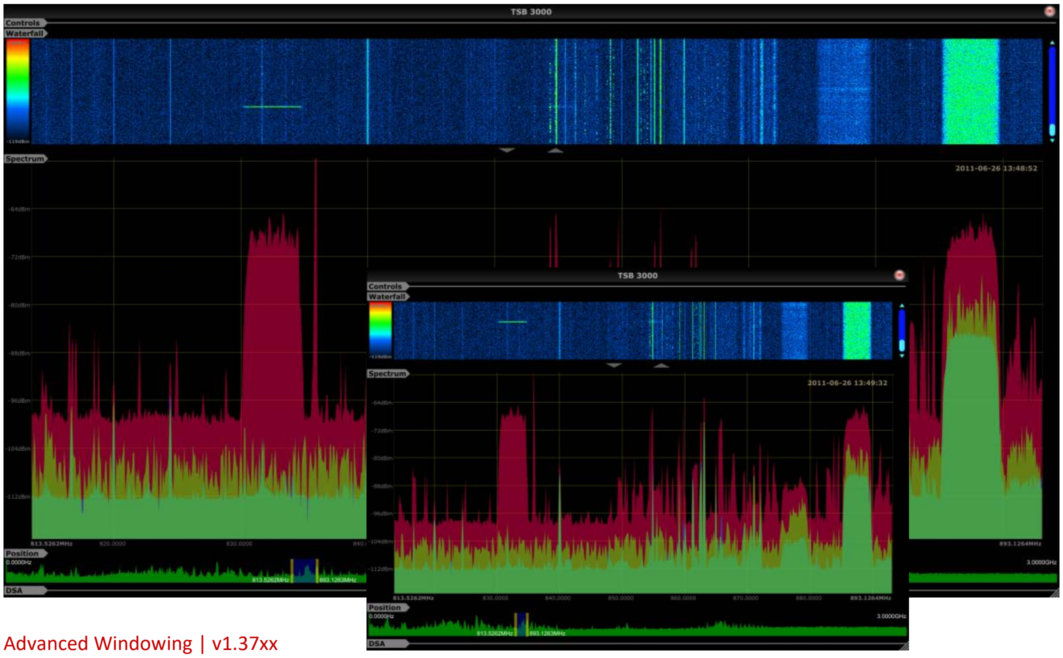
When one (1) or more spectral windows are open and actively displayed, the technical operator may open the currently selected TAB as an independent floating window that may be dragged to a second or even third display monitor, resized and tiled on the primary display monitor or any additional display monitor available.



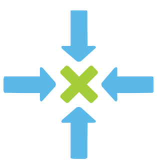
WINDOWING Control | v1.37xx

When a spectral window is opened as a floating TAB, the WINDOW button text will change to TAB and pressing the TAB button will seat and lock the spectral window back into the GUI in a tab ordered format.

The following images illustrate the technical operator's ability to display independent RF Spectral Windows, drag, resize and display only the spectral components desired.



Pressing the TAB button will return the selected spectral window back to a docked tabbed position within the Graphical User Interface (GUI).



TIP: Pressing the WINDOW button causes an independent floating window to be established. Pressing the TAB button seats and locks the window and reorders the TAB to the first position.

This unique feature allows any number of spectral range windows to be independently displayed on any number of hand-off display monitors; similar in concept to having a number of, side by side search receivers or spectrum analyzers.

Hide Spectrum Window Button

Selecting the HIDE button hides the currently active spectral window TAB.

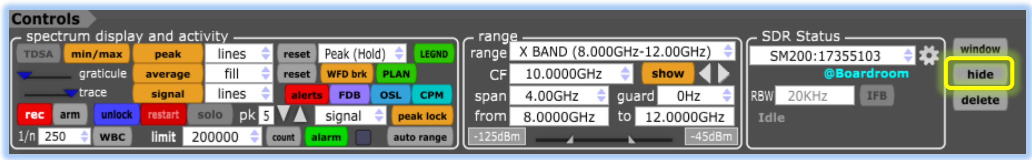
The spectral window may be recalled and displayed again by selecting the window from the | MENU | SPECTRUM | option list.

Closed windows are displayed as unchecked options within the menu list of open spectral windows.

When the technical operator utilizes the HIDE button, the window continues collecting spectral data in the background.

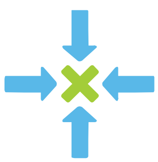
The operator may confirm this functionality by observing the status display.

Each active spectral window will remain part of the sweep collective.



Hide Spectrum Control | v1.37xx

The spectral window may be displayed again by selecting the | SPECTRUM | menu and selecting the profile that the operator has previously chosen to close and wishes to restore for display on the GUI.



TIP: Utilizing the HIDE Button, hides the window but does not suspend the collection unless the operator presses the pause button prior to utilizing the HIDE button.

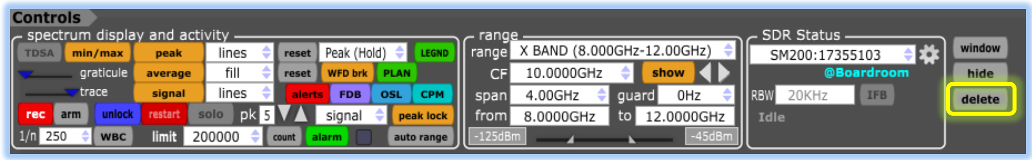
This feature allows the technical operator to display or hide any number of spectral windows that are actively collecting spectral and waterfall data in the background, while the technical operator monitors other specific windows of interest.

Delete Button

When the technical operator has opened a one (1) or more new spectrum bands or ROI, a new window tab is created for each of the specified bands or ROI.

Subsequently, the software automatically creates the necessary project management file structure within the Kestrel Project File (KPF) structure.

The | DELETE | spectrum button allows the technical operator to permanently remove all data for the affected spectrum window after displaying a pop-up warning.



Delete Spectrum Band Control | v1.37xx

This process will also result in the loss of all data associated with the deleted spectrum window.

The operator will be warned that deleting a spectral window TAB will result in the permanent loss of data.

This feature is useful, when the operator opens a new spectrum window for perhaps analysis, during a runtime session, but does not require the data for reports, or for saving as part of the Kestrel Project File (KPF) ^{TM} structure.

Deleting unwanted bands is a security feature, as well as providing the ability to significantly reduce the storage footprint.

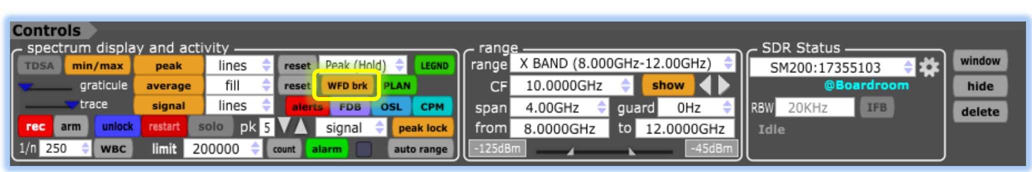
After a spectral window is deleted, the operator can utilize the | SPECTRUM | NEW SPECTRUM | on the MENU to create a new search range or recreate a previously deleted ROI with a new project file structure.

Show WFD Breaks | Button

When the technical operator pauses, restarts, or utilizes the spectrum “hand-off” feature, there will be invisible time line gaps that occur within the Waterfall Display (WFD).

It is important to know where these gaps are within the WFD when there has been any interruption of continuous data collection.

Pressing the BREAKS button places a horizontal marker line at each data collection interruption point and displays this marker as an overlay on the WFD.



WFD Breaks Control | v1.37xx

Pressing the Show WFD Breaks button a second time hides the horizontal marker line overlay from view.

This feature allows the technical operator to quickly determine where collection breaks have occurred without hunting for date and time stamp gaps.

Solo (RTE) Button

When the operator is running more than one (1) active spectral band window; all windows form part of the overall sweep collective.

Each open spectral window adds to the overall sweep time as part of the collective as can be observed in the following chart.

Sweep Time Collective Chart (SA Series)		
Display Tag	**Range of Interest (ROI)**	**Average Sweep Time (Sec)**
TSB 1500	0 Hz to 1500 MHz	10.6 (Sec)
HF	3 MHz to 300 MHz	0.6 (Sec)
50 MHz - 100 MHz	50 MHz to 100 MHz	0.6 (Sec)
GSM 1900 DL	1930 MHz to 1990 MHz	0.8 (Sec)
FM	87.5 MHz to 108 MHz	0.5 (Sec)
	Total Sweep Time	**13.1 (Sec)**

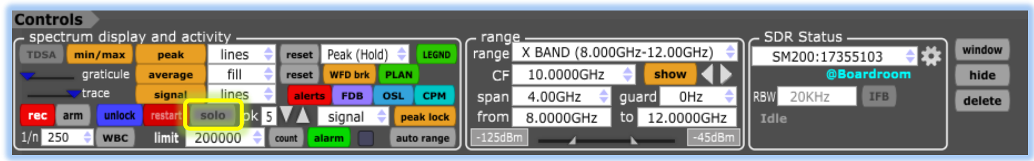
Sweep Time Collective Chart | v1.38xx

When the technical operator has opened a new spectral window, consisting of a spectral profile, Range of Interest (ROI) or a zoomed overlap potion of a currently established and sweeping ROI (open as new band), the new spectral window becomes an independent and separate collection process.

The secondary, (independent) window is not updated during the sweep of the original window, even if frequency overlap occurs, but rather updates in sequence as part of the collective.

Each independent spectral window is scheduled for sweep as part of the overall collective and will sweep in the order in which each window was opened or established by the technical operator.

Pressing the SOLO (RTE) button temporarily pauses and locks out all other spectral windows with the exception of the window for which the SOLO (RTE) button is enabled.



SOLO Band Control | v1.37xx

The active sweep sequence will continue and complete the current sweep cycle for each active spectral window.

Once the current sweep sequence is complete, the SOLO (RTE) window will now have uninterrupted priority and update continuously giving 100% of the computer processing resources to a single spectral window as selected by the technical operator.

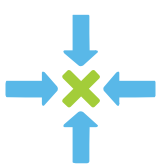
Pressing the SOLO (RTE) button on another widow, other than the current SOLO (RTE) window, will cause priority to shift to the new operator selected spectral window.

This important feature allows the technical operator to shift real-time priority to a specific Range of the Interest (ROI) when a spectral event is observed or otherwise identified during deployment.

As can be observed with the example sweep time collective chart, the total average sweep time is 13.1 seconds.

In reality, this time may actually be longer when the threat analysis algorithm is also active.

If the technical operator observes a spectral event within the FM band, pressing the SOLO (RTE) button for this spectral window will result in an average sweep time of 0.5 seconds rather than 13.1 seconds.



TIP: Collection is suspended for all other spectral windows until the technical operator presses the SOLO (RTE) button a second time releasing the priority and returning to the original sweep pattern and including all active spectral windows, or the SOLO (RTE) button is pressed on another spectral window.

When the SOLO (RTE) is active for any specific spectral window, all other spectral windows are basically paused and the SOLO (RTE) button will display ORANGE indicating that the technical operator has enabled SOLO (RTE) on another spectral window.

Pressing the SOLO (RTE) button on another spectral window will release SOLO (RTE) on the original window and give priority to the new window as selected by the technical operator.

If the technical operator selects another spectral tab while SOLO mode is active on another band tab, the SOLO button will blink on all other tabs, while active.

Open Range as New Band (SOLO)

There is yet another unique feature that allows the technical operator to immediately open the currently displayed (zoom) level Range of Interest (ROI) as a new band with automatic (SOLO) priority.

The new band (SOLO) priority feature is co-located and accessed with a right mouse click within the RSD window and displays a pop-up dialog box that allows the technical operator to either save an image in (.PNG) format or open the currently displayed (zoom) Range of Interest (ROI) as a new band with immediate (SOLO) priority.

This feature utilizes a fast acquisition mode when the Range of Interest (ROI) is limited to the signal event level and provides the ability to capture and analysis pulsed signal events more effectively in near-real time.

TIP: The Dynamic Alert Annunciator (DAA) does not run during SOLO mode operation and will automatically pause whenever SOLO mode is active. The DAA will resume normal runtime operation once SOLO mode is terminated.

SOLO Mode | Limit Button

During normal mode runtime, the | TRACE LIMIT | value defined by the technical operator will inhibit runtime when the trace limit value is realized stopping runtime collection for the present location.

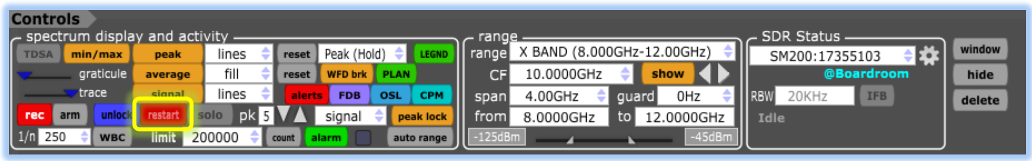
The | TRACE LIMIT | functionality will also track the defined limiting value, unless the technical operator selects the | -LIMIT | button to override the defined runtime limiting value permitting the | SOLO MODE | to remain as the priority override band. By design the | SOLO (PRIORITY) MODE | is analytical in nature and therefore tracking the defined | TRACE LIMIT | value is counter-productive.

Pause / Restart Button

The |PAUSE | RESTART | combination button serves a number of important operational functions and is used to pause the current active and displayed spectral window.

The pause / restart function is independently applied to each open spectral window.

The data collection function is suspended from the collective sweep and the threat analysis algorithm when pause is active for any given spectral window.



PAUSE | RESTART Control | v1.37xx

Pressing the PAUSE / RESTART button activates any window previously paused by the technical operator.

The PAUSE / RESTART button is utilized as part of the Differential Signal Analysis (DSA) functionality.

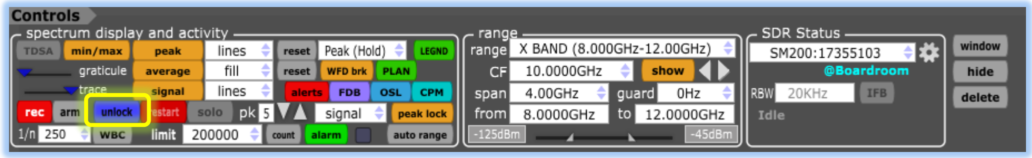
DSA Trace Lock | Button

The Differential Signal Analysis (DSA) ™ functionality is a complex and integral module of the Kestrel TSCM ® Professional Software.

The Kestrel TSCM ® Professional Software utilizes a sophisticated DSA algorithm that requires only minimal control input from the technical operator, making the DSA module a very powerful TSCM specific tool that in the past was found on virtually every spectral analyzer on the market during the past 30 years referred to as trace math.

From a function standpoint, the DSA feature is easy to use and technical operator work flow oriented.

The | DSA ™ | LOCK | button is utilized to | LOCK | the | PEAK | spectral data for each | DSA ™ | location preventing the corruption of comparative spectral data while moving to another collection location.

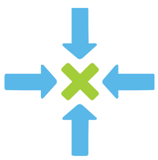


BAND TRACE LOCK Control | v1.37xx

Once the desired number of sweeps has been completed for any given location, the technical operator presses the LOCK button before moving to the next DSA location.

The operator may manually | UNLOCK | the spectral trace if desired and collect additional spectral data at the same location.

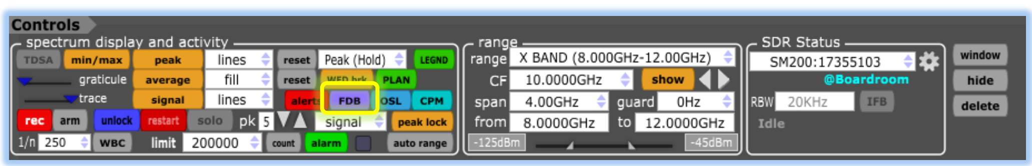
It is necessary to press the | PAUSE / RESTART | button to resume collection for the unlocked spectral trace.



TIP: It is important to note that the collected peak trace data will be corrupted should the technical operator restart the data collection in a location other than that of the original collection location. Always confirm your intention when unlocking a band.

Frequency Database (FDB) | Button

The FDB button toggles the Frequency Database (FDB) display marker overlay to be visible on the Graticule when one (1) or more FDB files are loaded.

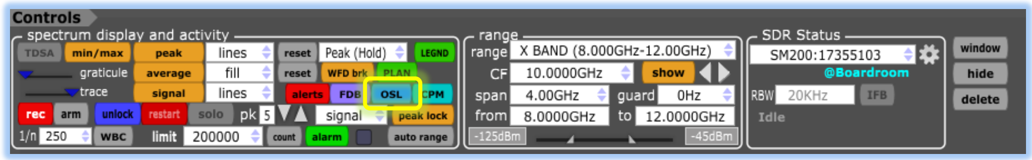


Display FDB Control | v1.37xx

The technical operator may select and load FDB ™ files from the | ASID | LOAD FDB | menu.

Operator Signal List (OSL) ™ | Button

The OSL ™ button toggles the Operator Signal List (OSL) ™ spectral marker flags on the Graticule.



Controls | v1.37xx

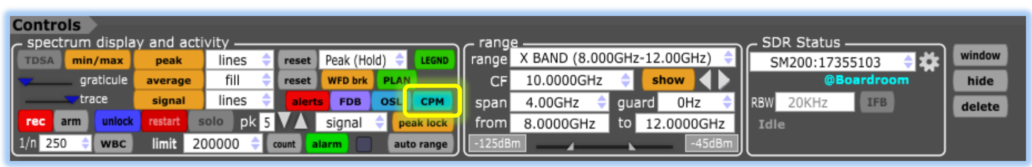
The Operator Signal List (OSL) ™ is a component of the Advanced Signal Intelligence Database (ASID) ™.

All OSL ™ signal events are recorded on the sidebar control group (ATL) and the Master Automatic Threat List (ATL) ™.

OSL ™ signal events span multiple Kestrel Project Files (KPF) ™ and are available for display and review against historical and future projects.

Channel Profile Mask (CPM) ™ | Button

The Channel Profile Mask (CPM) ™ button provides the ability to toggle the CPM ™ display on the Graticule.

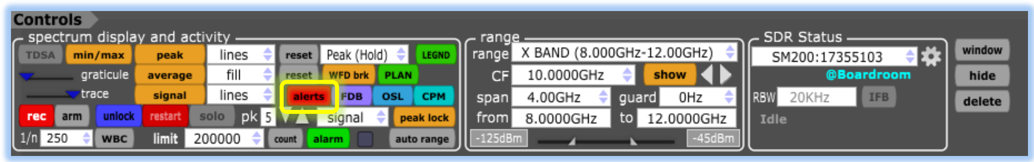


CPM ™ Control | v1.37xx

The ability to custom build, define, create, edit and delete any number of Channel Profile Masks (CPM) ™ is fully supported and may be accessed from the | SPECTRUM | CHANNEL PROFILE MASK EDITOR | menu.

Alert Zones Display | Button

The Dynamic Alert Annunciator (DAA) ™ provides the ability to toggle operator defined alert zone overlay on the spectrum display.



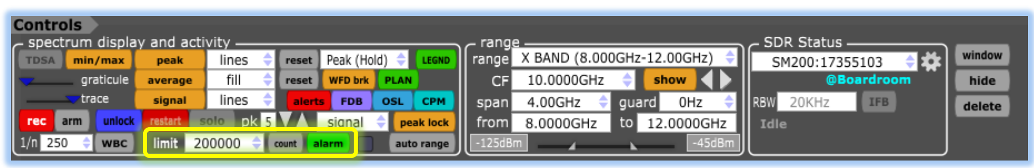
ALERTS Display Control | v1.37xx

By default, all alert zones are displayed as they are defined by the technical operator, pressing the | ALERTS | button will hide the alert zones.

Pressing the | ALERTS | button a second time will invoke all alert zones to display.

Trace (Limit | Count) | Control

The application is built on advanced file write management principles that include active scheduling across all receiver and all spectrum bands, file write compression, and both trace and time-based runtime and compression limiting.



ALERTS Display Control | v1.37xx

When the operator has deployed the software in a Location Differential Signal Analysis (LDSA) ™ mode, the trace and time limiting allows the operator to program a maximum | TRACE COUNT | for each location.

In the event that the operator has a specified time-on-target, the | TRACE TIME | mode can be utilized.

For example, if the operator has 4 hours on target (240 minutes) and has selected or defined < 8 > active collection locations within the target area, this allow the operator to collect for 30 minutes at each location.

Using the | TRACE TIME | method allows for easy calculation of workload within the specified time available.

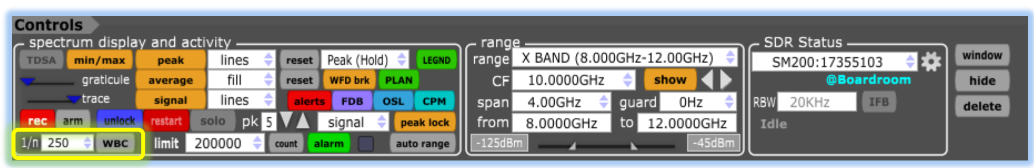
When time is not a factor, the technical operator can use the | TRACE COUNT | mode to maximize the number of traces captured for each active collection location.

The trace limit | ALARM | notifies the technical operator at the completion of the | TRACE COUNT | or | TRACE TIME | who is free to complete other phases of the inspection when the system is actively collecting, and immediately alerted to completion at the current location and move the platform to the next operational location.

File Write Management | Control

The Kestrel TSCM ® Professional Software utilizes a highly advanced file write compression capability to provide extended collection times of days, weeks or months, when deployed as a Remote Spectrum Monitoring and Surveillance (RSSM) ™ platform.

This capability allows all signal events to be captured at virtually any realistic decimation rate to control the (time Vs storage) and significantly reduce the amount of analytical data that must eventually be reviewed by the technical operator or analyst.



DATA COMPRESSION Control | v1.37xx

When the technical operator has deployed the software for an extended period of time, an operator defined compression rate expressed as < 1/n=? > such as < 1/n=100 > indicates the capture data will be < 100x > smaller than < 1/n=1 > or real-time, collecting all data without compression.

There will be a small-time disparity that will increase with decimation rate, however, all peak data is captured and written to storage.

Analytical trace data is limited to the actual written to storage data, so if a compression rate of < 250 > is selected by the operator as illustrated in the above image, there will be < 1 > Kestrel Super Trace (KST) ™ for each < 249 > real time traces, which are discarded and not available for analytical playback.

With new technology radios, such as the Signal Hound (SM200A) Spectrum Monitoring receiver, with speeds in the < 1 THz > range, make the Kestrel ® file write management capability and essential resource.

Since the waterfall display is a real-time trace level display, 100% of the data is displayed as long as the WFD buffer permits.

Pressing the | WBC | button, removes all unsaved data and show the spectrum at the Kestrel Super Trace (KST) ™ level.

Signal Hound SM200A | Sweep Speed vs Probability of Intercept (POI)

Range of Interest (ROI)		Sweep Speed (mSec)	Sweep Frames (Sec)	Sweep Speed GHz (Sec)	Estimated 100% POI (mSec)	SM200A Radio Mode	Kestrel SOLO Mode	Selected RBW (kHz)	Derived RBW (kHz)
20 GHz		92	10.9	221.2	89.48	Normal	Disabled	20	---
20 GHz		81	12.4	248.9	80.57	Normal	Enabled	20	---
20 GHz		24	40.7	817.5	24.59	Fast	Disabled	20	30.8
20 GHz		17	57.6	1152.3	17.37	Fast	Enabled	20	30.8

Signal Hound SM200A | Write Compression Event Time Resolution (Uncertainty)

Time (1/n=25) Resolution (Sec)	Time (1/n=50) Resolution (Sec)	Time (1/n=100) Resolution (Sec)	Time (1/n=250) Resolution (Sec)	Time (1/n=500) Resolution (Sec)	Time (1/n=750) Resolution (Sec)	Time (1/n=1000) Resolution (Sec)	Time (1/n=2500) Resolution (Sec)
2.3	4.6	9.2	23	46	69	92	230
2.025	4.05	8.1	20.25	40.5	60.75	81	202.5
0.6	1.2	2.4	6	12	18	24	60
0.425	0.85	1.7	4.25	8.5	12.75	17	40.5

Probability of Intercept (POI) | Write Compression Time Resolution | v1.39xx

Compression Time Resolution (Uncertainty)

When the Kestrel TSCM ® Professional Software advanced write management compression is utilized during both operator assisted and extended runtime deployment within a managed Remote Spectrum Surveillance and Monitoring (RSSM) ™ role, there is an apparent event time discrepancy which results in the inability of the technical operator to resolve the precise time of any particular Signal of Interest (SOI) event from approximately < 425 mSec @ 1/n=25 > to < 3.83 minutes @ 1/n=2500 >.

This process results in write file sizes between < 25 > and < 2500 > times smaller in storage footprint and significantly reduces active memory allocation, processor loading and write storage requirements.

This advanced compression technique provides tremendous runtime advantages against a minor time discrepancy in resolving the precise event time to a block time period equal to the < 1/n=? > value selected.

Any write compression value from < 1/n=1 > (Real-Time) to < 1/n=10000 > (Maximum Compression) can be selected by the technical operator based on mission specific deployment parameters.

Signal Hound SM200A | Write Compression Event Time Resolution (Uncertainty)	
Time (1/n=5000) Resolution (Sec)	**Time (1/10000) Resolution (Sec)**
460 Sec | 7 Min 40 Sec	920 Sec | 15 Min 20 Sec
405 Sec | 6 Min 45 Sec	810 Sec | 13 Min 30 Sec
120 Sec | 2 Min	240 Sec | 4 Min
85 Sec | 1 Min 25 Sec	170 Sec | 2 Min 50 Sec

Write Compression Event Time Resolution | v1.39xx

Kestrel Super Trace (KST) ™

Time resolution is resolved by the date | time stamp of the relevant Kestrel Super Trace (KST) ™ containing all captured peak trace events from < 1> to < 10,000 > normal real-time sweeps.

For example, < 1/n=50 > represents a runtime capture of < 49 > normal runtime traces that are compressed and written to trace < 50 >.

Trace < 50 > represents a Kestrel Super Trace (KST) ™ containing all combined Peak Envelope Capture (PEC) ™ and written to the KST ™ referenced by a unique < date | time > stamp, containing all peak data within the operator defined time resolution.

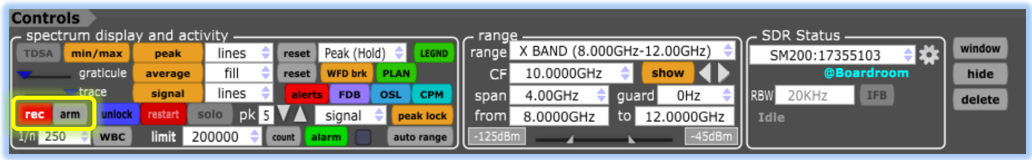
Record | Armed Record | Control

The Kestrel TSCM ® Professional Software supports automatic recording of all data to storage by default.

In simple terms it is (almost) idiot proof from an operator perspective!

All default settings are record all data unless the operator disables the record mechanism during the setup or runtime process.

The | REC | ARM | buttons keep this process simple.



DATA COMPRESSION and WRITE MANAGEMENT Control | v1.37xx

When the technical operator disables the | REC | button for any particular spectrum band, no data is recorded to storage.

In this mode, the software acts like a basic spectrum analyzer in which what you see is what you get, and when you cannot see it, or the data is no longer in the buffer, that is it, no data is recorded for that particular band, no data available for analytical process, and no data available for playback or review.

Well to the 1980's!

There is also one additional mode setting that can control the file write process and is supported by the threat alerting detection system.

The | ARM | mode when selected invokes the alerting process where an alert such as the | Minimum Detection Amplitude (MDA) ™ | exceedance, causes the software to record the < event + duration > as a recorded event.

Essentially, when the | ARM | mode is selected, an alert invokes the | REC | process to enable.

This is a powerful tool to record only events of interest across each independent spectrum band or radio.

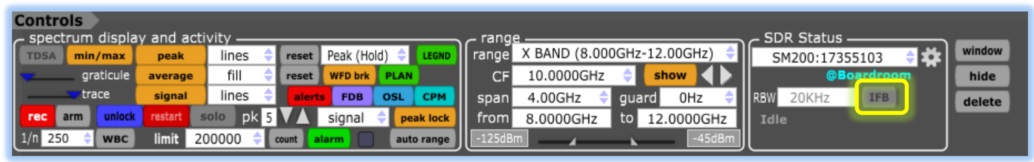
IF Broadband (IFB) ™ | Control

The Kestrel TSCM ® Professional Software supports yet another extremely powerful feature referred to as | IFB | within the Kestrel ® architecture.

The | IFB | mode is essentially a zero span, demodulator running mode that operate within the hardware real-time bandwidth from 240 kHz to 160 MHz depending the radio.

This powerful mode has several applications such as the instantaneous capture of IQ samples by elimination of the lag time in detection, switching to demodulation and starting the IQ recording process on a triggered event being the primary benefit.

Operation in | IFB | mode, provides the means of targeting Signals of Interest (SOI) at the a much-reduced operational Range of Interest (ROI) and significantly narrower Resolution Bandwidths (RBW).



IFB Control | v1.37xx

When the technical operator wishes to invoke the | IFB | mode, the current | ROI | must be no more than the maximum real-time bandwidth of the hardware.

For example, on the Signal Hound (BB60C) the maximum real-time bandwidth is 27 MHz and therefore the | IFB | mode will be locked out if the current bandwidth is greater than 27 MHz.

The technical operator can zoom in on the display to a SPAN of less than 27 MHz and utilize the < open range as new band SOLO > and activate the | IFB | mode.

This results in the approximately a sweep rate of 9 mSec, 120 FPS or 2.33 GHz/Second in SOLO sweep mode.

In this case enabling the | IFB | mode, results in a real-time display of the, in this case the operator selected 19.97 MHz SPAN running at 610 Hz RBW.

When combined with the targeted alerting, this provides as close to 100% intercept as is possible.

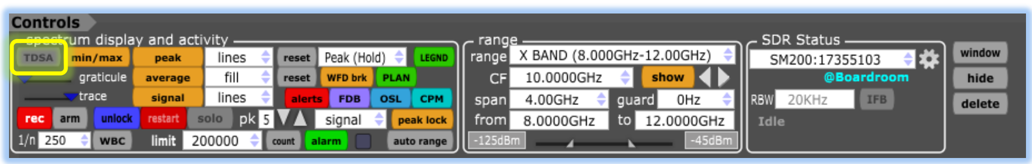
TDSA ™ | Button

Within the Time Differential Signal Analysis (TDSA) ™ Architecture the ability to produce a time periodic peak trace is supported.

The | TDSA ™ | button can be enabled when operating within the | TDSA ™ | mode to produce and display a secondary peak trace that displays all peak data set, or the current | TDSA ™ | PERIOD | as defined by the technical operator.

For example, the operator might define the | PERIOD | as < 30 Minutes > which translates into a MAX PEAK build and hold for < 30 minutes > allowing the technical operator to view a current state of signal and band level activity for the | PERIOD |.

At the end of the | PERIOD | a new | TDSA ™ ICON | is produced and displayed in the | DSA ™ | control group for direct comparative with other time derived time | PERIOD | and the peak trace | RESETS | automatically and begins the MAX PEAK build and hold for the next < 30 minute > | PERIOD |.



TDSA Button | v1.37xx

Unless the | TDSA ™ | feature is enabled and active the | TDSA ™ | button is disabled and cannot be selected.

Default Control Settings (DCS)

The various Default Control Settings (DCS) found throughout the Kestrel TSCM ® Professional Software have been specifically lab and field tested to provide an excellent starting point for most typical deployment setup requirements.

As the technical operator gains valuable training and experience and develops a better understanding of the Kestrel TSCM ® Professional Software capability and limitations, we strongly recommend experimentation with the various setup configurations available to maximize the overall effectiveness and ability of the Kestrel TSCM ® Professional Software.

Results will vary significantly depending on the parameters that the technical operator has selected during the initial setup process, based on technical operator experience.

Signal Hound Configuration (USB-SA44B)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the USB-SA44B search receiver as co-located with the | ACQUISITION | ANALYZER CONTROL | SIGNAL HOUND CONFIGURATION | control group.

Signal Hound Configuration (USB-SA44B)			
Control	**Default**	**Option Range**	**Recommended**
Attenuation	**10 dB**	0 dB, 5 dB, 10 dB, 15 dB	0 dB, 5 dB
Low-Noise Amplifier (LNA)	**0 dB**	0 dB, 10 dB	10 dB
IF Sensitivity	**Low**	Low, Medium, High	High, Medium
Image Rejection	**ON**	ON, HS Inject, LS Inject, OFF	ON

SH Defaults | v1.38xx

Signal Hound Configuration (USB-SA124B)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the USB-SA124A/B search receiver as co-located with the | ACQUISITION |ANALYZER CONTROL | SIGNAL HOUND CONFIGURATION | control group.

Signal Hound Configuration (USB-SA124B)			
Control	**Default**	**Option Range**	**Recommended**
Attenuation	**10 dB**	0 dB, 10 dB, 20 dB, 30 dB	0 dB
Low-Noise Amplifier (LNA)	**ON**	The LNA is not switchable on the (USB-SA124A/B) receiver	---
IF Sensitivity	**Low**	Low, Medium, High	High, Medium
Image Rejection	**ON**	ON, HS Inject, LS Inject, OFF	ON

SH Defaults | v1.38xx

Signal Hound Configuration (BB60C)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the BB60C Spectrum Analyzer and RF Reorder as co-located with the | ACQUISITION |ANALYZER CONTROL | SIGNAL HOUND CONFIGURATION | control group.

Signal Hound Configuration (BB60C)			
Control	**Default**	**Option Range**	**Recommended**
Gain Type	**Medium Gain**	Auto, No Gain, Low Gain, Medium Gain, High Gain	Low Gain, or Medium Gain
Auto Gain Reference (Gain Type = Auto)	**-60 dBm**	0 dBm, -10 dBm, -20 dBm, -30 dBm, -40 dBm, -50 dBm, -60 dBm, -70 dBm, -80 dBm	-60 dBm (Only active on AUTO Mode)
Attenuation	**0 dB**	Auto, 0 dB 10 dB, 20 dB, 30 dB	0 dB, 10 dB, or as required
Sweep Time (mSec)	**1 mSec**	1 mSec, 2 mSec, 5 mSec, 10 mSec, 20 mSec, 50 mSec, 100 mSec	1 mSec
Spur Rejection	**None**	None, ON	None, 24 GHz / second, or ON, 12 GHz / second
Window	**Nutall**	Nutall, Blackman, Hamming, Flat Top, Flat Top (EMC) 9 kHz, Flat Top (EMC) 120 kHz	Nutall, or Hamming

SH (BB60C) Defaults | v1.39xx

Signal Hound Configuration (SM200A/B/C)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the SM200A/B/C Spectrum Monitoring Receiver as co-located with the | ACQUISITION |ANALYZER CONTROL | SIGNAL HOUND CONFIGURATION | control group.

Signal Hound Configuration (SM200A/B/C)			
Control	**Default**	**Option Range**	**Recommended**
Pre-Selector	**Disabled**	Enabled, Disabled	Enabled
Reference Level (Auto Attenuation)	**-60 dBm**	0 dBm, -10 dBm, -20 dBm, -30 dBm, -40 dBm, -50 dBm, -60 dBm, -70 dBm, -80 dBm	-30 dBm (Only active on AUTO Attenuation)
Attenuation	**Auto**	Auto, 0 dB 10 dB, 20 dB, 30 dB	0 dB, 10 dB, as required
Sweep Speed (mSec)	**Normal**	Auto, Normal, Fast	Fast
Spur Rejection	**Disabled**	Enabled, Disabled	
Window	**Nutall**	Flat Top, Nutall, Blackman, Hamming, Gaussian 6dB	Nutall

SH (SM200A) Defaults | v1.40xx

TIP: The factory default settings are not necessarily ideal for TSCM oriented deployment and the technical operator is strongly advised to review the current (default) settings when a new search receiver is connected for the first time and during the initial setup process.

Sidebar Control Group

The following table summarizes the Kestrel TSCM ® Professional Software, Default Control Settings (DCS) for the various features and functionality, co-located on the sidebar control group.

Most of the key technical operator features and runtime functionality can be directly accessed from the sidebar control group without the need to navigate to layers of sub-menus.

Our | Software Development Group (SDG) ™ | has integrated a wide range of status display (situational awareness) elements on the sidebar control group, allowing the technical operator to see exactly what is occurring during the runtime collection process.

Graphical User Interface (GUI) Sidebar Control Group			
Control	**Default**	**Option Range**	**Recommended**
Chirp Threat Mode (CTM)	**Disabled**	Disabled / Active	Active
Harmonic Signature Threshold (HST)	**Disabled**	CTM / HST	CTM Mode
2nd HARM	**-35 dBc**	-50 dBc to 0 dBc	-30 dBm
3rd HARM	**-45 dBc**	-50 dBc to 0 dBc	-40 dBm
Above ANF	**10 dB**	3 dB to 20 dB	15 dB ANF
Minimum Detection Amplitude (MDA)	**Disabled**	Disabled / Active	Active
MDA (Display Limit Line)	**Hidden**	Hidden / Display	Display
MDA (Detection Level) Absolute	**-40 dBm**	-140 dBm to 0 dBm	Set (15 to 20 dB) above the noise floor
MDA (Detection Level) Relative	**10 dB**	10 dB to 80 dB	Set based on A-ANF averaging setting *****
Signal Combining Technology (SCT)	**20 kHz**	-50 kHz to 100 kHz	15 kHz to 25 kHz
Spectrum Baseline Logging (SBL)	**Disabled**	Disabled / Active	Use as a standalone signal logging tool
Above ANF	**15 dB**	3 dB to 40 dB	15 dB to 25 dB
ANF	**Hide**	Hide / Show	Displays ANF Level
*** Ambient Noise Floor (ANF) Smoothing (Averaging)**	**1 MHz**	100 kHz to 100 MHz	Lower = Less Sensitivity Higher = Increased Sensitivity

Side Bar Menu Defaults | v1.39xx

Analyzer Control Group

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Analyzer Control group.

Analyzer Control Group - Table Column (Options and Defaults)			
Function	**Description**	**Option Range**	**Default**
Name (click to configure)	Device Friendly Name and Configuration	Default or Custom Friendly Name	**Show Default Name**
Type	Receiver Type (Model Number)	---	**Default (Locked)**
Location	RDSA ™ (Location Programming)	Defines Independent Receiver Locations	**Undefined**
SN	Receiver (Serial Number)	---	**Default (Locked)**
License	Activation Security Key (ASK)	Not Loaded, 1, 3, 7, 10, 30, 60 days, 1, 3, 6, 12, 24 months, Indefinite	**Not Loaded (ASK Required)**
Port	Communication Port	USB; LAN	**Device Dependent**
Connected	Connection Status	"---" (Not Connected) Yes (Connected)	**"---" (Not Connected)**
Spectrum	Receiver Available for Spectrum (Sweep)	"---" (Not Assigned) Yes (Assigned)	**"---" (Not Assigned)**
Demodulate	Receiver Available for (Demodulation)	"---" (Not Assigned) Yes (Assigned)	**"---" (Not Assigned)**
Analysis	Receiver Available for (Analysis)	"---" (Not Assigned) Yes (Assigned)	**"---" (Not Assigned)**

TIP: The Analyzer Control Group displays automatically when the application is first started; to allow the technical operator to review, adjust and confirm the setting for each connected search receiver or analyzer.

Network Addresses (TCP/IP)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Network Addresses control group.

Depending on the specific search receiver or analyzer connectivity options, it may be possible to connect some supported devices using TCP / IP rather than a High-Speed USB 2.0 port for direct communication with the software.

Utilizing multiple search receivers or analyzers simultaneously across both LAN and USB ports is fully supported and provides real-time direct "hand-off" capability of both the spectrum and demodulation runtime processes.

Network Addresses (TCP / IP) - Table Column (Options and Defaults)		
Type	Type (Model Number)	**Default (Locked)**
Address	Dynamic IP Address	**Default (Show)**
Comments	Operator Defined Comment (Optional)	**Default (Show)**

Network Addresses | v1.39xx

New Project (Antenna Locations)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the New Project (Antenna Locations) dialog window.

The technical operator can right mouse click on table header to expose table column display options.

New Project (Antenna Locations) | Table Column (Options and Defaults)		
Name	Operator Defined Antenna Location	**Default (Locked)**
Latitude	GPS Capture or Operator Defined	**Default (0.0000S)**
Longitude	GPS Capture or Operator Defined	**Default (0.0000W)**

Setup Wizard (Antenna Locations) | v1.39xx

Locations List (Antenna Locations)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Location (Location List | Project Locations) dialog window.

Locations List (New Location) | Table Column (Options and Defaults)		
Name	Operator Defined Antenna Location	**Default (Locked)**
Latitude	GPS Capture or Operator Defined	**Default (0.0000S)**
Longitude	GPS Capture or Operator Defined	**Default (0.0000W)**

Location List | v1.39xx

Floor Plan (Antenna Locations)

The following summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Floor Plan (Antenna Locations) control group.

Floor Plan (Antenna Locations) | Table Column (Options and Defaults)		
Name	Operator Defined Antenna Location	**Default (Locked)**
Latitude	GPS Capture or Operator Defined	**Default (0.0000S)**
Longitude	GPS Capture or Operator Defined	**Default (0.0000W)**

Floor Plan (Antenna Locations) | v1.39xx

Sidebar Automatic Threat List (ATL)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Sidebar Automatic Threat List (ATL) control group.

Sidebar Automatic Threat List (ATL) | Table Column (Options and Defaults)		
ID	Signal Database Reference ID	**Default (Locked)**
Harm	Signal Type (Fundamental or Harmonic)	**Default (Hide)**
dBc	Level (dBc)	**Default (Hide)**
dB ANF	Level (dB) Ambient Noise Floor	**Default (Hide)**
Frequency	Frequency (Hz) (kHz) (MHz) (GHz)	**Default (Show)**
Level	Signal Amplitude (dBm)	**Default (Show)**

Side Bar ATL | v1.39xx

Master Automatic Threat List (MATL)

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality co-located on the Master Automatic Threat List (ATL) control group.

Master Automatic Threat List (ATL) | Table Column (Options and Defaults)		
ID	Signal Database Reference ID	**Default (Locked)**
Harm	Signal Type (Fundamental or Harmonic)	**Default (Show)**
Frequency	Frequency (Hz) (kHz) (MHz) (GHz)	**Default (Show)**
Level	Signal Amplitude (dBm)	**Default (Show)**
BW	Instantaneous Bandwidth (Captured)	**Default (Show)**
dBc	Level (dBc)	**Default (Hide)**
dB ANF	Level (dB) Ambient Noise Floor	**Default (Hide)**
Detected	Date and Time Signal Event Detected	**Default (Show)**
Location	Antenna Location of Detected Signal	**Default (Show)**
Mod. Time		**Default (Hide)**
Mod. Location		**Default (Hide)**
Identity	Operator Defined Identity	**Default (Show)**
Notes	Operator Defined Notes	**Default (Show)**

Master ATL | v1.39xx

Global Settings vs Independent Settings

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) ™ for the various features and functionality that may have global Vs independent implications during deployment.

Global Vs Independent Settings Chart		
Function	**Description**	**Location**
Ambient Noise Floor (ANF)	Global across all active Spectrum Band tabs and search receivers	Sidebar Control Group
Chirp Threat Mode (CTM)	Global across all active Spectrum Band tabs and search receivers	Sidebar Control Group
Harmonic Signature Threshold (HST)	Global across all active Spectrum Band tabs and search receivers	Sidebar Control Group
Minimum Detection Amplitude (MDA)	Global across all active Spectrum Band tabs and search receivers	Sidebar Control Group
Spectrum Baseline Logging (SBL)	Global across all active Spectrum Band tabs and search receivers	Sidebar Control Group
Graticule Control (Dimmer)	Global across all active Spectrum Band tabs and search receivers	Spectrum Display and Activity (Controls TAB)
Trace Control (Dimmer)	Global across all active Spectrum Band tabs and search receivers	Spectrum Display and Activity (Controls TAB)
Centre Frequency (CF) Marker Line	Global across all active Spectrum Band tabs and search receivers	Horizontal Range (Controls TAB)
Resolution Bandwidth (RBW)	Independent across all Spectrum Band allocations; spectrum window tabs; and search receivers	SDR Status (Controls TAB)
Peak, Average, Signal Trace Control	Independent across all Spectrum Band allocations; spectrum window tabs; and search receivers	Spectrum Display and Activity (Controls TAB)

Master ATL | v1.39xx

The following table summarizes the Kestrel TSCM ® Professional Software Default Control Settings (DCS) for the various features and functionality that may have global Vs independent implications during deployment.

Global Vs Independent Settings Chart		
Function	**Description**	**Location**
SOLO Band (Priority)	Global across all active Spectrum Band tabs and is search receiver independent	Spectrum Display and Activity (Control Tab)
Frequency Database (FDB)	Independent for each Spectrum Band	Spectrum Display and Activity (Control Tab)
Operator Signal List (OSL)	Independent for each Spectrum Band	Spectrum Display and Activity (Control Tab)
Channel Profile Mask (CPM)	Independent for each Spectrum Band	Spectrum Display and Activity (Control Tab)
Spectral Profiles (SPF)	Global across all search receivers and analyzers	Spectrum Menu Structure

Controls Tab | v1.39xx

The OSL ™ and FDB ™ setup are located within the ASID ™ menu structure, and the Channel Profile Mask (CPM) ™ setup is located within the SPECTRUM menu structure.

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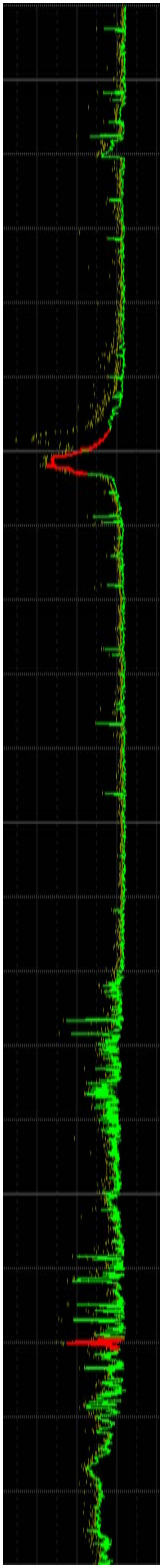
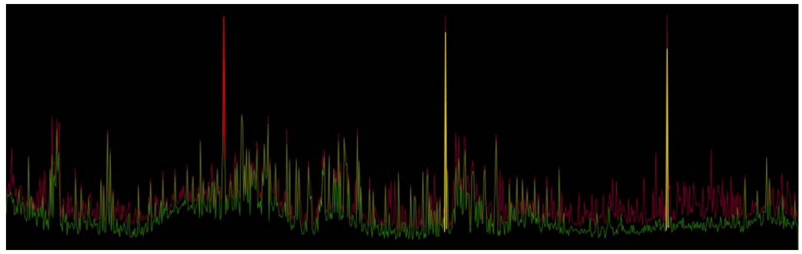


Chapter 6

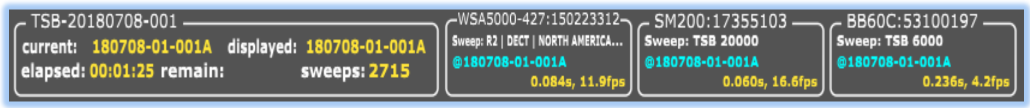
Status Display Group

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Status Display

Our innovative user interface (UI) status display group provides the technical operator with valuable information as to the current state and operational status and state of the Kestrel TSCM ® Professional Software.



Status Display Group | v1.37xx

At first glance the various status display groups might seem a little intimidating or even confusing to new technical operators, however, once the basic principles and tremendous advantages of combined and co-located status displays is realized, the technical operator will quickly develop a sense of total situational awareness.

The technical operator will soon understand that many of the status display windows are operationally and context sensitive, dynamically update, display combined control status elements, all depending on the current operation or software state.

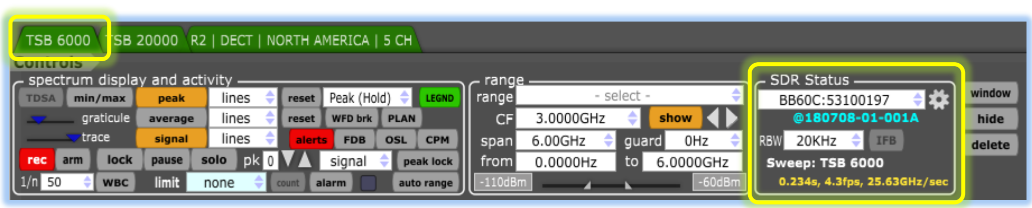
Context sensitive visual feedback provides a strong element of situational awareness for the technical operator.

This is of particular importance during unattended remote monitoring assignments.

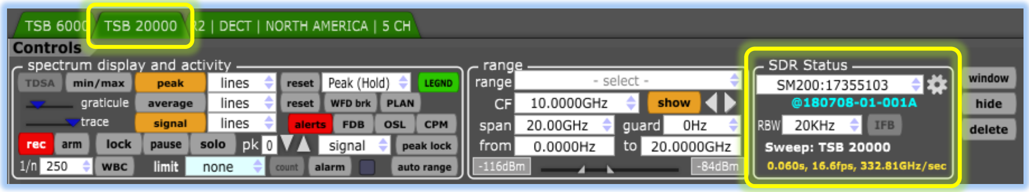
Many of the status displays are contextually dynamic in nature.

SDR Status Display

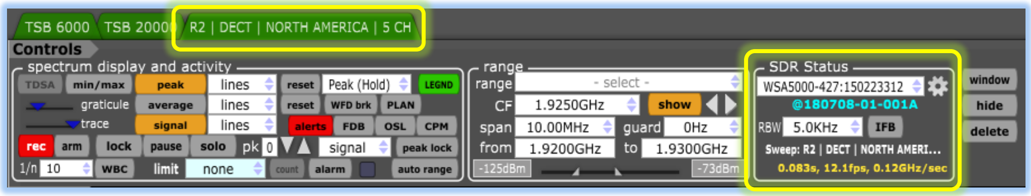
There is a primary SDR status display that is dynamically linked to each of the currently displayed active Spectrum Bands or Spectrum Band Allocations located within the | Controls | TAB for each independent spectrum band.



SDR Status Display | v1.37xx



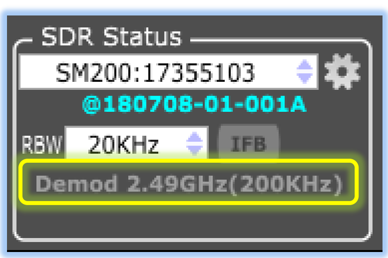
SDR Status Display | v1.37xx



SDR Status Display | v1.37xx

The SDR Status Display is a multiple use search receiver specific, visual STATUS display and provides dynamic spectrum "hand-off" capability as well as the ability to select or change the RBW setting.

The example below displays the SM200 during the demodulation process



SDR Status | v1.37xx

Status Display Group | v1.37xx

The status displays indicate that the TSB 20000 (100 kHz to 20 GHz) band is currently demodulating on the SM200 radio at a Resolution Bandwidth (RBW) of 20 kHz at a frequency of 2.4857 GHz with an IF bandwidth of 200 kHz.

All available search receivers and analyzers, available for dynamic “hand-off” of the spectrum are displayed in the SDR option list.

All legal value RBW settings appear in the RBW option list.

When the demodulation function is active on the same receiver assigned for spectrum, the sweep will pause during the demonulation process.

When spectrum and demodulation are accomplished on separate search radios, there is no interuption of the sweep or collection process.

Depending on the demodulation receiver status, entering a demodulation state may be delayed until the current sweep operation completes.

If the current operation is sweeping a narrow band, the process will occur very quickly, however, if handing off the demodulation process to a currently sweeping search receiver running a 10 GHz sweep, the process will take a longer period of time before the current sweep operation completes and demodulation becomes active with respect to slow sweep rate radios.

Sweep Status Display

The Sweep Status Display provides the technical operator with the Kestrel Project File (KPF) TM name of the working current project, the currently active collection Antenna Location and the currently displayed Antenna Location details.

Displaying a different | Antenna Location | for review or comparative analysis is fully supported without the need to interrupt collection at the current location.

Elapsed Sweep Time

The Elapsed sweep time and an estimated Total sweep time for the current ROI, provide useful visual feedback for the technical operator.

The Elapsed sweep and Total sweep time details are displayed for each successive active sweep window as part of the collective when multiple band allocations or Ranges of Interest (ROI) are active across several independent spectral windows.

Sweep Status Display | v1.37xx

The above example displays the current active Kestrel Project File (KPF) name (TSB-20180708-001), the current Antenna Location (180708-01-001A), the displayed Antenna Location (180708-01-001A), the elapsed time for the project (00:01:25) and as no remaining time is indicated and the technical operator knows that the project is running in Continuous Collection Mode (CCM) ™.

The total number of historical sweeps for the project is also displayed, this is the total number of sweeps of all currently running and paused spectrum bands assigned to this project.

Sweep Status Display | v1.37xx

The above image illustrates that the technical operator has programmed the | Activity Scheduler | for 1.0 hours as the | Total Duration | there is currently 00:25:29 hours remaining.

The | Progress Bar | is only displayed when a | Total Duration | is selected by the technical operator.

Sweep Status Display | v1.37xx

The above image demonstrates the ability of the software to display the current collection | Antenna Location | (180708-02-002A) and display historical trace data on the Graticule from another | Antenna Location | (180708-01-001A).

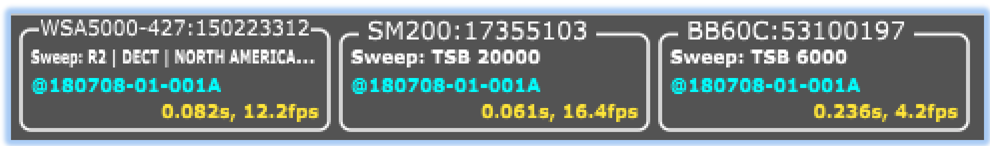
This simple | Antenna Location | file naming convention provides the Date (180708), the Floor or Level (02) and Room (001) and location within the room (A), designation is ideal when historical trace data from multiple Kestrel Project Files (KPF) ™ will be imported into a current project for comparative analysis.

Search Receiver Status (SRS)

Each connected and running search receiver or analyzer displays a separate status display process for that particular receiver and provides specific information at the receiver level.

The following image illustrates the Default receiver or analyzer name consisting of the Model Number and the Serial Number.

In non-RDSA operation, the software treats all bands and all radios as a single location even though the physical radios and or antennas may be remoted to another physical location.



Search Receiver Status | v1.37xx

Although it is possible to connect and operate any number of search receivers or analyzers, the UI only supports the display of the first four (4) receivers from a status perspective.

Demodulator Running + Frequency + IF BW

When the technical operator has activated the demodulator the Search Receiver Status will display “Demodulator Running”, the CF Frequency (MHz) and the IF Bandwidth (kHz) are displayed.

Search Receiver Demodulation Status | v1.37xx

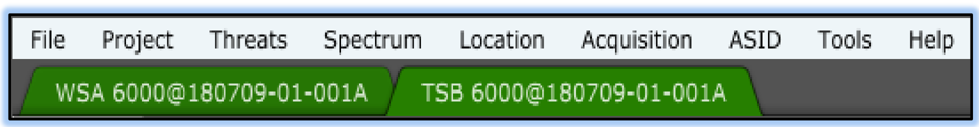
It is also possible to include an operator defined | FRIENDLY NAME | to replace the radio title annotation | RADIO MODEL: SERIAL NUMBER |.

RADIO (Friendly name) Status | v1.37xx

The friendly names are programmable from the | ANALYZER CONTROL | group | EDIT NAME | menu option.

Display ALL Locations Status | v1.37xx

To invoke the spectrum tabs to display the full band and location details for each band location, the technical operator can navigate to the LOCATION menu and select the | DISPLAY ALL LOCATIONS | menu option.



Display ALL Locations Spectrum Bands | v1.37xx

Threat Analysis Algorithm (TDA)

When the Threat Analysis Algorithm (TDA) is active, the analysis cycle begins immediately following the completion of each complete sweep cycle based on the Analysis Time Limit setting.

The Search Receiver Status display dynamically displays the current operation during analysis.

The progression of the analysis cycle is Sweep, Demodulate and Analyze.

The Sweep occurs at the end of each Analysis cycle.

The Demodulation and Analyze cycle will occur for each signal that meets the threat detection criteria.

Any connected search receiver or analyzer may be assigned for Analysis and this is accomplished from the Analyzer Control dialog window in the Acquisition menu.

The default analyze value is (20 Sec).

After analyzing for the set analysis time limit setting, the Kestrel TSCM ® Professional Software will complete a new full sweep cycle before continuing the next scheduled analysis cycle from the last position competed.

Graticule Status Display

The | DATE | stamp for each specific trace is displayed on the Graticule status displayed in real-time and during historical file review.

DATE | Trace Status Display Group | v1.37xx

The | TIME | stamp for each specific trace is displayed on the Graticule status display in real-time and during historical file review.

TIME | Trace Status Display Group | v1.37xx

The | TRACE REFERENCE NUMBER | for each specific trace is displayed on the Graticule status display in real-time and during historical file review.

SPECTRUM BAND TOTAL NUMBER OF TRACES | Trace Status Display Group | v1.37xx

The number of actual | KESTREL SUPER TRACES (KST) ™ | are displayed on the Graticule status display in real-time and during historical file review.

The | TRACE REFERENCE NUMBER | is the actual number of traces collected and displayed in buffer and the | KESTREL SUPER TRACES (KST) ™ | represent the actual number of traces committed to storage as part of the operator defined write management capability.

KESTREL SUPER TRACES (KST) | Trace Status Display Group | v1.37xx

The actual runtime is captured and displayed providing the technical operator with both the trace count and collection time on the same display.

This is valuable information in determining the total collection time at the spectrum band level.

RUNTIME COLLECTION CLOCK | Trace Status Display Group | v1.37xx

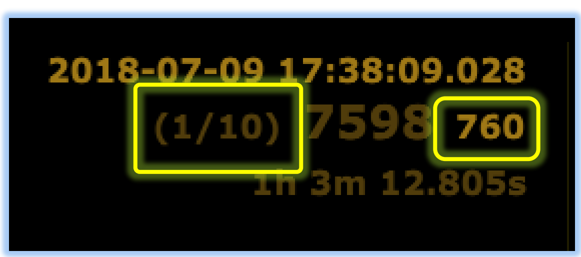
The Graticule status display provides a trace by trace reference and is used to navigate historical waterfall display data utilizing Live View Analysis (LVA).

The | DATE | and | TIME | stamp, and trace reference number are dynamically updated during the navigation process.

Kestrel Super Traces (KST) ™

After pressing the | Waterfall Buffer Clear (WBC) | button | WBC |, all unsaved waterfall data that has not been written to the storage drive will be cleared, leaving only the (n=???) data, compressing the hundreds or thousands of traces to the defined compression rate.

In the example illustrated below, after the technical operator has stopped collect and pressed the | WBC | button, the display updates to the actual number of | Kestrel Super Traces (KST) | written to storage and are available within | Live View Analysis (LVA) ™ |, for operator review, and for report generation.

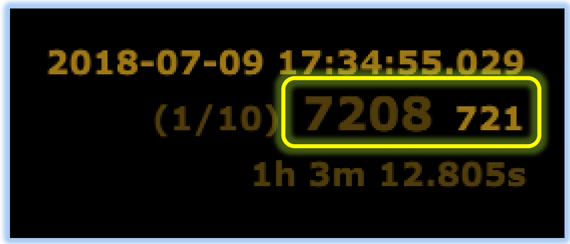


WRITE MANAGEMENT SETTING Status Display Group | v1.37xx

The display indicates that the operator had selected (n=10), meaning that 9 normal spectrum traces are captured and written as a single | Kestrel Super Trace (KST) ™ |.

This process is repeated until runtime capture is stopped.

Once the | WBC | button is pressed the 7598 (n=10) is displayed and can be decoded as 7598 waterfall traces = 768 | Kestrel Super Traces (KST) ™ |.



WRITE MANAGEMENT SETTING Status Display Group | v1.37xx

In the event the technical operator utilizes the | Live View Analysis (LVA) ™ | feature to navigate back in time the above image is displayed.

The operator has navigated back to trace 7208 represented by the | Kestrel Super Trace (KST) ™ | number 721 in the above image.

Graticule Annunciator Flags

There are a number of annunciator flags that may display to notify the technical operator of the current status of the runtime environment of the software, generated at the receiver firmware level.

These status flags indicate less than optimal settings or conditions, and the need for technical operator intervention.

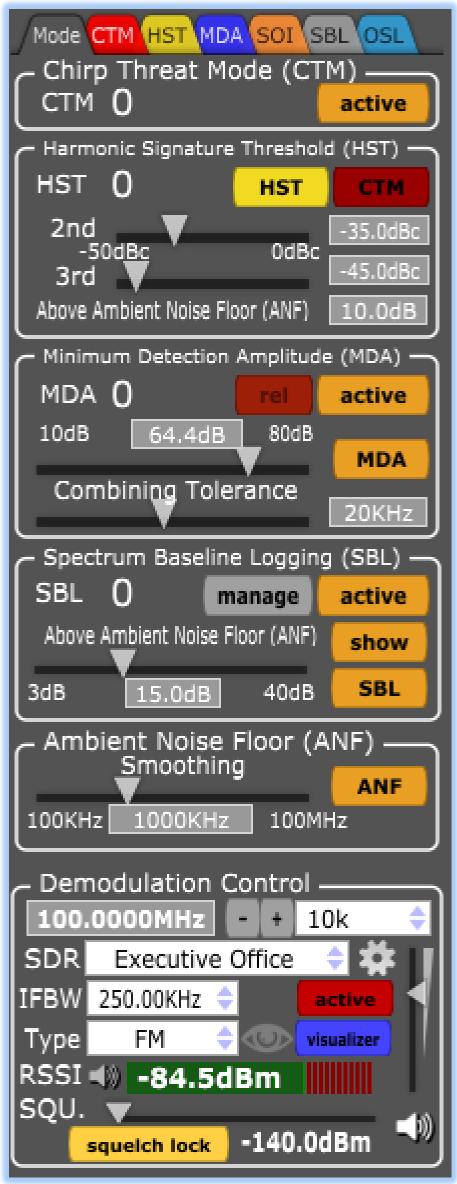
Graticule Annunciator Flags | Signal Hound (BB60C)	
ADC	**Analog to Digital Convertor (ADC)** | Indicates that the input level is too high. Either additional attenuation must be added or the gain reduced, or both. Corrective measures need to be taken to decrease the signal level to avoid runtime spectrum trace errors.
WQO	**Write Queue Overflow (WQO)** | Followed by the current buffer file size, indicates that the storage device write speed is not capable of writing fast enough and the software is temporarily buffering streaming data. It is common practice to observe this annunciator message during normal runtime when collecting large amounts of spectrum data. The buffer can handle up to 50 MB of streaming data.
DNC	**Device Not Configured (DNC)** | This is an error message indicating a possible loss of communication with the receiver firmware and is not a normally observed annunciator flag.
PFE	**Packet Framing Error (PFE)** | This is an error message indicating a possible communication error and resetting the host computer may be required.

Spectral Band TABS - Status | v1.38xx

The | Graticule Annunciator Flags | will appear within the upper left corner of the RF Spectrum Display (RSD) when any of the above conditions are detected by the software and will automatically reset when the condition that caused the flag to appear is no longer present unless a receiver level communication loss has occurred.

Side Bar Control Group

The | Sidebar Control Group | provides access to various control, signal and threat lists, threat detection settings and demodulation related functionality.



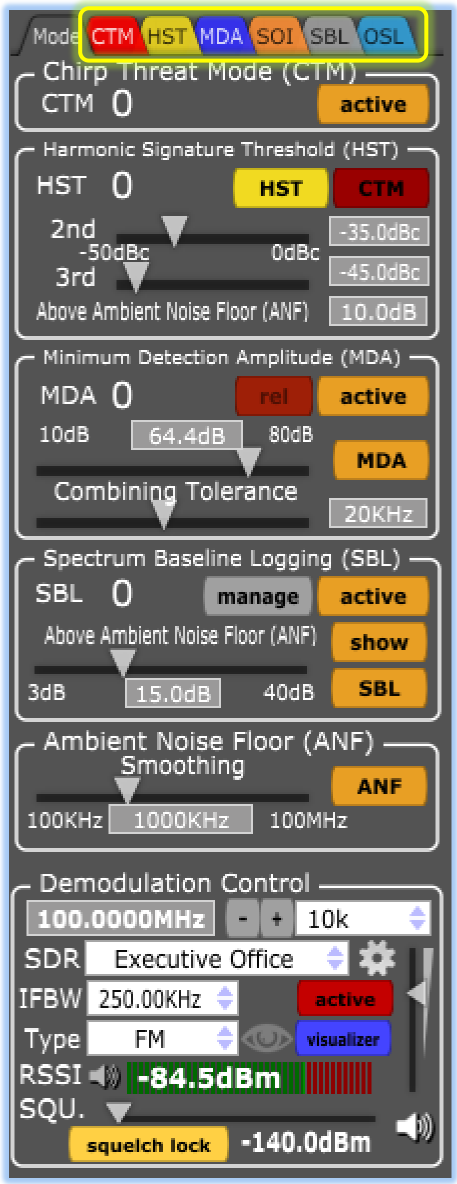
Sidebar Control Group | v1.37xx

The | Sidebar Control Group | is an essential element within the Kestrel TSCM ® Professional Software, operator centric workflow management structure, providing direct access to virtually all essential control groups.

The technical operator is able to immediately at a glance determine the current status and most operational settings without the need to navigate to a complicated sub-menu structure.

Automatic Threat List (ATL)

The technical operator can select any of the sidebar signal list tabs to display and review the ID, Frequency (kHz) (MHz) (GHz) and the Signal Level (dBm) for each signal event.



Automatic Threat Lest (ATL) | Sidebar Control Group | v1.37xx

The sidebar signal and threat lists provide the technical operator with essential signal event related information for analysis, review, editing and demodulation.

There are several important functions available to the technical operator.

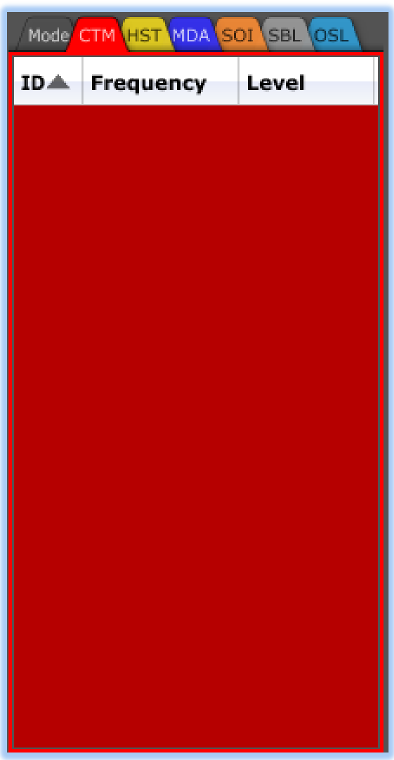
The technical operator can "Drag-and-Drop" any signal list entry onto the RF Spectral Display (RSD) Graticule to initiate a 20x zoom factor and place the SOI at CF.

The technical operator can "Drag-and-Drop" any signal list entry directly to the demodulator to initiate the demodulation process for the SOI.

The technical operator can right mouse click on any SOI located on a signal list to display an option list dialog menu to activate the demodulator for the SOI selected.

CTM List Tab

Signals that contain analog room audio are identified on the Graticule with a RED spectral marker flag.



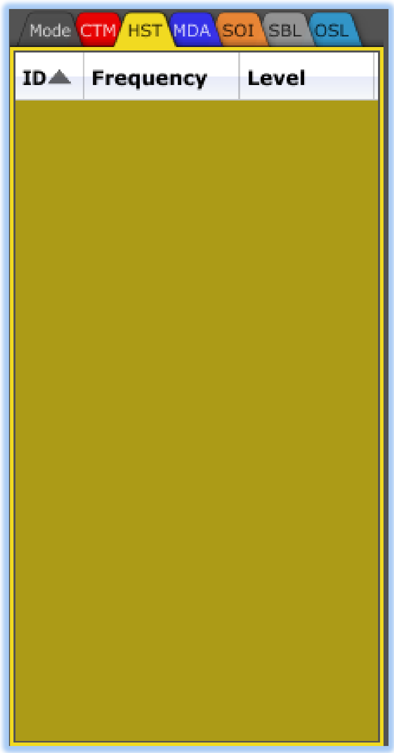
Sidebar Control Group | v1.37xx

Signals that appear on the CTM List are considered to be hostile or potentially hostile in nature and need to be carefully reviewed to determine the source.

HST List Tab

The HST List contains all signals that have a harmonic relationship and / or have met the Harmonic Signature Threshold (HST) criteria.

This is a complex control algorithm that analyzes MDA qualified signals for 2nd and 3rd harmonic based relationships in relation to the fundamental carrier power.



Sidebar Control Group | v1.37xx

This relationship is expressed as (dBc) and the technical operator can set the depth of the analysis by setting a level above the Ambient Noise Floor (ANF).

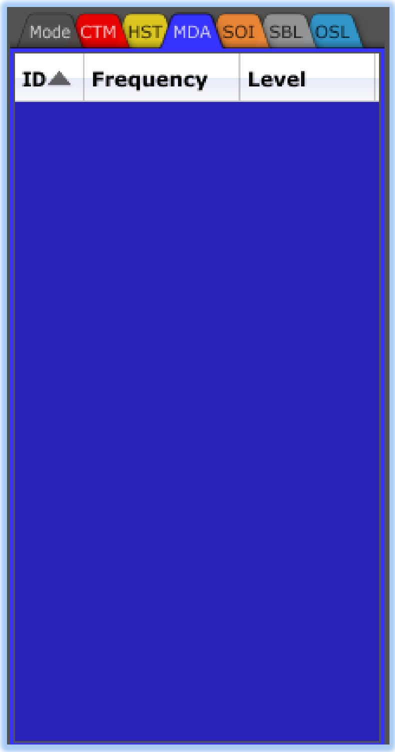
The HST function can be utilized to identify all harmonic relationships across the entire ROI or only those for which the Chirp Threat Mode (CTM) has identified as potentially hostile signals.

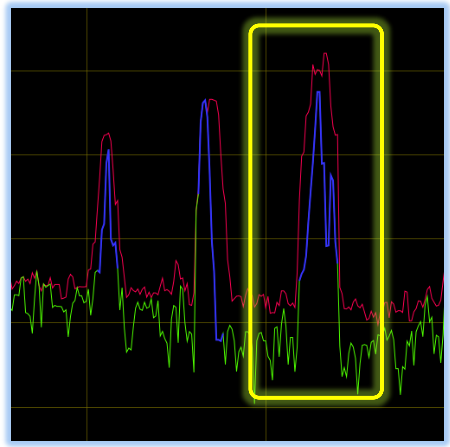
HST signal spikes are identified by a (YELLOW) spectral marker flag on the Graticule.

MDA List Tab

The MDA signal list contains all signals that have met or exceeded the Minimum Detection Amplitude (MDA) as selected by the technical operator.

The signal spike will display in (BLUE) on the RF Spectral Display (RSD) and the signal will be added to the MDA List.



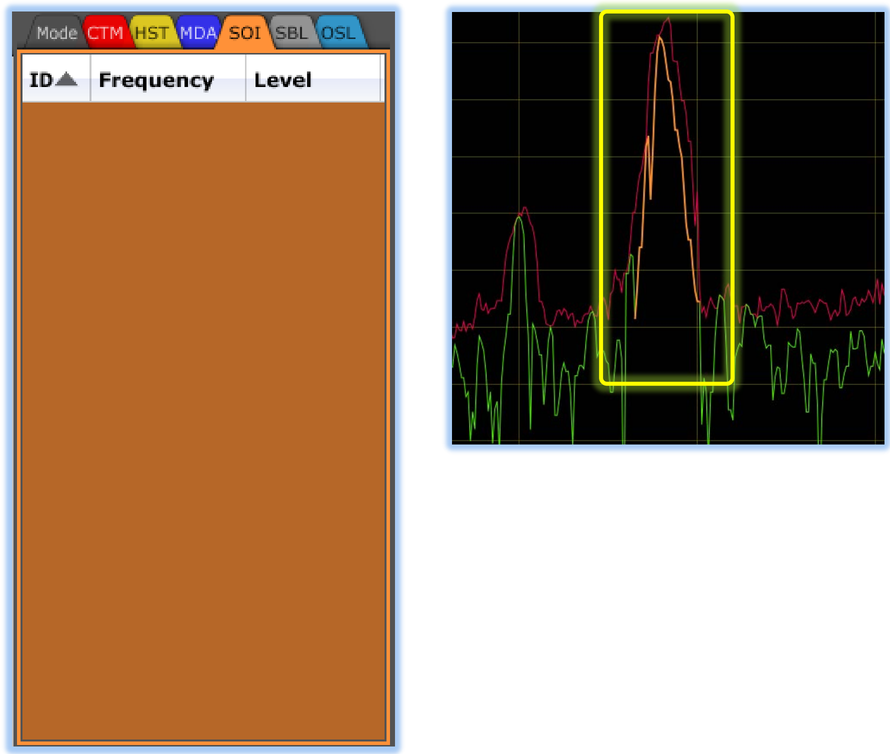


Sidebar Control Group | v1.37xx

All signals meeting the MDA will be analyzed when the HST or CTM functions are enabled by the technical operator.

SOI List Tab

The technical operator may utilize a left mouse click and drag a shaded box over any RSD SOI on the Graticule that may be below the MDA and therefore will not be chirped automatically.



Sidebar Control Group | v1.37xx

The signal spike will display as (ORANGE) on the spectral display and the signal will be added to the SOI signal list.

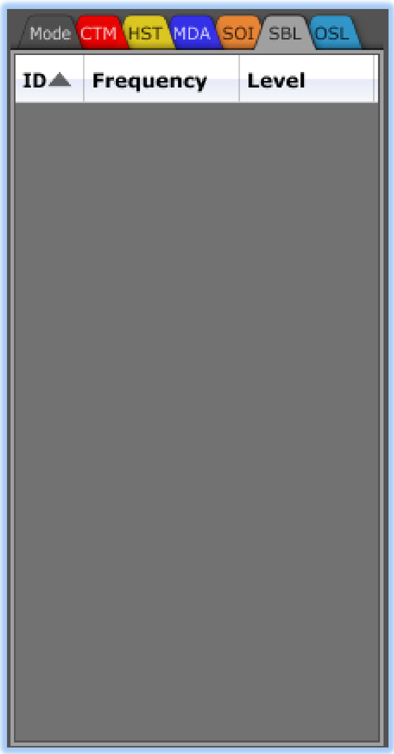
The signal will be chirped during the next analysis cycle even if it is below the MDA threshold when the threat detection algorithm is active.

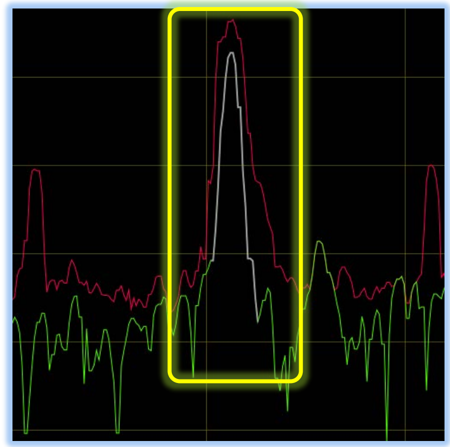
The operator may also right mouse click on any signal spike on the Graticule and select the Schedule CTM option.

During the next analysis cycle the signal will be chirped and analyzed as part of the threat detection process.

SBL List Tab

The SBL signal list contains all signals that have met or exceeded the Spectrum Baseline Logging (SBL) threshold as selected by the technical operator.



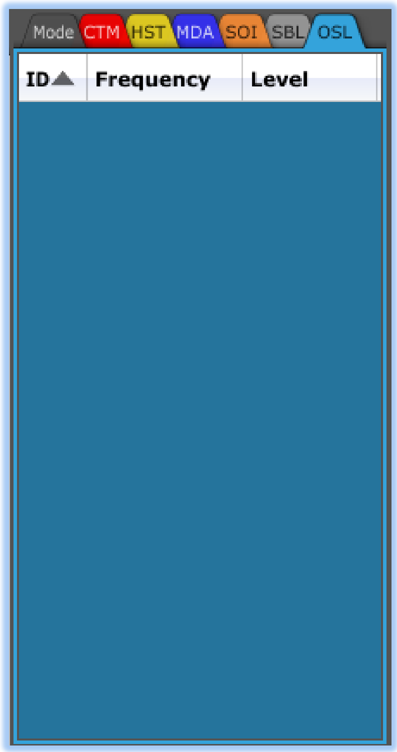


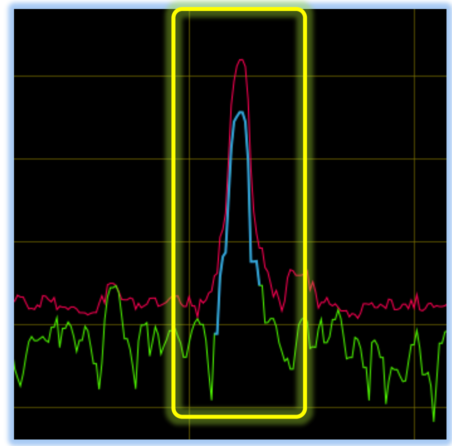
Sidebar Control Group | v1.37xx

The signal spike will display in GRAY on the RF Spectral Display (RSD) and the signal will be added to the SBL List.

OSL Database Tab

The OSL database contains all signals that have been added to the | Operator Signal List (OSL) ™ | automatically by the software or manually by the technical operator.





Sidebar Control Group | v1.37xx

The signal spike will display in Light Blue on the RF Spectral Display (RSD) and the signal will be added to the OSL ™ List.

Independent Spectral Bands – Activity Status

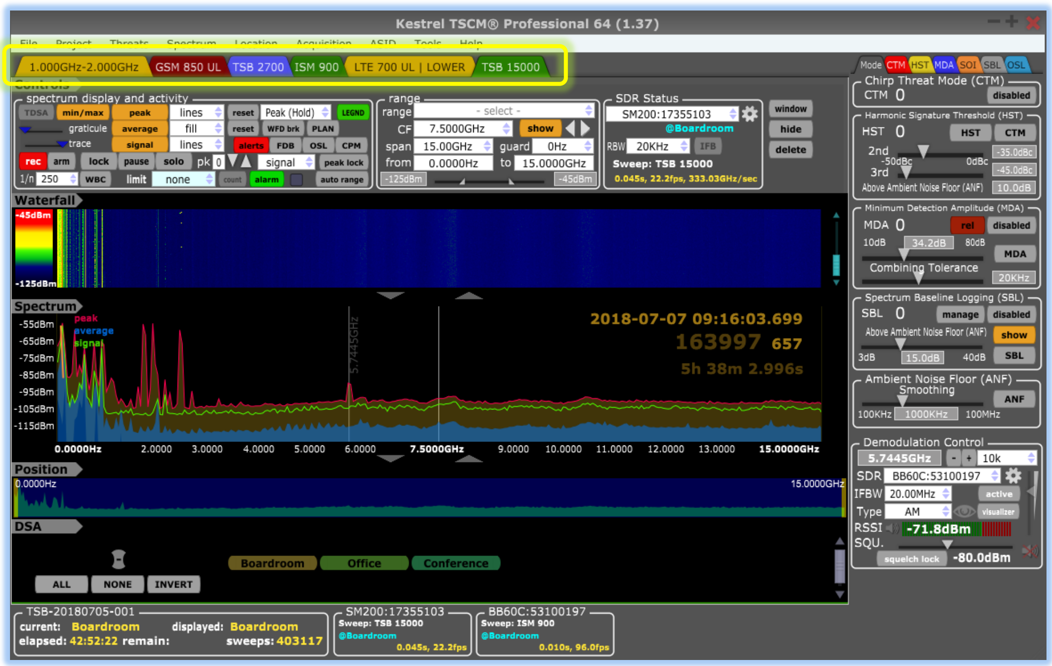
Each technical operator defined; independent spectral band is represented by a window TAB located on the main User Interface (UI).

Spectral Band TAB windows are populated with the Spectral Profile name or the Start and Stop frequency tag for a custom frequency range.

The Spectral Band TABS are colour coded RED, YELLOW and GREEN to enhance technical operator situational awareness as to the status of each independent spectral band.

Spectral Band TABS | Status	
RED	Inactive | Receiver is not currently assigned
YELLOW	Standby | Receiver is assigned, band not currently active
GREEN	Active | Band is actively sweeping the Range of Interest (ROI)
BLUE	Locked | Band has reached the assigned trace count limit
GRAY	Locked | SOLO Priority Mode Active

Spectral Band TABS Status | v1.40xx



Spectral Band Status | v1.37xx

ATL Signal Options

Right clicking on any signal list entry of a spectral marker flag, activates a menu dialog that identifies the database entry and allows the technical operator to display a Signal Profile of the SOI, Demodulate the SOI, Ignore the SOI, Un-Ignore an SOI, Schedule CTM analysis, Schedule HST analysis, generate an OSL entry and Delete a signal from the list and remove the Spectral Display Marker Flag from the Graticule.

Should the deleted signal be present in the ambient spectrum or reappear at a later time, and meets the MDA trigger threshold criteria, the signal will be flagged, analyzed and placed back on the appropriate threat list.

Occasionally, a signal flagged as MDA may not flag as hostile and placed on the CTM threat list.

The technical operator can manually delete the signal from the MDA list which in-turn allows the software to analyze the signal again, which is often confirmed as a CTM event.

SOI 1
- Signal Profile…
- Demodulate
- Ignore
- Un-Ignore
- Schedule CTM
- Schedule HST
- Generate OSL Entry
- Delete

Signal Event Menu | v1.38xx

The above menu illustrates an operator added Signal of Interest (SOI).

Ignoring a Signal Event

The | IGNORE | and | UN-IGNORE | feature is another milestone and example of the sophisticated simplicity of the Kestrel TSCM ® Professional Software.

Ignoring a signal event causes the spectral marker flag to dim and the accompanying signal list entry to display in a different color indicating that the “ignore” feature is currently active for that particular signal event.

It is also possible to | UN-IGNORE | a signal event that has been previously ignored, should the technical operator decide that the signal event is of interest at a later point in time.

This feature can be utilized by the technical operator to visually mark signal events that have been reviewed and cleared by the technical operator during analysis, leaving a clear indication of which signals have not been reviewed or analyzed.

A detailed list of "ignored" signal events can be included within the Session Report Generator (SRG).

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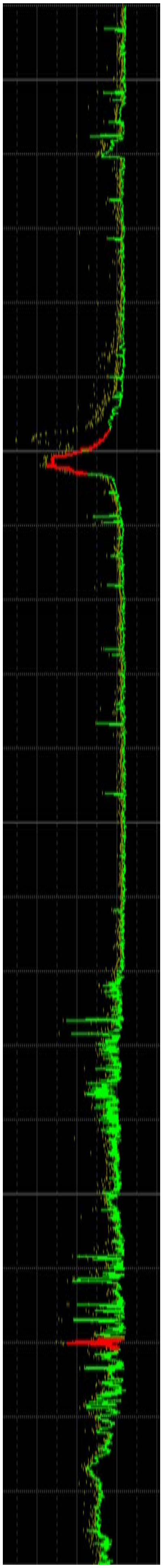
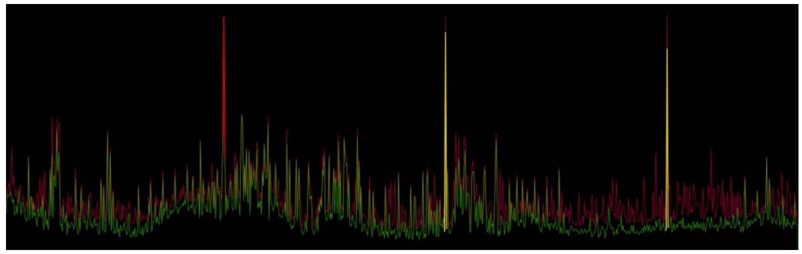


Chapter 7

RF Spectral Display (RSD)

Innovation is Simply the Beginning...

Review and Revision: 2020-08-15

RF Spectral Display (RSD)

There are two (2) operational modes that the technical operator may deploy depending on the mission parameters based on the level of capture and analytical information requirements.

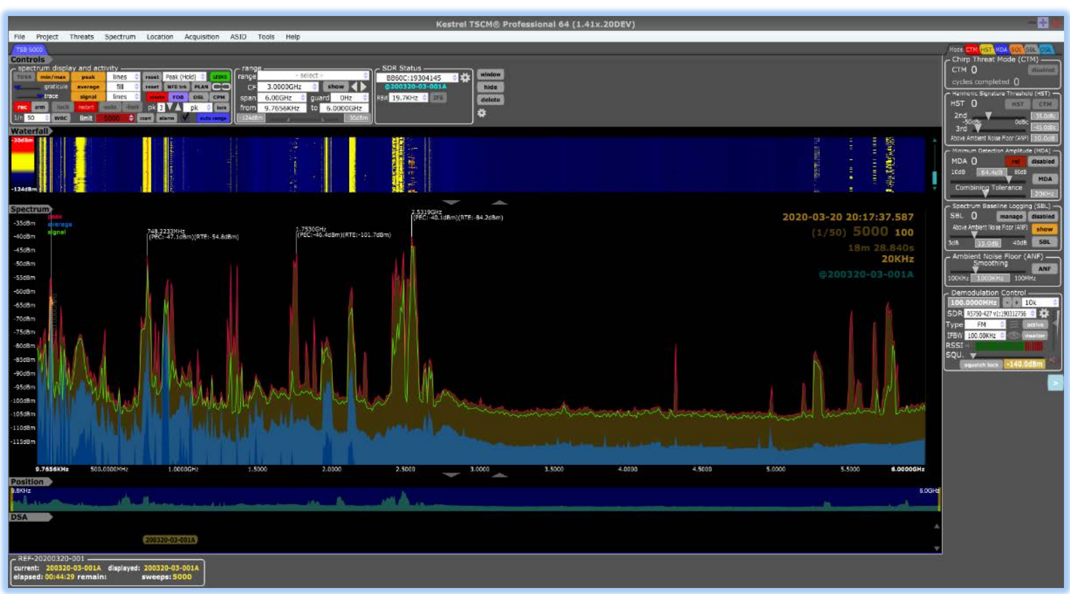
The | RF SWEEP MODE | establishes a default runtime sweep environment and is suitable for most common deployment requirements.

The | IF BROADBAND (IFB) ™ | mode permits the technical operator to deploy the software in a modified zero span configuration, up to the maximum Intermediate Frequency (IF) real-time bandwidth of the SDR hardware.

The real-time bandwidth level is 240 kHz to 160 MHz based on the various hardware options currently supported by the Kestrel TSCM ® Professional Software.

The RSD ™ is an important graphical display element and is perhaps the most familiar part of the Kestrel TSCM ® Professional Software from a visual display point of view and supports the display of the | RF Sweep Mode | and the | IF Broadband (IFB) Mode |, sharing all of the available display and navigation tools.

The RF Spectral Display (RSD) is utilized by the technical operator to observe the ambient RF spectral environment within the frequency domain.



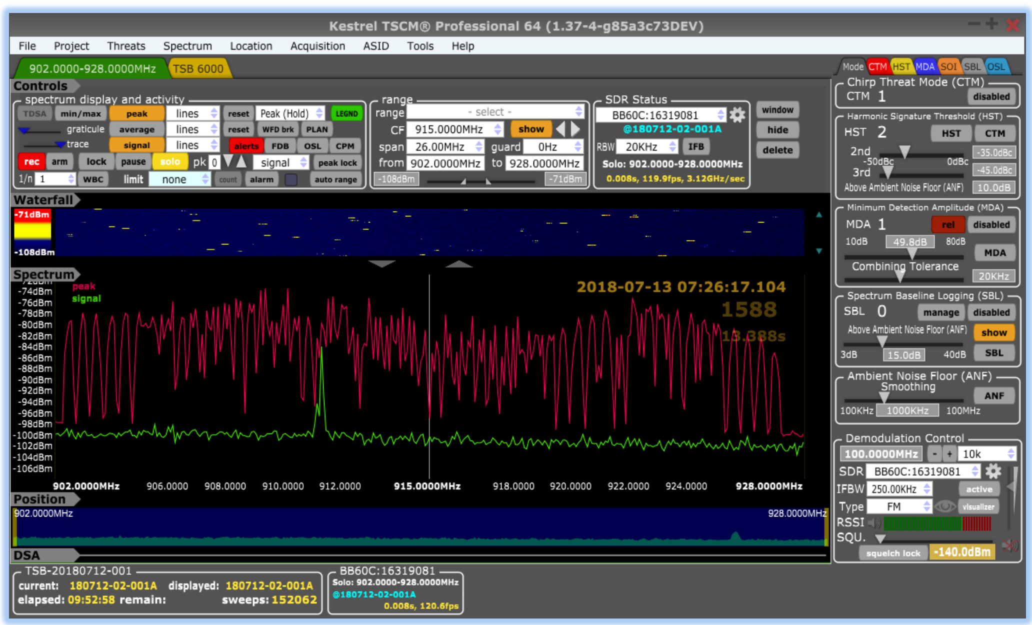
RSD Sweep Mode Display | v1.41xx

The technical operator can VIEW or HIDE the RF Spectral Display (RSD) without interrupting, or otherwise affecting the data collection process, and display the Spectrum Averaging Trace (SAT) and / or the Peak Envelope Capture (PEC) traces.

IF Broadband (IFB) TM Mode

The IFB TM mode can be utilized for any frequency Range of Interest (ROI) up to the maximum IF bandwidth of the hardware, (subject to performance limitations), and provides a number of very powerful advantages.

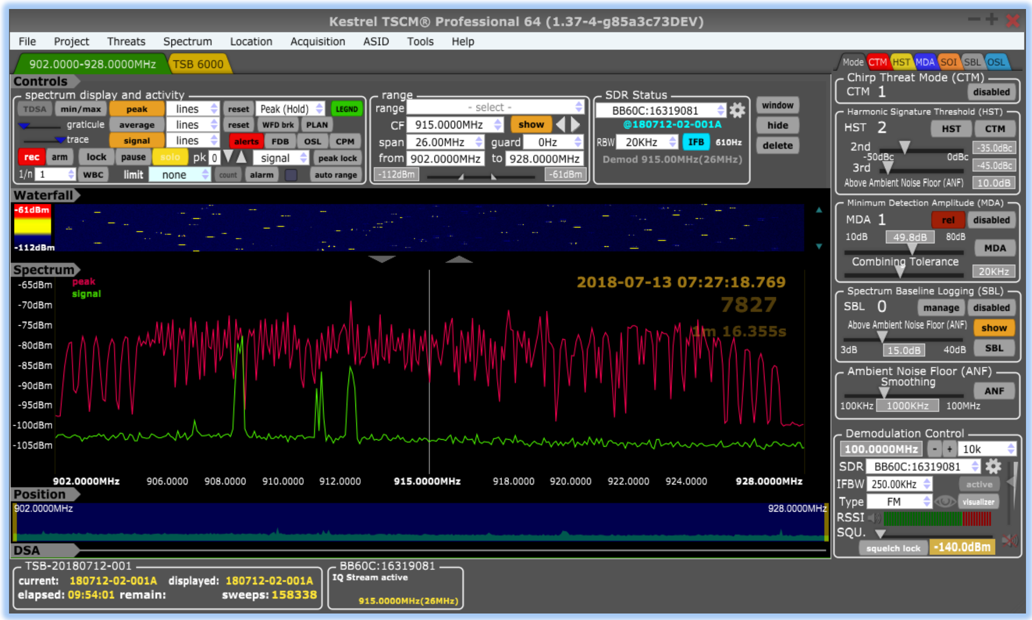
The first step is to enter a zoom band or new band solo mode to a Range of Interest (ROI) less than the maximum real-time hardware bandwidth which enters a normal sub-band sweep mode.



RSD Sub-Band SOLO | v1.37xx

In IFB TM mode, the hardware is running in a modified zero span mode, and therefore the demodulator is continuously active during the process.

This provides the ability to utilize pre-event buffer features, such as Triggered IQ capture, as associated with the Automatic Export Control (AEC) TM without first having to stop the active sweep, and enter the Demodulation mode, which can take valuable time to accomplish, all but missing short duration burst, or periodic signal events.



IFB MODE | v1.37xx

Another powerful advantage is that the IFB ™ dynamically selects a significantly narrower Resolution Bandwidth (RBW), for example, the RBW for the normal wide bandwidth ROI sweep, might be 20 kHz and switching to IFB ™ mode might see a Resolution Bandwidth (RBW) of 315 Hz.

The narrower bandwidth also enhances the Probability of Intercept (POI) due to a higher apparent speed.

Spectrum Display Controls | RF | IF |

The technical operator can double click the | Spectrum Control | tab to hide the RF Spectral Display (RSD) window, providing additional display space for the WFD or DSA windows.

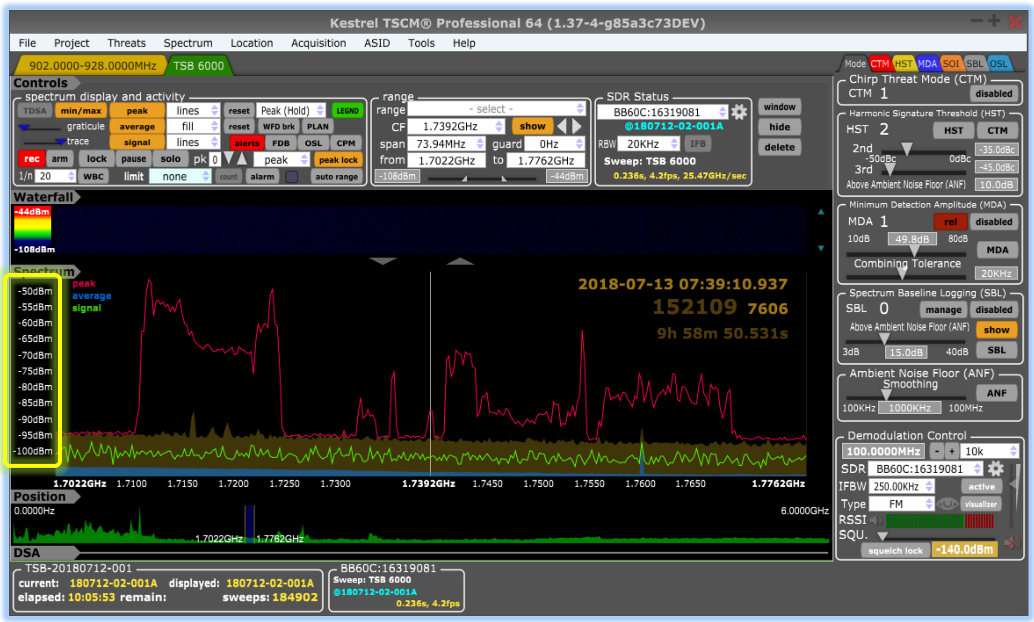
Individual | RF Spectrum Display (RSD) | tabs may also be (hidden) from the display utilizing the | HIDE | button to hide the currently active TAB and later select the band for display by navigating to the

To display (show) the hidden | RF Spectrum Display (RSD) | tabs the technical operator can access the | SPECTRUM | SPECTRUM SET | menu and select the band active again, if required.

Hidden | RF Spectrum Display (RSD) | tab options do not have checkmarks and return them to view.

Reference Level (dBm) | Amplitude |

The Reference Level (dBm) is displayed on the left side of the RF Spectral Display (RSD) Graticule.



RSD REF Level | v1.37xx

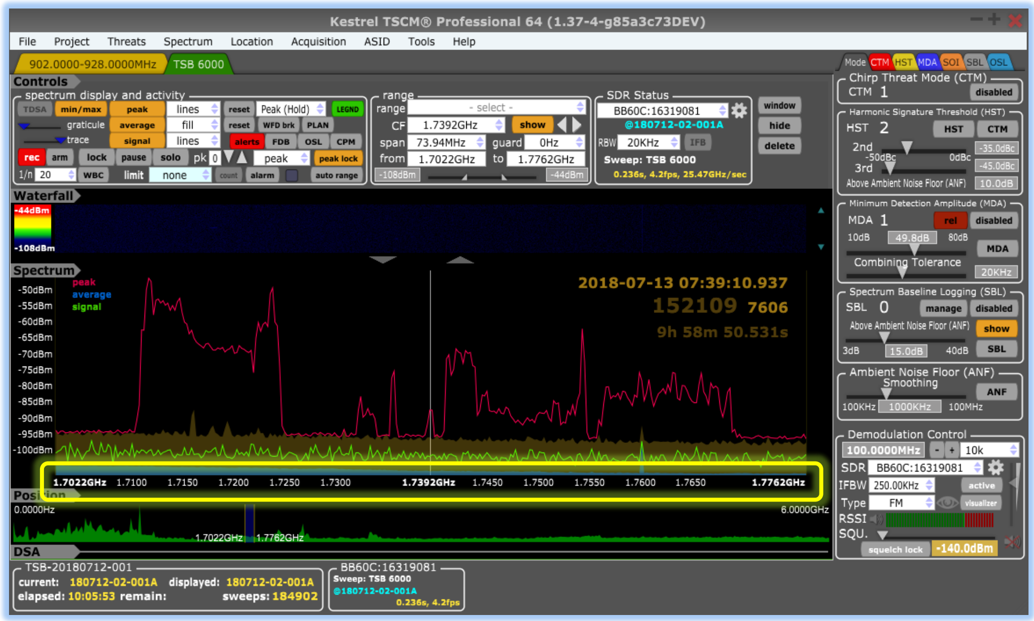
Each Graticule division is divided equally based on the Reference Level (dBm) control group settings.

Reference Level (dBm) | Frequency |

The current ROI or positional zoom SPAN is indicated in bold text at the bottom START and STOP edge of the RF Spectral Display (RSD) Graticule.

Frequency is displayed equally along the along the bottom of the spectral display and adjusts according to the position control and active zoom factor selected by the technical operator.

In full ROI view, the frequency from START to STOP is equally divided across the entire spectral display with the START / STOP values in bold text annotations.

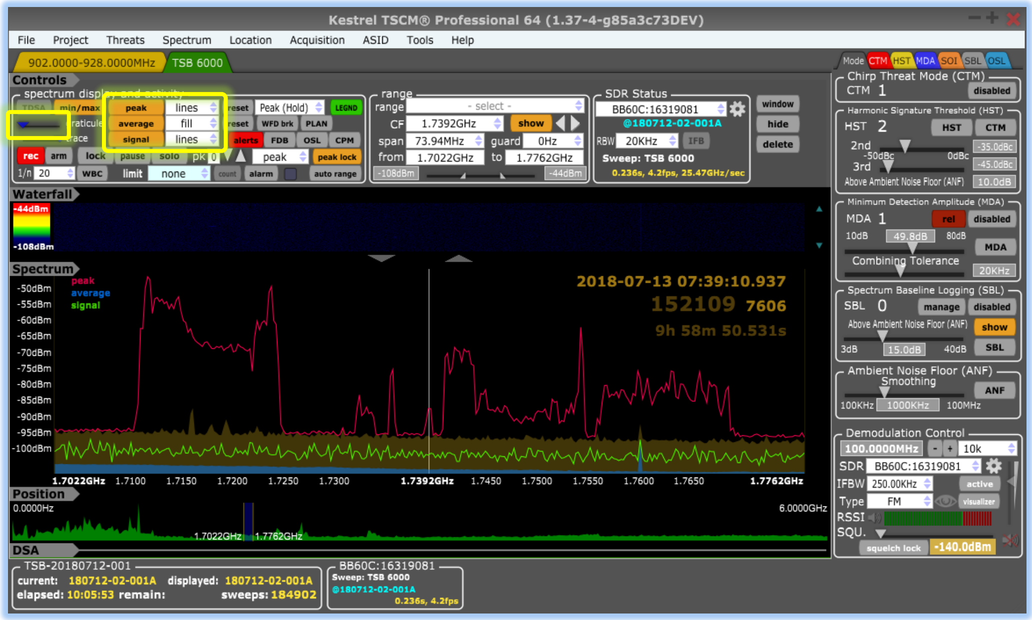


RSD Frequency REF | v1.35xx

The Graticule grid is dynamic in nature and is affected by reference level changes and any Positional Zoom Control (PZC) factor value.

Graticule Reference Grid | Display

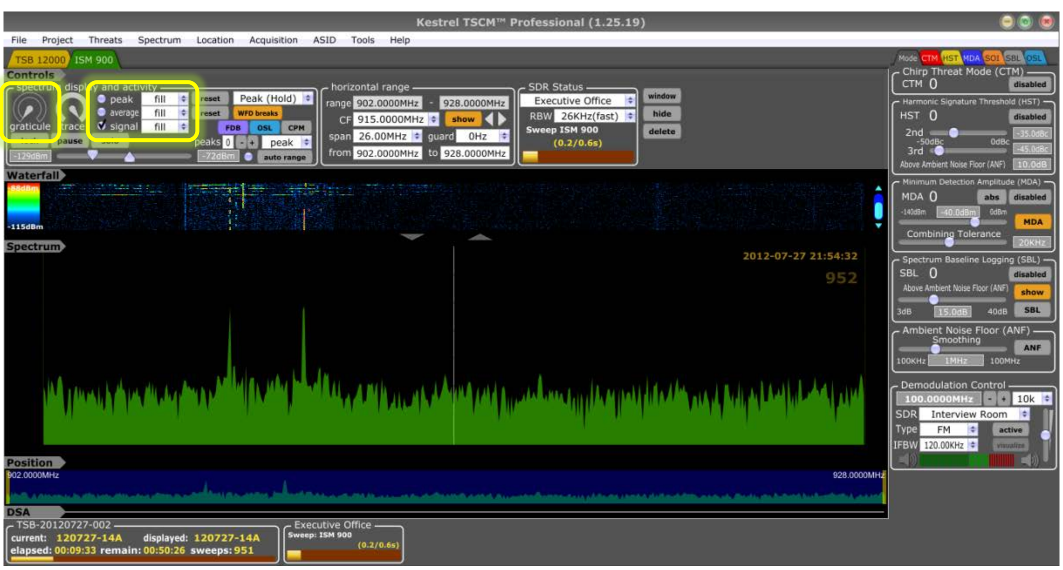
The Graticule | Horizontal (MHz) and | Vertical (dBm) grid lines are provided as a convenient reference overlay for the technical operator to accurately determine the relationship between SOI amplitude (dBm), bandwidth (SPAN) and the CF frequency of any signals present on the spectral display.



RSD Graticule Grid | v1.37xx

The background Graticule grid lines can be dimmed or turned off completely utilizing the Graticule dimmer control slider bar located on the controls tab. The default brightness setting is 25%.

When signal identification is deemed to be more important than precise test and measurement signal parameters, turning off or dimming the Graticule significantly enhances the technical operator's ability to observe the signal environment.



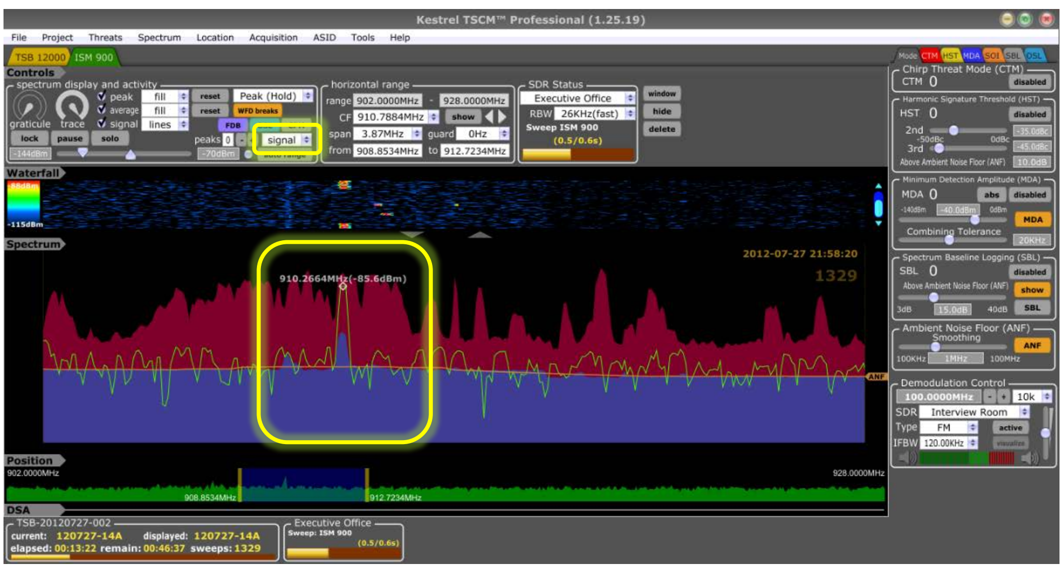
RSD | v1.35xx

The frequency and amplitude annotations are not affected by the use of the Graticule dimmer control, which can be dynamically restored to any range up to full brightness, as required.

Spectral Marker

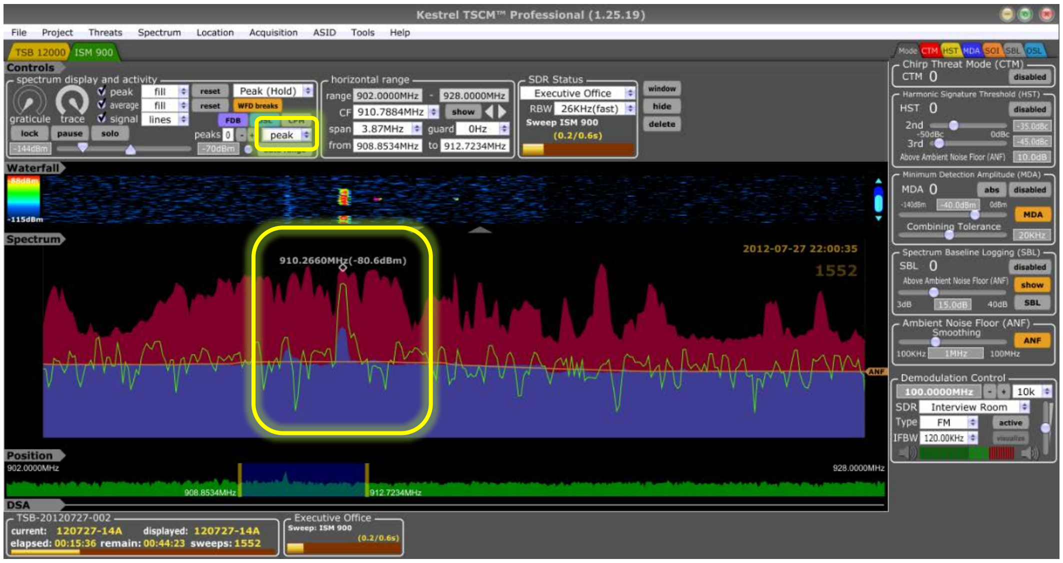
There is another unique | Spectral Marker | feature available to determine the frequency and amplitude of any particular SOI even with the Graticule gridlines disabled.

Utilizing a right mouse “click and drag” within the RF Spectral Display (RSD), results in a marker displayed with frequency position and amplitude level annotations, which will follow the Real-Time Event Trace (RTE), Peak Envelope Capture (CEP) and Spectral Average Trace (SAT) depending on the current | Peak Seeking Marker (PSM) | selection setting option box located on the control tab.



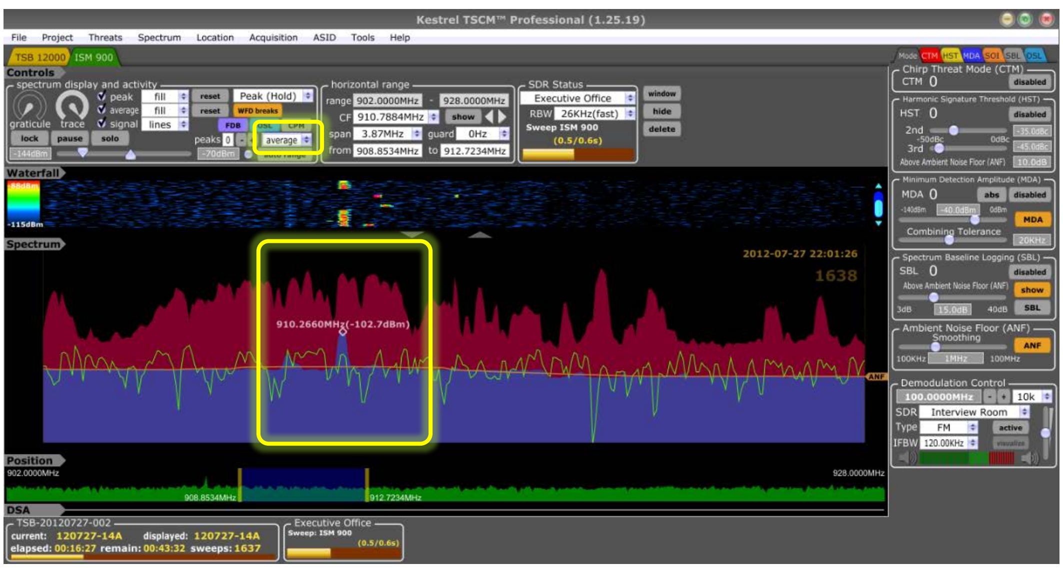
Spectral Marker | v1.35xx

The example above illustrates the | Spectral Marker | ability with the | PSM SIGNAL | option selected for the | Spectral Marker | display.



RSD + Spectral Marker | v1.35xx

The example above illustrates the | Spectral Marker | ability with the | PSM PEAK | option selected for the | Spectral Marker | display.



Spectral Marker | v1.35xx

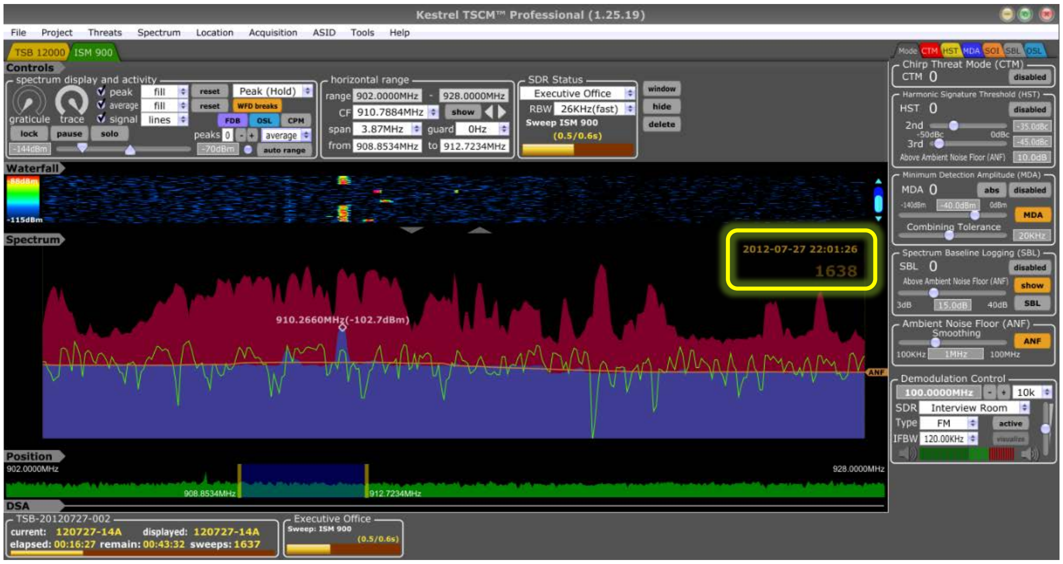
The example above illustrates the | Spectral Marker | ability with the | PSM AVERAGE | option selected for the | Spectral Marker | display.

Operation is shared with the right mouse click | MENU | feature.

A right mouse click once displays the menu, move the mouse cursor off the menu corner, and right click a second time to display the | Spectral Marker |.

Date | Time Stamp

A DATE and TIME stamp is displayed on the upper right corner of the spectral display window and updates at the completion of each completed sweep event creating a permanent record of the date and time of capture at the trace level.



Trace Date | Time Stamp | v1.35xx

This information is also ported to the Automatic Threat List (ATL) and is an integral part of the project file saving and report generator structure.

During Live View analysis (LVA) the DATE and TIME stamp indicates the precise DATE and TIME of capture for the single historical trace currently being displayed analyzed by the technical operator.

Reference Level | Independent (RSD) Scaling

The ability to independently adjust the RSD is fully supported within the Kestrel TSCM ® Professional Software application.

There are three (3) co-located hot spots within the RSD reference level annotation region that responds to mouse wheel control.

Positioning the mouse cursor in the center or middle area of the RSD annotation region allows the technical operator to utilize the mouse wheel to adjust the upper and lower reference level scale simultaneously.

Positioning the mouse cursor over the upper reference level annotation area allows the technical operator to adjust the upper reference level limit without significantly affecting the current lower reference level limit.

Positioning the mouse cursor over the lower reference level annotation allows the technical operator to adjust the lower reference level limit without significantly affecting the current upper reference level limit.

Reference Level Annotation

The reference level is dynamically populated and is displayed based on the minimum and maximum reference level limits set by the technical operator or the manual Auto Range control, or Auto Range Checkbox.

Frequency Annotation

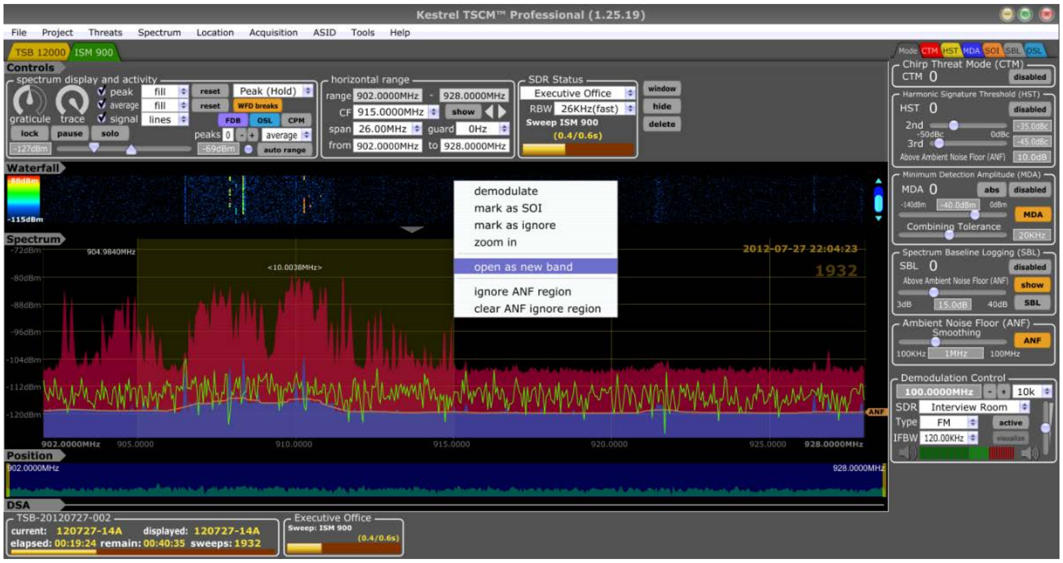
The frequency divisions are dynamically populated and are displayed based on the ROI selected by the technical operator, or for the current window SPAN when the Positional Zoom Control (PZC) is utilized.

Start Frequency | Stop Frequency |

The fixed (bold) frequency annotations located on the RIGHT and LEFT bottom corner of the Graticule, indicate the START and STOP frequency of the currently displayed window SPAN.

Open as New Band

The ability to select any portion of a currently displayed spectrum band is fully supported by the Kestrel TSCM ® Professional Software.



Open New Band | v1.35xx

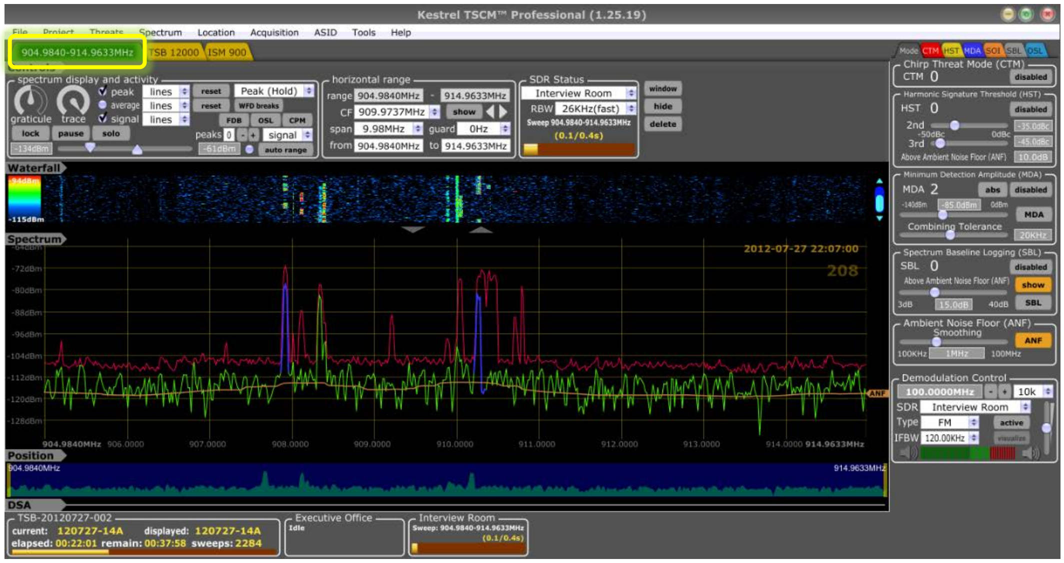
The technical operator utilizes the left mouse button to grab and drag a shaded selection box over any portion of the currently display RF Spectral Display (RSD) to generate a new independent band window based on the selected Range of Interest (ROI).

The start frequency, stop frequency and bandwidth of the selected new band are annotated and displayed on the Graticule during the selection process.

Once the desired spectrum range is selected, releasing the left mouse button will cause an option menu to appear on the Graticule and the technical operator selects the menu option “Open as New Band” to compete the process.

Open New Band Menu | v1.34

A new spectral band window will appear as an independent seated spectral tab and will indicate the Start and Stop frequency as illustrated in the example image below.



Open New Band | v1.35xx

The new spectral band becomes part of the overall sweep collective.

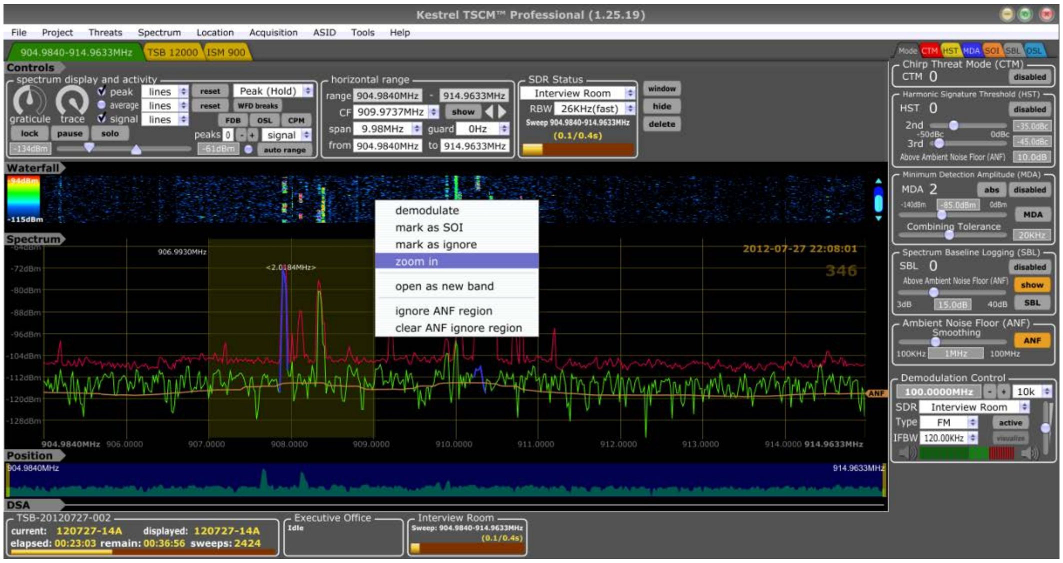
It may be necessary to press the Auto Range button or select the Auto Range Check Box to center the spectrum on the Graticule.

Sub-Band | Zoom Control

The technical operator may simply wish to zoom into a specific sub-band region without necessarily creating an independent sub-band window.

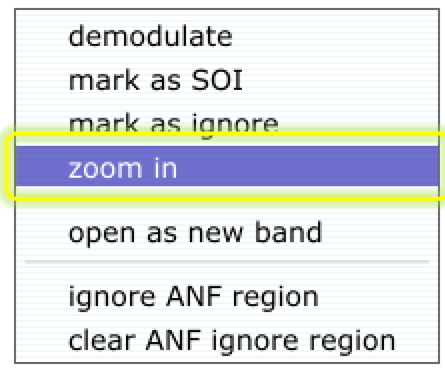
The same selection process utilized for “Open as New Band” as described above, is also utilized to select the specific zoom Range of Interest (ROI).

The Start and Stop frequency and bandwidth are displayed during the selection and drag process.



Sub-Band Zoom | v1.35xx

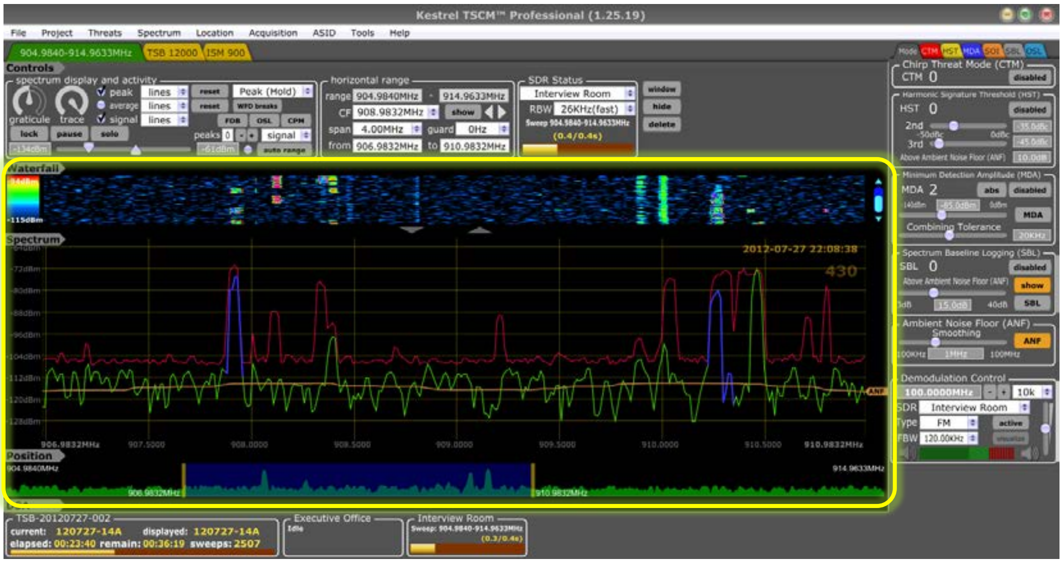
Upon releasing the left mouse button, an option menu appears on the Graticule and the technical operator selects the “Zoom In” menu option to complete the zoom process.



Sub-Band Zoom Menu | v1.35xx

The RF Spectral Display (RSD) zooms to the new sub-band region as selected by the technical operator.

The Positional Zoom Control (PZC) and / or mouse wheel are utilized to exit the current zoom state, if desired.



Sub-Band Zoom | v1.35xx

Spectral Baseline Clipping (SBC)

Support is provided for manual display of | Spectral Baseline Clipping (SBC) | for the RF Spectrum Display (RSD) to better focus technical operator attention on signal events that exceed the current | Spectral Baseline Clipping (SBC) | level.

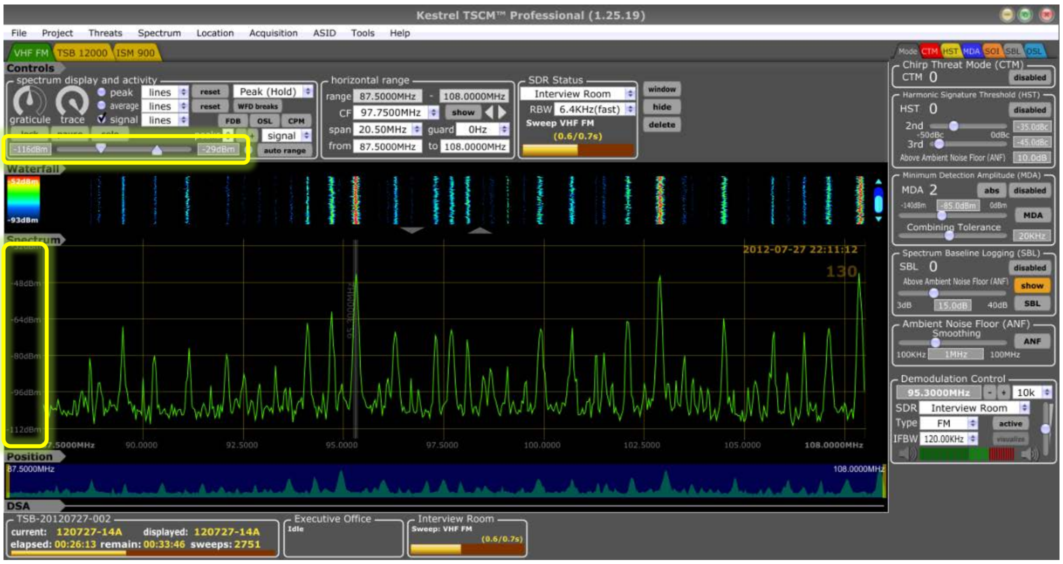
Selecting | Auto Range | might result in the Graticule displaying a reference level range of (-134 dBm to -66 dBm) for example and will therefore display the noise floor and considerable noise floor clutter with a margin of approximately 5 dB at the bottom and 10 dB at the top.

Ambient Noise Floor (ANF) clutter includes low level, instantaneous noise floor events and spurious artifacts that often appear to be discrete signals that may either, continuously or momentarily rise above the average noise floor level and can be a distraction for the technical operator

TIP: The Auto Range Checkbox must not be selected when the technical operator wishes to utilize Spectrum Baseline Clipping (SBC) as the Independent RSD Scaling feature is disabled when the Auto Range Checkbox is selected.

The majority of these apparent signal events can cause the technical operator to focus attention on the Ambient Noise Floor (ANF) rather than on potentially significant signal events.

The following example illustrates the Graticule when the technical operator has pressed the Auto Range button during runtime.



Spectral Baseline Clipping (SBC) | v1.35xx

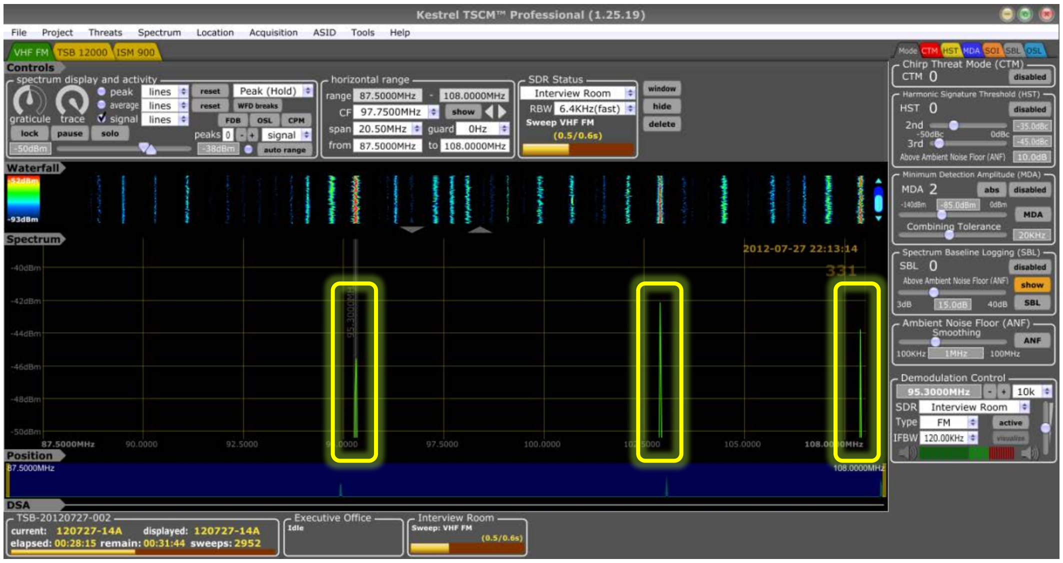
The technical operator can better focus attention on those signals that exceed the current Ambient Noise Floor (ANF) level, and in the process, override the effects of Auto Range settings by hiding or blanking all signal activity below the selected SBC level.

Adjusting the reference level to (-100 dBm to -75 dBm) results in only signal events exceeding (-100 dBm) to display on the Graticule.

Noise floor clutter and all signal events below (-100 dBm) are not visible on the Graticule and are hidden from view.

The ability to display only those Signal of Interest (SOI) permit the technical operator to better identify currently active and new signal events that are occurring in the Near-Field RF Spectral Environment in real-time.

The following example illustrates the benefit of Spectral Baseline Clipping (SBC) when the technical operator adjusts the lower and upper reference level to display only high amplitude signal events.



Spectral Baseline Clipping (SBC) | v1.35xx

The technical operator can access the advanced SBC display feature utilizing three (3) different methods, including the reference level slider bar, direct reference level input boxes and the Reference Level - Independent RSD Scaling function.

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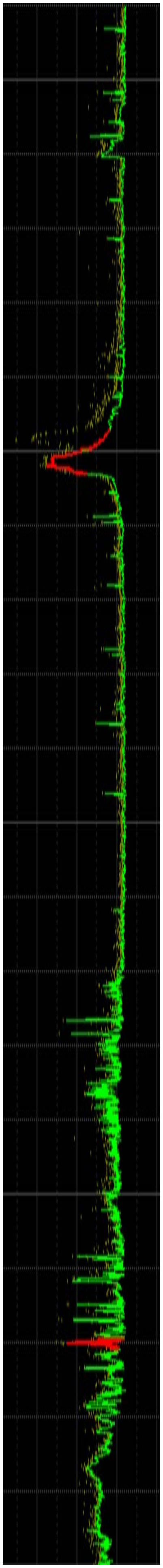
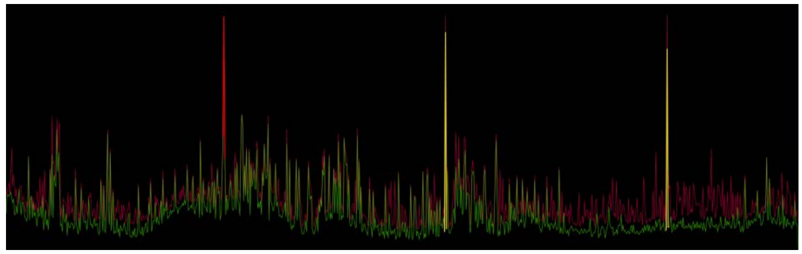


Chapter 8

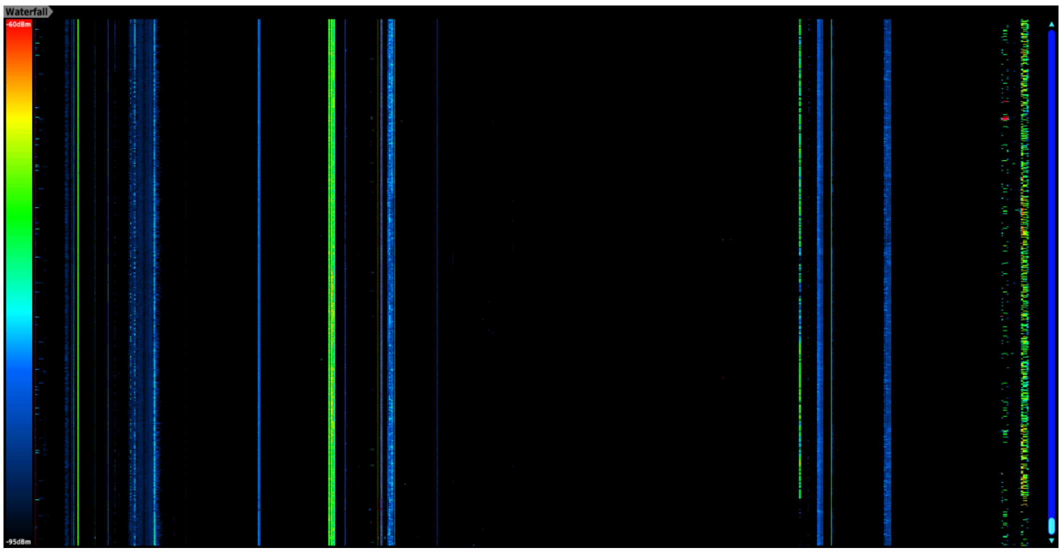
Waterfall Display (WFD)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Waterfall Display (WFD)

The ability to display, capture, zoom and review the WFD is an essential TSCM specific feature, specific to identifying periodic, intermittent, burst and other signal events within the RF spectral environment, as a function of time, amplitude and the Signal of Interest (SOI) bandwidth parameters.



WFD | v1.38xx

Waterfall Colour Palette

The WFD colour palette is located on the left side of the WFD and provides the technical operator with the ability to view the various WFD signal events based on bandwidth, and displayed amplitude (dBm), as a colour intensity.

Signal events that are at or near the Ambient Noise Floor (ANF) will typically be displayed as darker colours | BLACK | or | BLUE | and lighter colours such as light blue, green, yellow and red, indicate stronger amplitude signals, unless the technical operator has selected, or defined a customer Waterfall Display (WFD) reference colour palette.

The Waterfall Display (WFD) colour palette is amplitude based and is displayed on the left side of the Waterfall Display (WFD) window, along with the current upper and lower reference level, defined as (dBm) values.

The darker colours | BLACK | or | BLUE | generally represent the Ambient Noise Floor (ANF) level and can be observed as the most prominent Waterfall Display (WFD) background, contrasting the signal events that appear above the noise floor.

The Light Blue, Green, Yellow, and Red generally represent the amplitude of signal spikes, and potentially, spurious artifacts, spectral images, and noise, well above the Ambient Noise Floor (ANF), making it a relatively simple task to quickly determine the characteristics of individual specific signal events, contrasting the background.

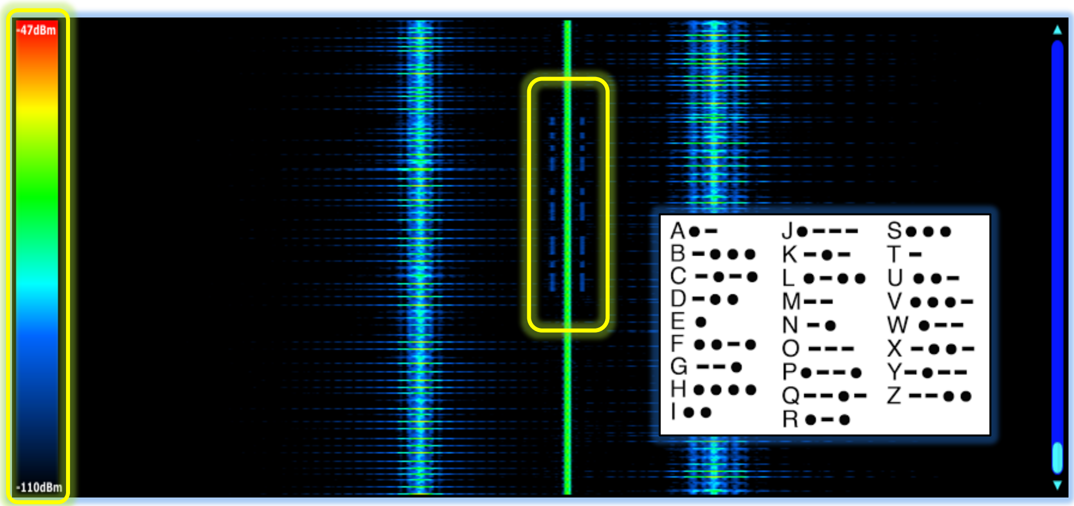
The Waterfall Display (WFD) is a powerful tool for capturing various forms of Spread Spectrum signals that tend to be very close to the Ambient Noise Floor (ANF), and periodic, or continuous signal events.

Many spread spectrum signals are not easily visible on the RF Spectral Display (RSD) or even observable in real-time but are easily identified on the Waterfall Display (WFD) as a function of time and will be captured on the Peak Envelope Capture (PEC) trace, and the MIN-MAX reference trace, when enabled.

Periodic and intermittent signals can easily be identified, and discrete signal characteristics can be determined, and reviewed by the technical operator as to the nature and characterization of the Signal of Interest (SOI).

Periodic or broken (disconnected) vertical lines or dots indicate intermittent, or periodic signal event, and solid vertical lines indicate the presence continuous, or uninterrupted signal events.

Modulation characteristics can often be visualized providing valuable clues as to the type and origin of the signal.



WFD | v1.38xx

The WFD can also be utilized to identify various coded intelligence, associated with the RF carrier as observed in the above waterfall image.

The observed dots and dashes represent the transmitted navigational aid, Morse code identifier as | VAK |.

The discrete signal bandwidth, including variations in modulation over-time, and RSSI levels can be observed by the technical operator, as a function of horizontal position (placement), and colour intensity.

Reference Level

The | WFD | upper and lower reference level as a (dBm) value, is displayed within the colour palette window, and correlates with the RF Spectral Display (RSD) ™ reference level.

The reference level can be adjusted by the technical operator, utilizing the Reference Level slider bar, or manual text input boxes, located within the | RANGE | control group, or directly from the UI for both the RSD or WFD reference displays.

Reference Level | Independent (WFD) Scaling

The ability to independently adjust the | WFD | is fully supported within the Kestrel TSCM ® Professional Software application.

There are three (3) co-located hot spots within the | WFD | colour pallet that respond to mouse wheel, and / or mouse double click control.

Positioning the mouse cursor in the center or middle area of the | WFD | colour pallet allows the technical operator to utilize the mouse wheel to adjust the upper and lower reference level scale simultaneously.

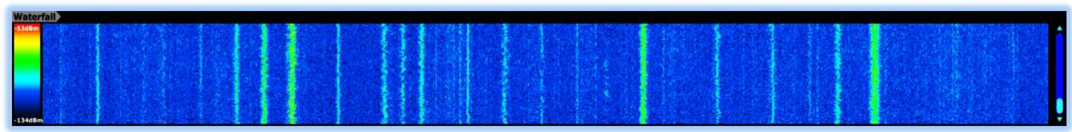
Positioning the mouse cursor over the upper reference level annotation allows the technical operator to adjust only the upper reference level limit without affecting the current lower reference level limit.

Please note that the annotation may not be visible if the selected colour palette is the same colour as the text value annotation.

Positioning the mouse cursor over the lower reference level annotation allows the technical operator to adjust only the lower reference level limit without affecting the current upper reference level limit.

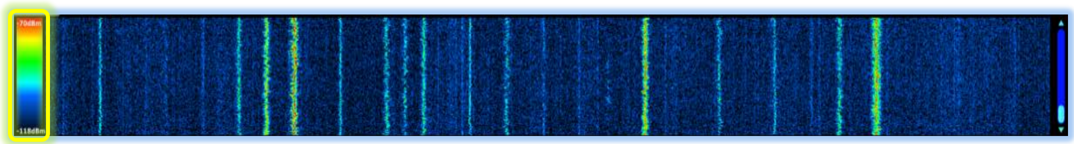
Please note that the annotation may not be visible if the selected colour palette is the same colour as the text value annotation.

Double clicking within the center or middle area of the | WFD | colour pallet causes the | WFD | to reset to the default (auto range) reference level setting, consistent with the RF Spectral Display (RSD).



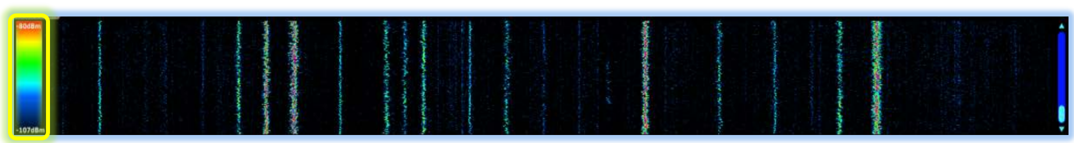
Independent WFD Reference Level Scaling | v1.35xx

The above image is an example of the default | WFD | display based on auto range settings.



Independent WFD Reference Level Scaling | v1.35xx

The above is an example of the adjusted | WFD | display, based on the technical operator's adjustment of the independent | WFD | reference level scaling feature.



Independent WFD Reference Level Scaling | v1.35xx

The above image is an example of the further adjusted | WFD | display, based on the technical operator's adjustment of the independent | WFD | reference level scaling feature.

Analytical Reference Level Offset (ARLO) ™

The ability to set the WFD to display only those signals at and above a certain threshold is fully supported within the software.

Left mouse clicks on the lower WFD reference level annotation results in a dynamically generated menu option list of relevant reference levels for selection by the technical operator.

Selecting a populated option, invokes the WFD to render only signal events at and above the | Analytical Reference Level Offset (ARLO) ™ | selected.

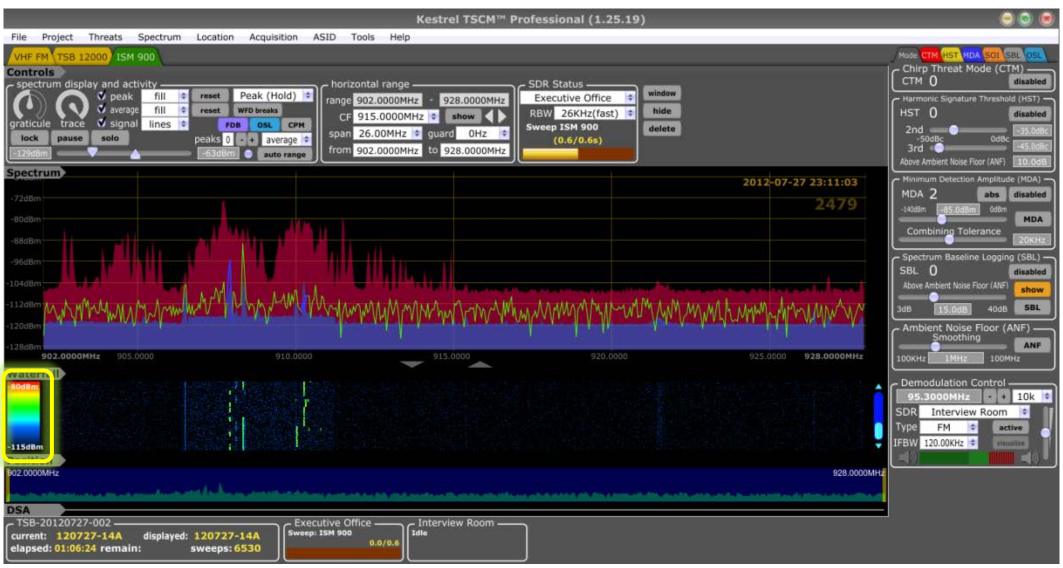
This feature is dynamically generated based on the auto range reference level and can any selected range value may be selected to address the technical operators display preferences.

WFD | Vertical Position

The WFD may be dragged to any vertical position order within the UI workspace by utilizing the mouse to | CLICK | HOLD |and | DRAG |, the WFD label tag to a new location within the UI vertical stack order.

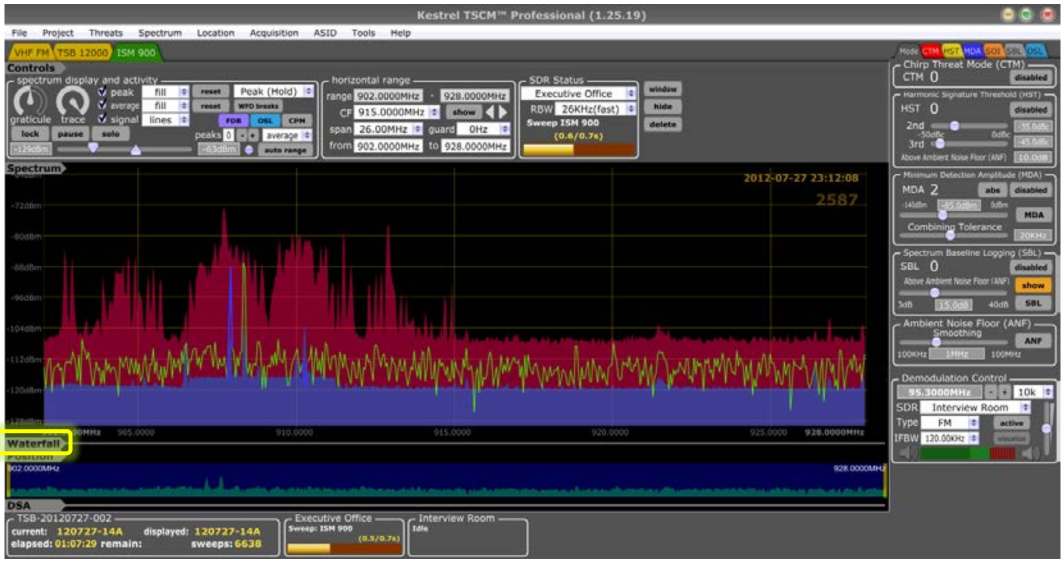
For example, the | WFD | may be relocated to below the RF Spectral Display (RSD) window.

Vertical drag and drop positioning is not a global control element, and only the current spectral window tab will be affected by operator input.



WFD Position | v1.35xx

The technical operator may also double mouse click the waterfall control tab, to hide the | WFD | display from view, giving priority to the other display control windows, during runtime and historical file review.



WFD Position | v1.35xx

Data collection continues to occur in the background, and is <u>not</u> interrupted when the WFD, is not currently displayed.

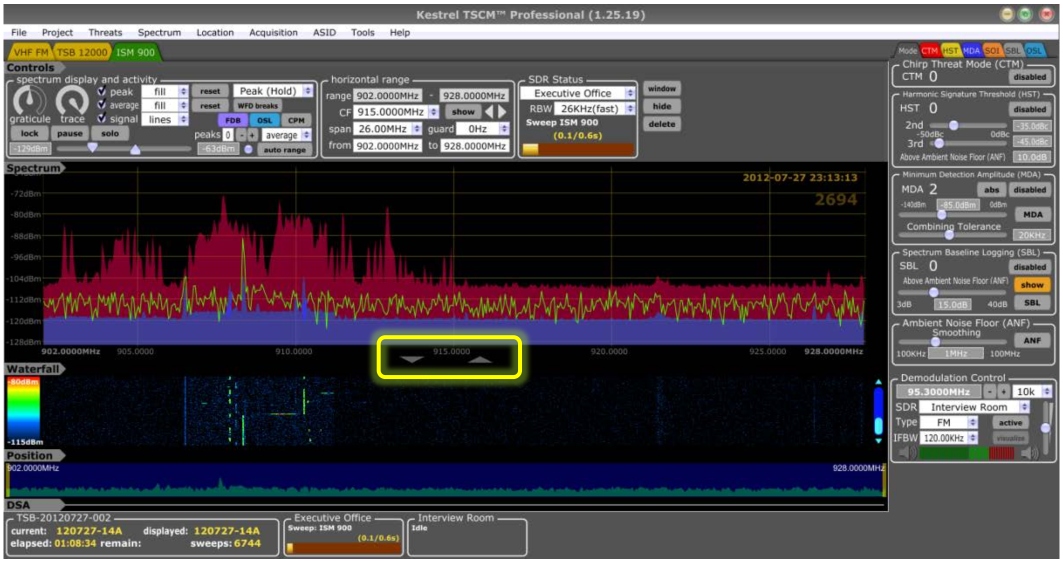
Hiding the WFD places greater emphasis, and technical operator focus, on the RF Spectral Display (RSD) window, which automatically fills the additional space previously occupied by the WFD window.

Double clicking the Waterfall Control | TAB |, a second time causes the WFD window to become visible again at the last operator drag / resize setting.

WFD Sizing Tabs

When the WFD is displayed, it can be dragged to a larger (or smaller) percentage of the display UI, utilizing the drag UP / DOWN tabs located just below or above the WFD display depending on actual position of the WFD, to reveal additional historical trace data, that may currently be displayed off screen.

Likewise, Live View Analysis (LVA) ™ can also be used to scroll backwards in time to view historical data.

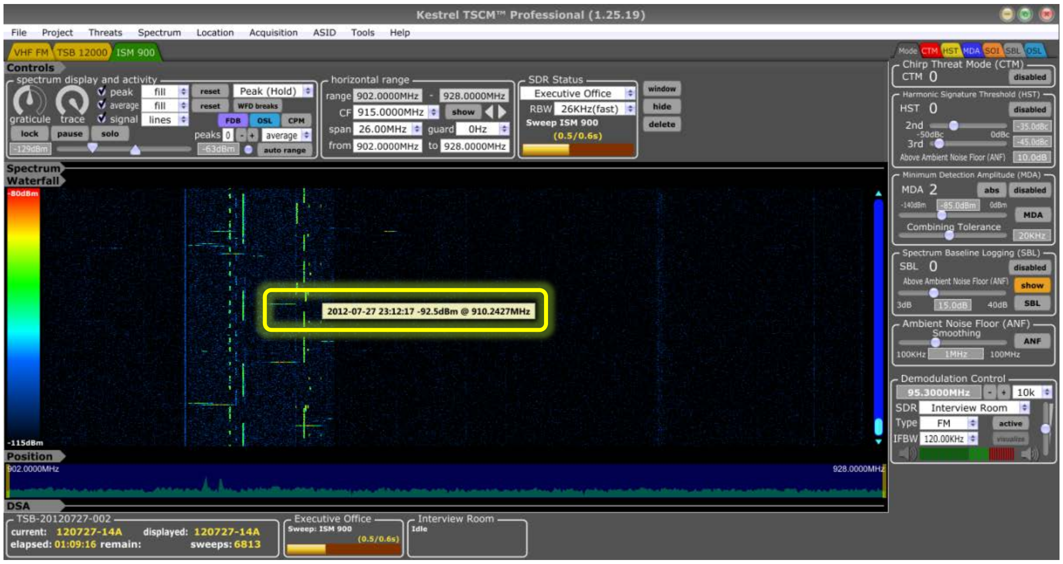


WFD Position | v1.35xx

Increasing the size of the WFD display area correspondingly decreases the size of the UI space that is available for the RF Spectral Display (RF), and other control windows within the vertical stack.

Mouse Functionality

As the technical operator moves the mouse cursor over the Waterfall Display (WFD), a text annotation flag will appear, and dynamically updates as the cursor is moved to various positions within the WFD window.



WFD Signal ID | v1.35xx

The dynamically populated pop up annotation, will display the date and time stamp of captured, amplitude (dBm), and the frequency of the historical signal event at the current cursor position, in real-time.

Image Capture (Alt [FN] - Print-Screen)

The ability to capture a screen image is supported within the Kestrel TSCM ® Professional Software, referred to as Image Capture Tool (ICT) ™, and also as a standard Microsoft Windows ™ based keyboard feature.

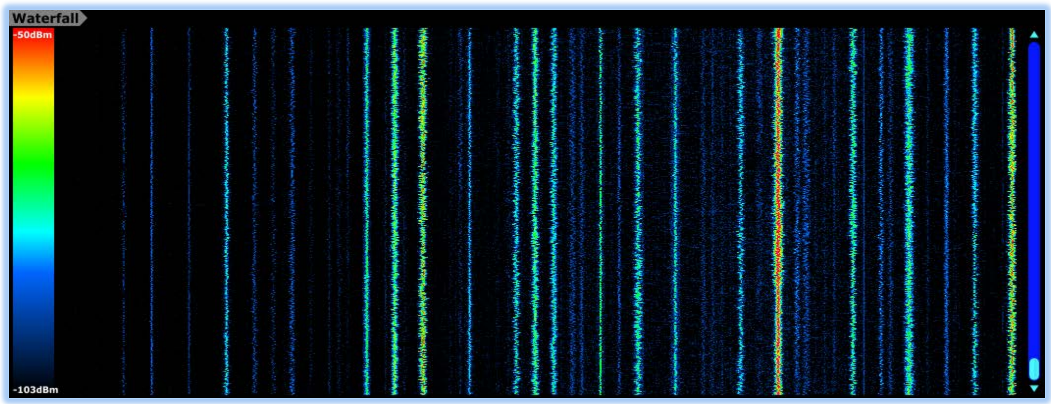
To capture the entire UI screen image in (.BMP) file format, the technical operator can utilize the keyboard based | ALT (or sometimes FN) | PRINT SCREEN | command.

The | ALT (or sometimes FN) | PRINT SCREEN | command, copies the entire currently selected UI onto the Microsoft Windows ™ clipboard, which in-turn may be directly pasted into a Microsoft Word ™ document or other suitable third-party application, that is capable of displaying images, such as Microsoft ™ Picture Manager.

The Windows "Snipping Tool" may also be utilized.

Image Capture Tool (ICT)

When the technical operator utilizes a right mouse click on the WFD window, a | SAVE IMAGE | menu dialog appears at the cursor position.



ICT | v1.39xx

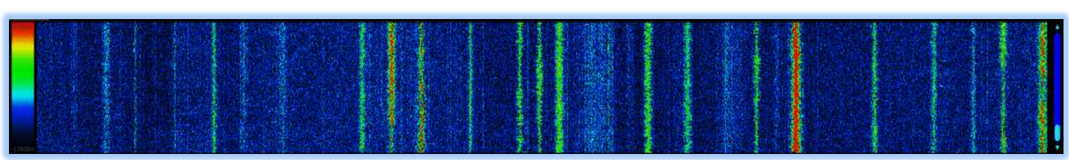
Selecting the | SAVE IMAGE | dialog button, results in a save file window being displayed.

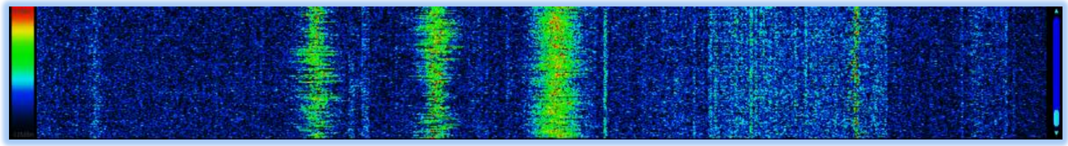
The default location will be the current Project File Directory, with a File Naming Convention (FNC), “waterfall_band_location.png”, where the “waterfall” indicates that that file is and image capture of the WFD, the “band” indicates the current spectral profile or custom “ROI” and “location” represents the current capture location.

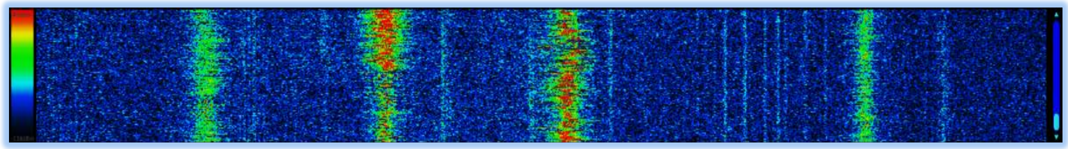
The Image Capture Tool (ICT) is unique in that it will save only the WFD as displayed at the time of capture, unless currently paused.

In the event that the entire application window is required to be captured, the operator can utilize the | SAVE APPLICATION WINDOW |, rather than the | SAVE IMAGE | menu option.

The example WFD image captures below, represent the default waterfall window size at different captured zoom factors.







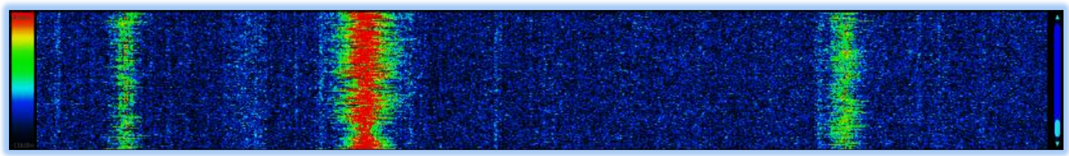


Image Capture Tool (ICT) | v1.39xx

The example WFD image captures below represent the default waterfall window size when the RF Spectral Display (RSD), is hidden from view at various zoom factors.

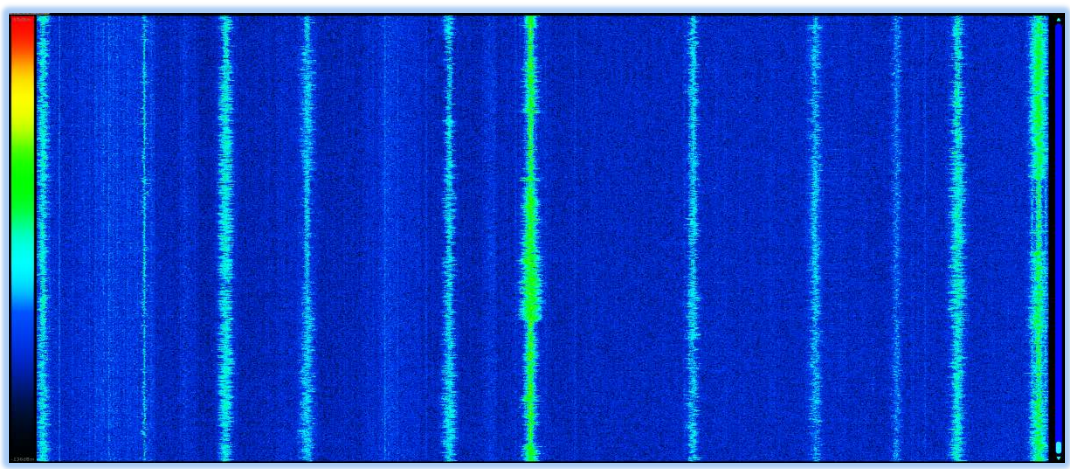


Image Capture Tool (ICT) | v1.39xx

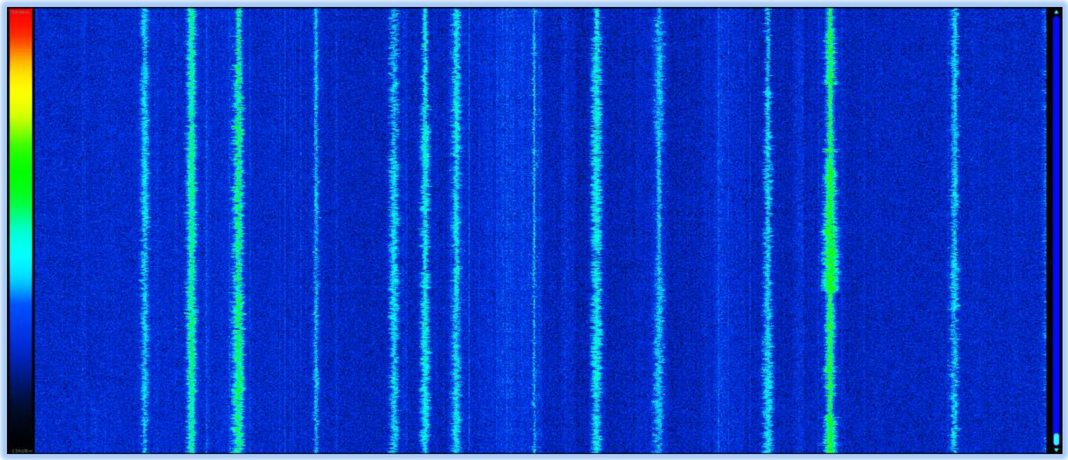


Image Capture Tool (ICT) | v1.39xx

The ability to display WFD data, utilizing the Positional Zoom Control (PZC) allows the technical operator to see any signal event clearly, utilizing the PZC feature.

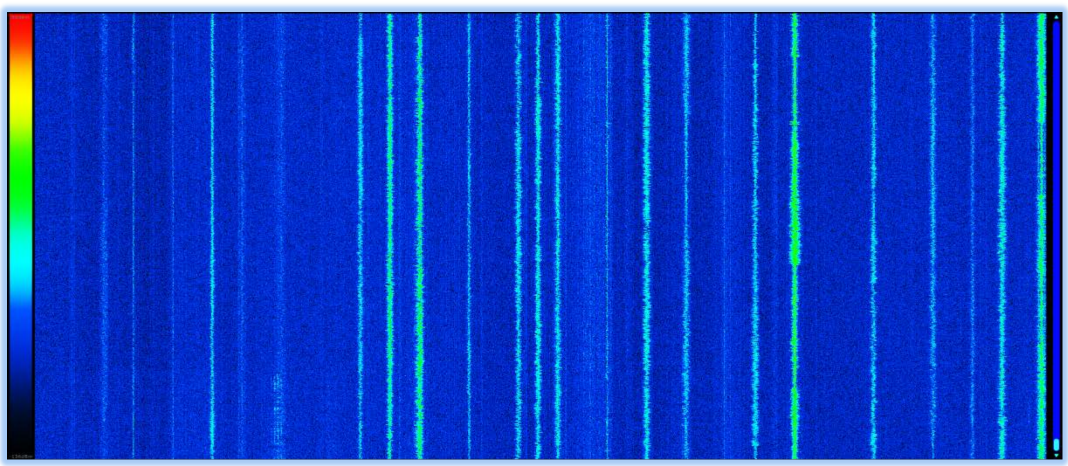


Image Capture Tool (ICT) | v1.39xx

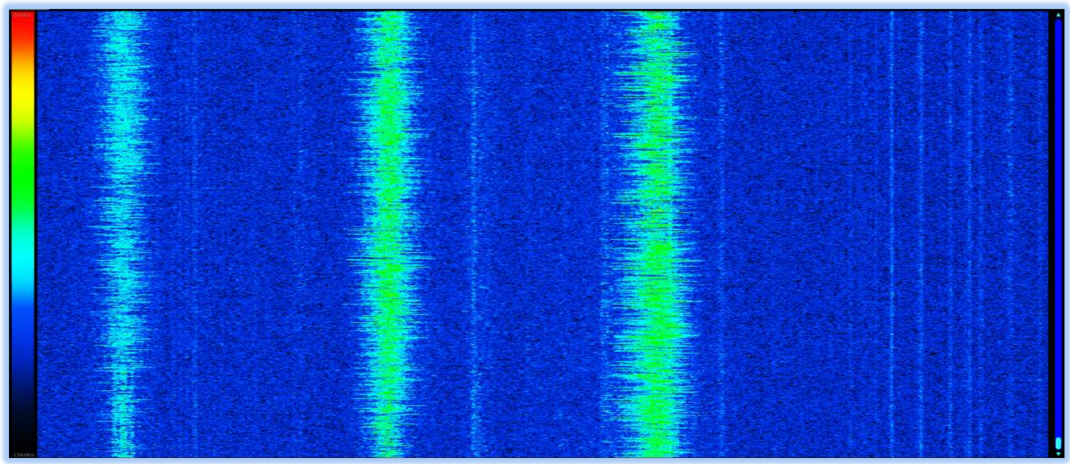
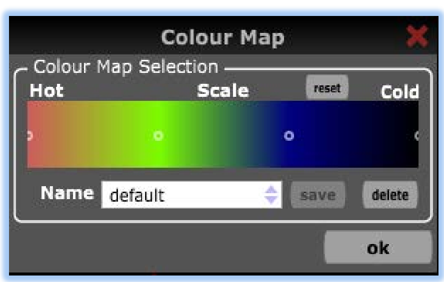


Image Capture Tool (ICT) | v1.39xx

Waterfall Colour Palette

The WFD reference level colour palette, contains a powerful operator defined | COLOUR MAP | editor, and profile builder.

The technical operator can access this the | COLOUR MAP | by a right mouse click on the WFD reference window.



WFD Colour Map | v1.39xx

The operator can | EDIT |, | SELECT | and | DELETE | existing colour map profiles, or | DEFINE |, new profiles.

The | COLOUR MAP | profile database, is transportable, and easily moved to another computer running the Kestrel TSCM ® Professional Software.

Waterfall Colour Profiles

The operator can define and save custom colour maps and select the profiles during runtime and post event analysis of historical project files.

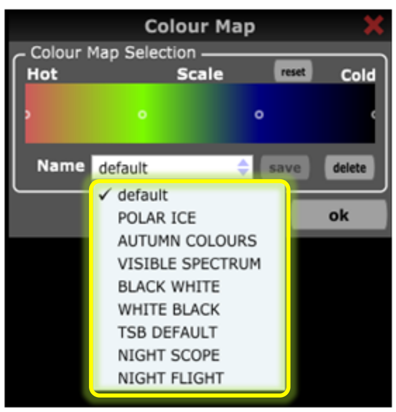
The colour map profile database file | COLOURMAP. KCM | can be copied and moved to another machine running the Kestrel TSCM ® Professional Software.

The default location for the | COLOURMAP.KCM | file is the | KESTREL SETTINGS | directory.

The | COULORMAP.KCM | is a not human readable and may be corrupted if the file extension is altered or changed.

The directory path for the | COLOURMAP.KCM | file is;

| C:\Users\Paul D Turner\AppData\Roaming\PDTG\settings\colourmap.kcm |, where the user "Paul D Turner", is substituted with the actual computer user.



Colour Map Profiles (Example) | v1.39xx

The technical operator can quickly select any existing | COLOUR MAP | during runtime, or post event analysis, as either an | ACCESSIBILITY | feature, or simply as an operational | PREFERENCE |.

The above image illustrates the ability of the technical operator, to define custom working | COLOUR MAP | PROFILES |, and access them within the application, or edit existing profiles, or save altered existing profiles, as entirely new profiles.

Colour Map | Profile Editor

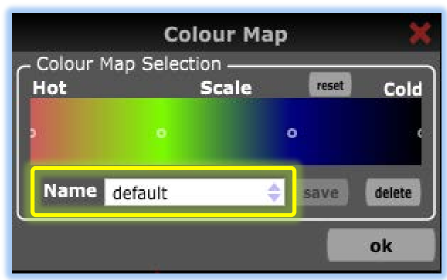
There are a number of uniquely combined functions exposed to the technical operator within the | COLOUR MAP | control window.

The following describes in some detail, the scope of the operator defined functionality for the colour map database editor.

The | COLOUR MAP | control window is accessed by a right mouse click, on the current waterfall reference level colour palette.

The | COLOUR MAP | editor will display and reference the default or current custom profile palette.

If no custom | COLOUR MAP | profiles have been defined by the technical operator, the "default" profile will display as illustrated below.

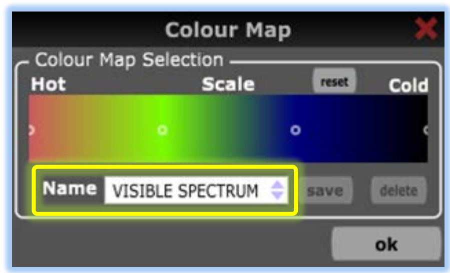


Colour Map Database Editor | v1.39xx

The technical operator can select another | COLOUR MAP | profile (if available), by selecting another available profile from the | NAME | combination box.

If no custom profiles have been defined and saved previously, the operator can either copy a | COLOURMAP. KCM | from another instance of Kestrel, or use the editor to edit, rename, and define a new custom profile.

The first step is to type a | NAME | of the new profile, such | VISIBLE SPECTRUM | and then edit the currently displayed colour map structure, to reflect the desired colour palette.



Adding a Custom Profile | v1.39xx

To edit the currently displayed colour map, there are three (3) tools available to modify the custom profile.

First, the small circles (markers) represent the current defined colour palette points.

Utilizing a right mouse click, on the circles (markers) invokes a palette colour selection window for that circles (marker) zone, as observed in the illustration below.

The | SCALE | capability allows the operator to move and adjust any of the circle (marker) zones to adjust the balance of the existing zones.

This process also can be used to remove all other circle (marker) point colour references and allow the operator to essentially start over and add new circle (marker) colour references.

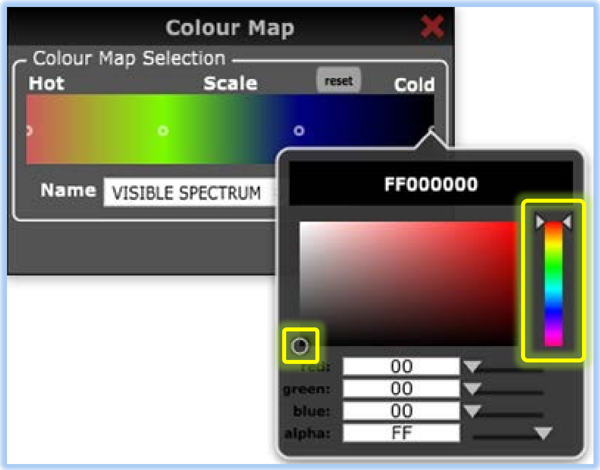
The | RESET | button can be used to reset the colour palette, back to the state, prior to making any changes, prior to pressing the | SAVE | button.

Once the technical operator has created the desired | COLOUR MAP |, it is essential to press the | SAVE | button.

Closing the | COLOUR MAP | window, without pressing the | SAVE | button, will result in the profile not being saved to the database.

The | DELETE | button is used to permanently remove the selected | COLOUR MAP | from the database.

Don't worry about getting the desired effect precisely right on the first attempt, as you can save the new profile, test it out, and then open the profile again, to further refine the | COLOUR MAP |, as desired.



Editing the Colour Map | v1.39xx

The | HEX CODE RGB | can be edited as desired to define the colour range for the selected circle (marker) selected.

This process is repeated for each of the defined circle (marker) points visible on the palette.

The add a new colour palette zone, the operation can apply a left mouse click to the right or left of the existing circles (markers), to enable a new colour zone.

The | HEX CODE RGB | palette editor will display and the operator can edit the new zone accordingly.

Multiple Layer Waterfall Display

The RDSA ™ feature provides for a powerful multiple receiver overlay of simultaneous trace level spectra, including (peak, average, and signal), and the ability to overlay narrow bandwidth bands, and sub-bands within a wide bandwidth spectrum, from another independent receiver.

The ability to overlay multiple receiver waterfall data is supported and adds an entirely new capability within the Kestrel TSCM ® Professional Software.

Kestrel Super Trace (KST) ™ | Plot

The technical operator may be faced with days, weeks or months of collected waterfall data rendered, during long-term collection.

This, unfortunately requires a trace by trace operator assisted analysis, which can be extremely time consuming, and means working with tens of thousands of traces, and files sizes well beyond those easily handled by typical laptop computers, or the OS system block memory allocation.

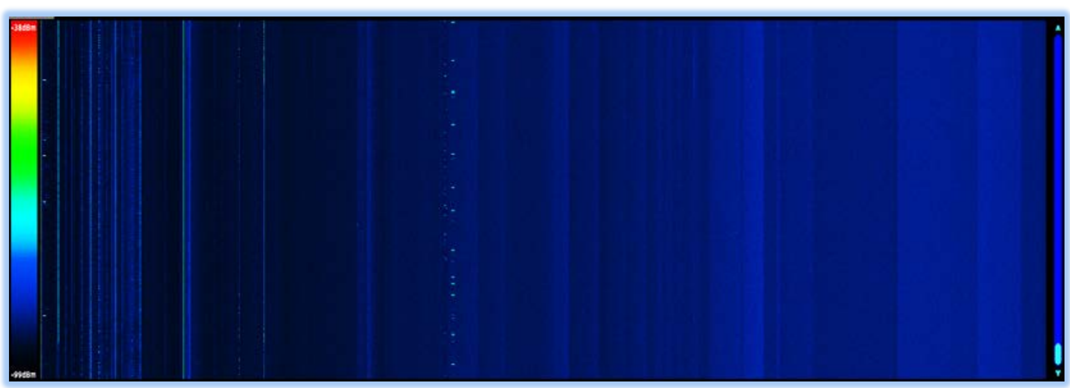
The extent of this problem, is directly affected by the communication method of the receiver, as well as the speed of the receiver, and definitely the capture parameters.

Illustrated below, are two (2) separate Waterfall Display (WFD) plots.

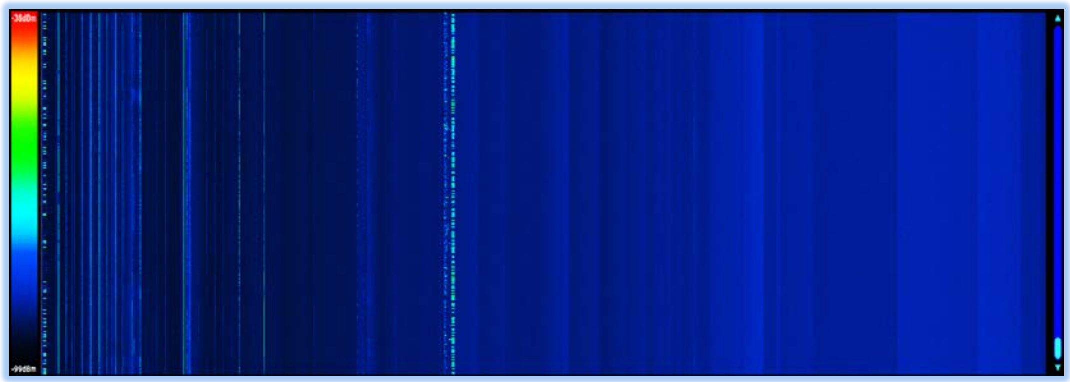
The first representing the typical WFD view, when signals, periodic and continuous, are captured on a trace by trace over a period of time.

The second plot represents a time compressed WFD rendering, referred to as Kestrel Super Traces (KST), which are displayed based on an (n=???) algorithm which captures the ambient peak data from all normal traces, before writing as one Kestrel Super Trace (KST).

For example, (n=20), represents the software's capability of capturing all of the peak trace data for nineteen (19) regular traces, and writing this as a single trace.



Normal Trace WFD Plot | v1.39xx



Kestrel Super Trace (KST) Plot | v1.39xx

Time compression of the waterfall display brings clarity to the various energy profiles as observed above, particularly for periodic signal events.

Kestrel Super Trace (KST) Plot | v1.39xx

The above image provides a split view (compressed / uncompressed) of the Kestrel Super Traces (KST) ™ Vs the Real-Time periodic spectra.

The clarity of the compressed energy pattern, clears shows the advantages realized when burst, periodic signal events need to be identified, and analyzed during long term deployment.

Analysis and Review

The waterfall compression is actually taking place at the write storage level when this feature is enabled.

However, the WFD display will continue to render all spectrum data, on a trace by trace basis during collection, and remain visible with a buffered environment.

The file storage footprint is significantly reduced, as the amount of data that needs to be analyzed, is minimized, and the computer memory block allocation is considerably smaller, making the rendering process more efficient.

Waterfall Buffer Clear (WBC) ™

The | WBC | button provides the ability to immediately (permanently) clear or remove any unsaved waterfall trace data that remains within the screen display memory buffer during runtime, or after the collection process is paused.

When the technical operator presses the | WBC | button, this invokes the Waterfall Display (WFD) to enter the (n=???) display mode and immediately removes the all unsaved data, just as if the application and project were shut down and restarted.

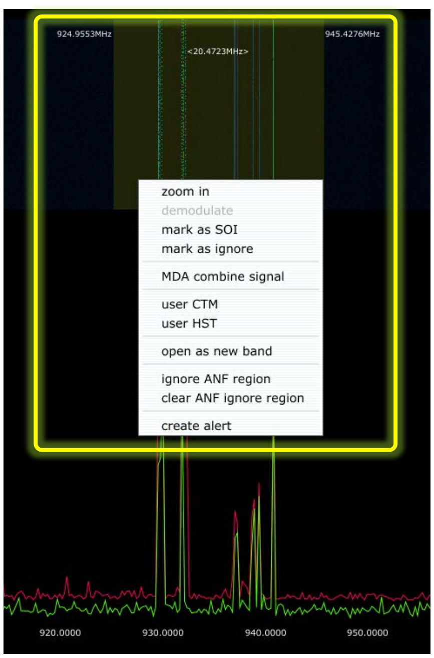
The WFD will now only display the | Kestrel Super Traces (KST) ™ |, along with the actual number of traces and (n) value, displayed on the Graticule.

The WBC button will automatically strobe and clear the buffer, when the technical operator switches the DSA collection location during runtime collection.

WFD Zoom Control

The Waterfall Display (WFD) | ZOOM CONTROL | feature is accessed by a left mouse click, and dragging a shaded box over the desired zoom area of the waterfall display.

On mouse click release, select the | Zoom In | option on the displayed menu structure.

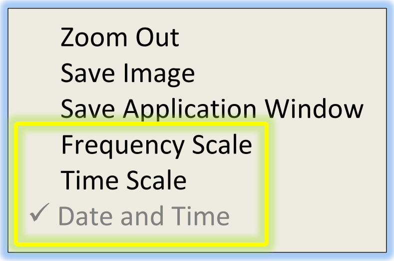


Waterfall Zoom Control | v1.39xx

Selecting the | ZOOM IN | menu option results in a dynamic zoom ratio depending on the bandwidth selected by the technical operator.

WFD Frequency + Date + Time Overlay

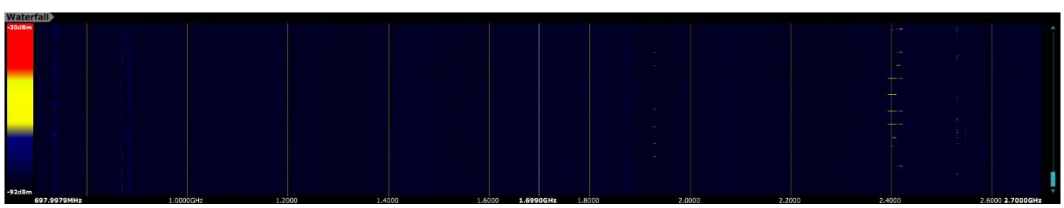
The ability to enable a frequency scale overlay and a date and time overlay permits the technical operator to visually bracket RF energy events across the Waterfall Display (WFD).



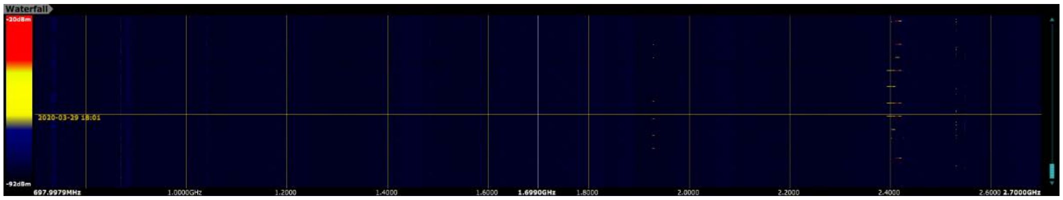
Waterfall Display Menu Options | v1.40xx

Once the date and time are displayed (default), the date can be disabled, if desired and the time will render a waterfall marker for each minute of runtime capture.

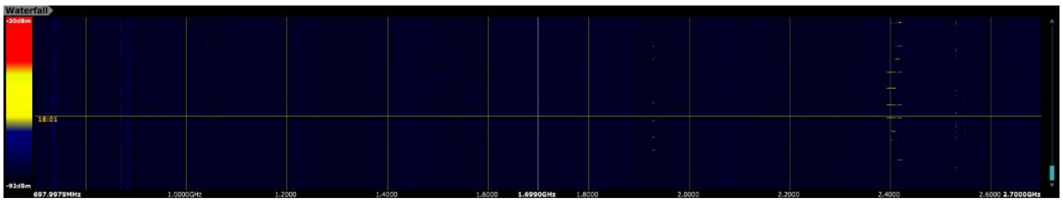
Waterfall (Default View) | v1.40xx



Waterfall (Frequency Scale) | v1.40xx



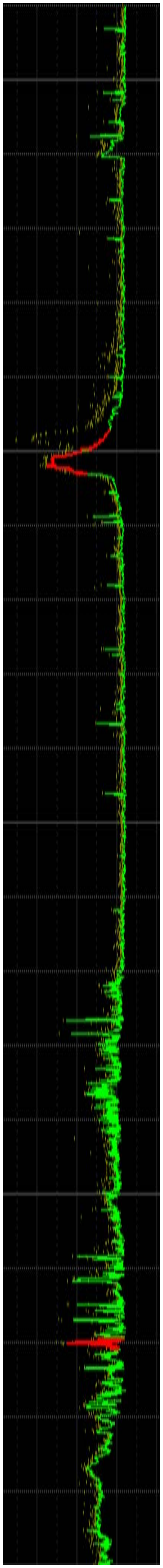
Waterfall (Frequency + Date | Time Scales) | v1.40xx



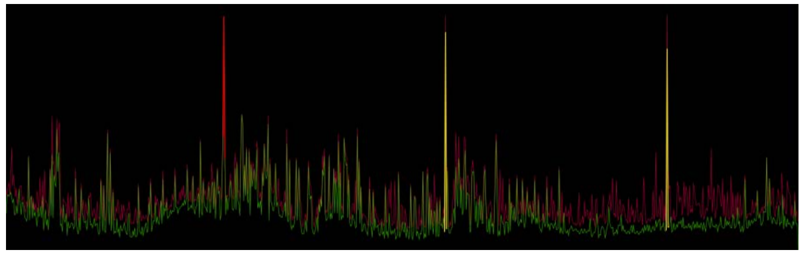
Waterfall (Frequency + Time Only Scales) | v1.40xx

Intentionally Left Blank

Intentionally Left Blank



Chapter 9



Live View Analysis (LVA) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Live View Analysis (LVA) ™

Live View Analysis (LVA) ™ is a major technological achievement in advanced workflow management that was specifically developed for the Kestrel TSCM ® Professional Software application.

The LVA ™ functionality provides the technical operator with the unique ability to immediately review historical RF Spectral Display (RSD), and Waterfall Display (WFD) trace data, trace by trace (based on write management) decimation, while the software continues uninterrupted collection in the background.

The technical operator may also utilize the Kestrel TSCM ® Professional Software Live View Analysis (LVA) ™ feature during post analysis review to "playback" and view a historical project file in full detail by opening a KPF ™ project, within the application.

Post event analytics, can be accomplished in near real-time easily and seamlessly, should the technical operator observe a Signal of Interest (SOI) event occur within RF Ambient Spectrum Environment during runtime.

The technical operator can immediately activate LVA and view any signal event at the individual trace level in both full ROI, and at any given zoom factor.

The LVA ™ Control Group is located on the right side of the WFD and consists of UP (back in time) and DOWN (forward in time) navigation buttons; a navigation slider bar and a Trace Marker Reference (TRM) overlay that displays whenever Live View Analysis (LVA) ™ is currently active, as an indicator of the individual WFD trace that is currently displayed on the RF Spectral Display (RSD).

Whenever LVA ™ is active, either by accident, or as a deliberate action by the technical operator, the display TRM ™ will move to the center of the Waterfall Display (WFD) and stop updating, both the Real-Time Event (RTE) and Waterfall Display (WFD) elements, however, collection is still occurring in the background.

This allows the technical operator to utilize the | FORWARD | and | BACKWARD | analysis capability to b utilized to review any Signal of Interest (SOI), or potion of any Range of Interest (ROI) at the trace level.

As an operator visual indicator and reminder that Live View Analysis (LVA) ™ is currently | ACTIVE | the backward and forward arrow flash, along with the center slider bar graphic control.

Analysis and Review Mode (ARM) ™

See Chapter 15

Project and File Management

The Analysis and Review Mode (ARM) ™ provides significant technical operator flexibility and programmability, while providing for a tremendous measure of active file size management during runtime collection.

The technical operator can deploy the system in a basic Spectrum Analyzer (SA) mode of operation, without writing any spectrum, trace, or waterfall data to the local, or network storage device, unless specifically activated on demand by the operator.

With this mode of operation, only the display buffer data is available for review in real-time.

There is a record | REC | button located on the | Spectrum Display and Activity | control group that | STARTS | and | STOPS | the write process "on-the-fly", permitting the operator to record only the desired spectral events.

The technical operator may initiate the record | START | and | STOP | the write process at any time, on demand, during runtime.

When a new spectrum window is defined during runtime, the technical operator may disable | RECORD | capability for any specific spectrum bands, utilizing the | NEW SPECTRUM | dialog window.

LVA ™ Navigation | UP Tab (Backward in Time)

The normal default display view is the Real-Time Event (RTE) ™ trace, actively being displayed on the user-interface with recent historical waterfall data being displayed based on the size of the WFD window area available on the UI, or as manually selected by the technical operator.

The mouse wheel can be utilized to navigate back in time when the cursor is placed over the WFD and allows the technical operator to review WFD data on a trace by trace basis in active LVA ™ mode.

Adjusting the mouse wheel | FORWARD | activates the LVA ™ feature and results in the RF Display (RSD) ™ displaying recent historical trace data, back to the first captured trace.

The | FORWARD | and | BACKWARD | arrows and slider bar tab controls flash | RED | to indicate that LVA ™ is currently active.

When the technical operator presses, or selects the LVA ™ navigational | UP | button a horizontal | Trace Reference Marker (TRM) | overlay will appear on the WFD indicating the actual historical trace level information on the user-interface, RF Spectral Display (RSD) window, based on the precise DATE / TIME stamp that the historical trace was captured.

Embedded historical DATE / TIME stamps are encoded and displayed on the RSD for each LVA ™ trace, subject to any operator defined write management decimation value selected.

Pressing the | WBC | button, will remove any unsaved Waterfall Display (WFD) data from being displayed as part of the Live View Analysis (LVA) ™ profile.

The WFD display may continue to advance or may become stationary depending on the actual position the | Trace Reference Marker (TRM) | overlay, within the WFD display window.

The Waterfall Display (WFD) will typically continue to progress until approximately one half of the waterfall display window area, as traversed by the horizontal | Trace Reference Marker (TRM) | overlay.

The RF Spectral Display (RSD) and Waterfall Display (WFD) will remain stationary anytime that the horizontal | Trace Reference Marker (TRM) | overlay is visible on the WFD window, and displays the historical trace data, based on the DATE / TIME stamp indicated on the UI.

The technical operator can simply move the LVA ™ slider bar, to activate the LVA ™ mode, or can utilize the UP / DOWN navigational buttons to move in small steps, to view the historical trace details.

The technical operator may also utilize the mouse wheel to navigate LVA ™ by hovering over the navigational slider bar area, or directly on the WFD display window.

TIP: Depending on the actual file size (number of write traces present), amount of unsaved (unavailable) data, host computer processing capability, and other factors, including the amount of Random Access Memory (RAM) available, the WFD trace data may take some time to load from the hard-drive file, render, display, or update. Live View Analysis (LVA) ™ can place significant demands on the host computer processor, and available memory, particularly when active collection is progressing in the background at high-speeds, and wide capture bandwidths.

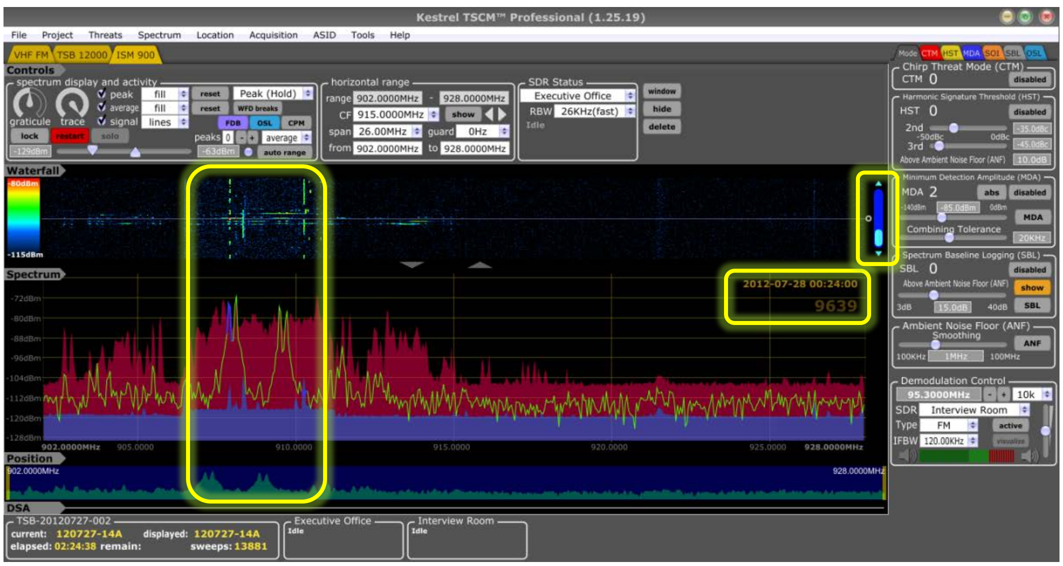
Trace Reference Marker (TRM) | Overlay

The horizontal | Trace Reference Marker (TRM) | overlay appears on the WFD when the technical operator utilizes the slider bar control or the | UP | navigational button to enter the active LVA ™ mode.

The following is a series of example Live View Analysis (LVA) ™ screen plots which illustrate this powerful tool.

The technical operator has observed an unknown periodic Signal of Interest (SOI) event that appears to be occurring within the target area.

Although, the Kestrel TSCM ® Professional Software is actively sweeping the Range of Interest (ROI) in the background, the technical operator is able to utilize LVA ™ to review and analyze the potentially hostile signal event during operator assisted collection.

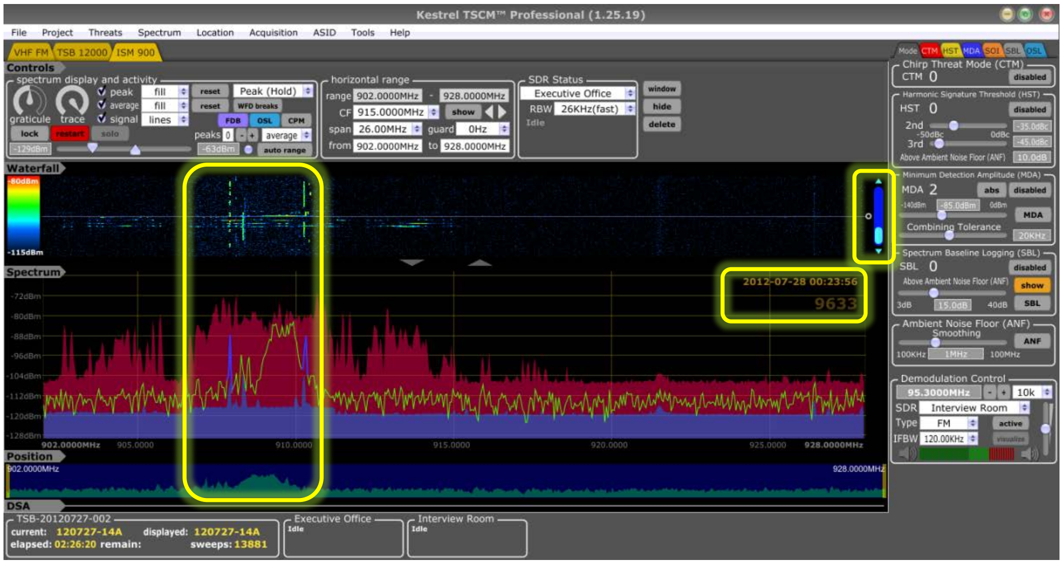


Live View Analysis (LVA) | v1.35xx

The technical operator has moved the LVA ™ navigation control | BACKWARD | in time to view an unknown signal event at 2012-07-28 00:24:00 (Trace 9639) as indicated by the Trace Reference Marker (TRM) ™ overlay and the RF Spectral Display (RSD), DATE / TIME stamp.

The RF Spectral Display (RSD) ™ reflects the ambient RF spectrum environment at the specified | DATE | TIME |, as currently displayed on the UI.

Utilizing the LVA ™ navigation control, the technical operator moves | BACKWARD | to review the next signal event as indicated by the | DATE | TIME | stamp displayed as 2012-07-28   00:23:56 (Trace 9633) on the UI.

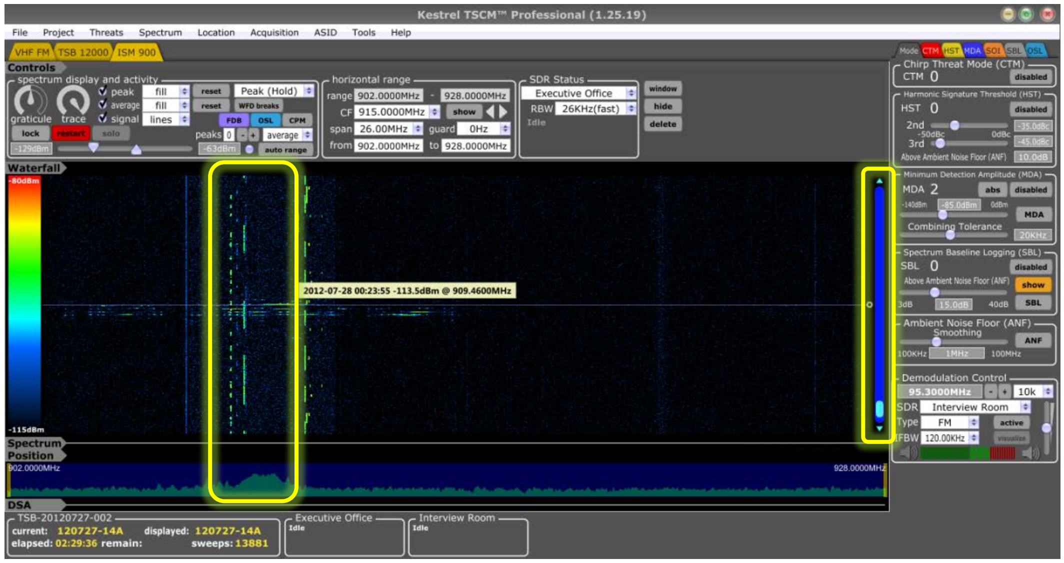


Live View Analysis (LVA) | v1.35xx

The following LVA ™ plot demonstrates the ability of the technical operator to display historical WFD data, to gain a better overview of the observed signal event.

It is an easy task for the technical operator to gain valuable insight about the Signal of Interest (SOI) when utilizing the WFD, as part of the analytical process.

The following plot illustrates the technical operator's ability to expand the WFD space on the UI, and hide the RSD, to establish greater focus on the WFD, for analysis.



Live View Analysis (LVA) | v1.35xx

When the RF Spectral Display (RSD) is displayed as a static window in LVA TM mode, the technical operator can review the historical data for the specific | DATE | TIME | as indicated on the RF Spectral Display (RSD) status display, including the actual number of runtime traces, and write management (decimation) traces captured, and the actual run time.

The technical operator can utilize the | Image Capture Tool (ICT) TM | to quickly capture and save a (.PNG) image, for further analysis, or to facilitate session report generation.

LVA TM is a powerful TSCM specific feature that can be utilized by the technical operator to immediately review past spectral events, such as intermittent signals, burst events, and is used extensively to capture screen shots of specific signal events in real-time, and during post analysis, and review.

LVA Navigation | DOWN Tab (Forward in Time)

This control has the same functionality as the LVA Navigation | UP | Tab.

Utilizing the mouse wheel to navigate | FORWARD | in time, when the cursor is placed over the WFD, is fully supported and allows the technical operator to review WFD data on a trace by trace basis.

Adjusting the mouse wheel | BACKWARD | in time activates the LVA feature.

The | FORWARD | and | BACKWARD | arrows and slider bar control, flash | RED | to indicate that the LVA ™ mode is currently active.

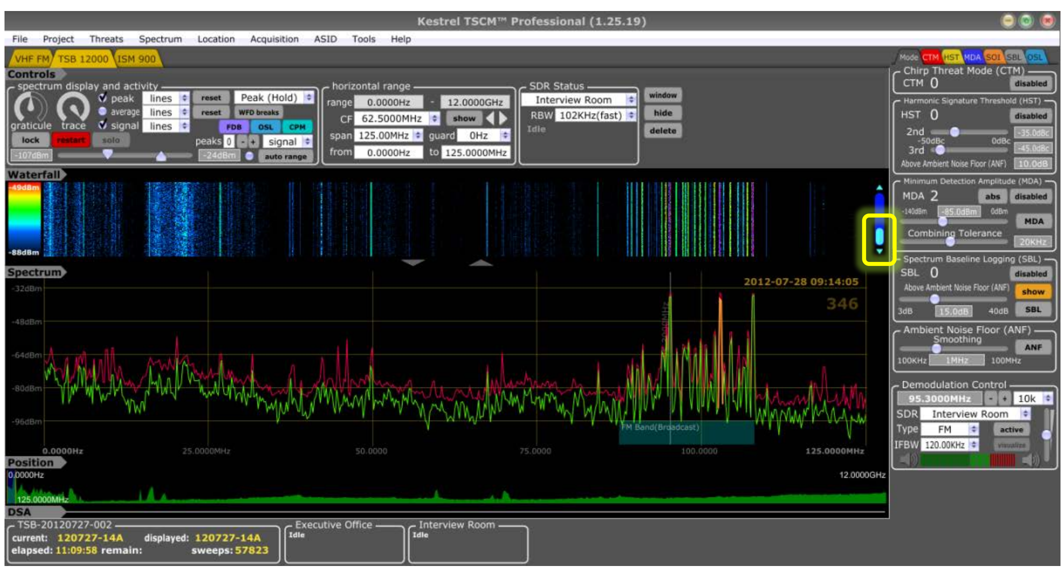
TIP: The technical operator must drag the LVA ™ navigation bar all the way down to the default position, to restore and observe normal display activity of real-time signal events.

LVA ™ | Slider Bar

The LVA ™ Slider Bar allows for larger incremental adjustments when large portions of the waterfall data need to be reviewed by the technical operator.

Given the moderate processing and memory demands involved in rendering the Waterfall Display (WFD) trace data, rendering may take a short time to update when LVA ™ is being utilized with vigor, particularly during runtime, on limited specification computing platforms.

This issue may also prove more prominent when the host computer has limited graphics processing ability.



Live View Analysis (LVA) | v1.35xx

The above image illustrates the real-time spectral and waterfall activity, as the navigational slider bar is currently set to the default position.

The | DATE | TIME | stamp and capture time, for the last competed sweep (Trace 346) is also displayed, assuming the collection has been stopped.

Live View Analysis (LVA) | v1.35xx

The technical operator can utilize the LVA ™ Slider Bar | BACKWARDS | in time to review WFD data on a trace by trace basis.

The currently displayed LVA ™ position is (Trace 270).

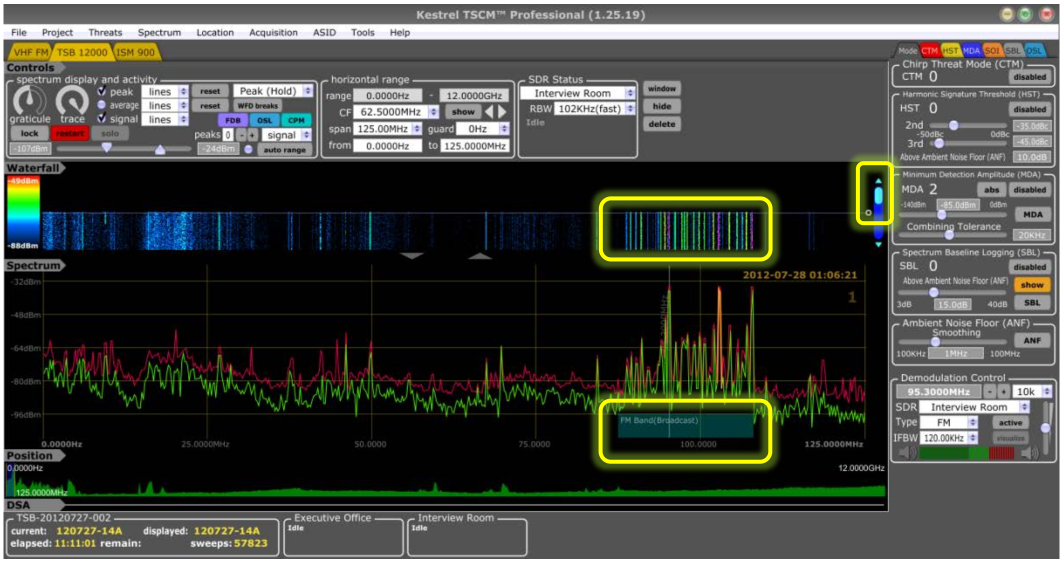
The above image illustrates the ability to display a Channel Profile Mask (CPM) ™ for the FM Broadcast band.

Moving the slider all the way to the bottom resets and locks the display back to a real time display mode.

During Live View Analysis (LVA) ™ the collection process continues uninterrupted and is available for review by the technical operator at any time utilizing the LVA ™ feature.

All display and analysis functionality, including the dimmer controls, spectral trace controls, display options, and Positional Zoom Controls (PZC) are fully supported, and functional in LVA ™ mode.

The technical operator can adjust any aspect of the visual display parameters and utilize the Image Capture Tool (ICT) to save a (PNG) file of the currently displayed, static spectral of waterfall LVA ™ view or signal event.



Live View Analysis (LVA) | v1.35xx

The above image illustrates the WFD and RSD display in LVA ™ mode at the collection starting point, described as 2012-07-28 01:06:21 (Trace 1).

The technical operator is currently displaying the SOI related Spectral Marker Flags, Real Time Event (RTE) (Line) trace, and the Peak Envelope Capture (PEC) (Line) trace.

The Channel Profile Mask (CPM) ™ for the FM Broadcast band is currently displayed.

Spectral Marker Flags

By default, the Kestrel TSCM ® Professional Software | Spectral Marker Flags | are actively displayed for any automatic, or manual capture of a signal event, on any of the signal, or threat lists, including operator defined Signals of Interest (SOI) entries.

This is a unique Kestrel feature, and significantly enhances the situational awareness of the technical operator.

The technical operator can HIDE / SHOW any combination of the | CTM | HST | MDA | SOI | SBL | and | OSL | Spectral Marker Flags by accessing the | SPECTRUM | menu option list, or for the Operator Signal List (OSL) ™, pressing the OSL ™ button.

Show WFD Breaks | Time Gaps

Identifying breaks, or time gaps within the data collection structure, is an essential capability fully supported in the Kestrel TSCM ® Professional Software.

Breaks can occur during | Single Receiver Operation (SRO) | when the technical operator activates the demodulation process, or when collection is paused for any other reason during deployment, leaving invisible time gaps in collection difficult to identify.

Active programming of the Activity Scheduler or Project Scheduler for multiple Start / Stop events will also cause breaks in collection, resulting in time gaps, and loss of continuity of data.

Tactical, analytical, and legal reasons exist, and therefore, the technical operator must be aware of any time gaps during the collection process.

During | Dual Receiver Operation (DRO) ™ | Multiple Receiver Operation (MRO) ™ | and the "on-the-fly" dynamic spectrum "hand-off" process, identifiable breaks occur as the active spectrum "hand-off" completes, with varying time gaps from a few mSec to several seconds, depending the collection hardware and current runtime task.

The continuity of the Waterfall Display (WFD) prevents the technical operator from easily identifying breaks, visually during runtime, or post analysis review, due to the continuous nature of the waterfall rendering at the trace level.

The Kestrel TSCM ® Professional Software provides a means of identifying any breaks, or time gaps, within the collection process that occur for any number of deployment reasons.

The | WFD BREAKS | button is located on the | CONTROLS | SPECTRUM DISPLAY AND ACITIVITY | control group.

When the | WFD BREAKS | button is active, a horizontal overlay will appear on the Waterfall Display (WFD) at the precise point of each specific break, or time gap in the continuity of data.

Utilizing | Live View Analysis (LVA) ™ | the technical operator can quickly determine the precise time stamp detail and trace number of where each specific break in continuity of the data collection process occurred and determine the significance of the identified time gap.

Utilizing the LVA ™ navigational controls the technical operator is able to determine, and / or verify, all breaks, or time gaps, in the data collection process as illustrated in the following series of example LVA ™ plots.

Show WFD Breaks | v1.35xx

The above example illustrates the UI in LVA ™ mode with the | WFD BREAKS | button deactivated (GRAY).

The technical operator is currently navigating | BACKWARD | in time during post analysis review.

Show WFD Breaks | v1.35xx

The above example illustrates the LVA ™ mode with the | WFD BREAKS | button as activated (ORANGE), by the technical operator.

A break reference overlay will display at each break in the data collection process providing the technical operator with a visual indicator.

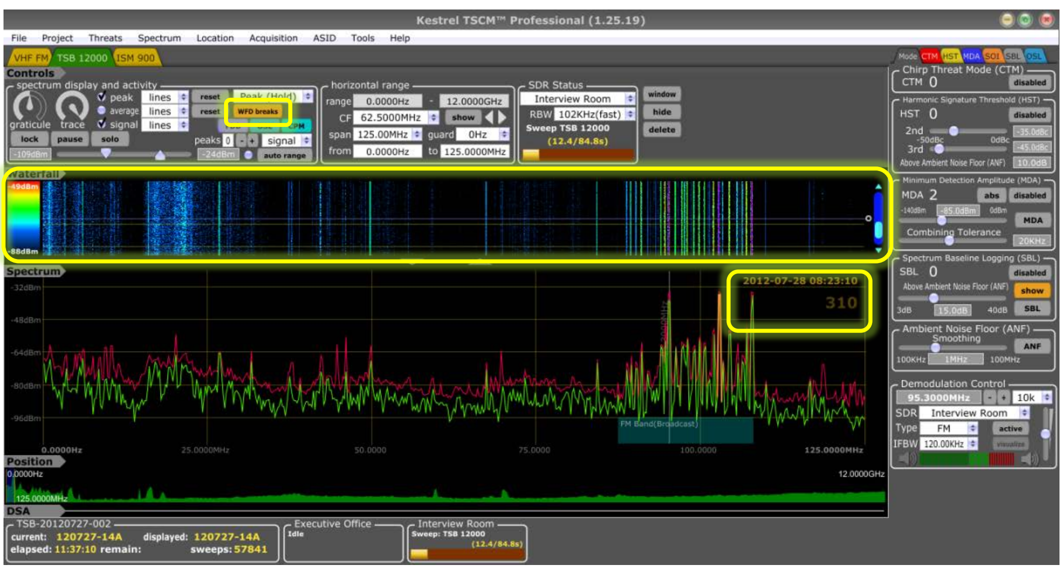
Time gaps can be seconds, minutes, hours, or days; however, each will display the same from a visual perspective with consecutive trace count references.

Show WFD Breaks | v1.35xx

The technical operator has navigated back in time to 08:03:21 identified as (Trace 296) on the UI.

Show WFD Breaks | v1.35xx

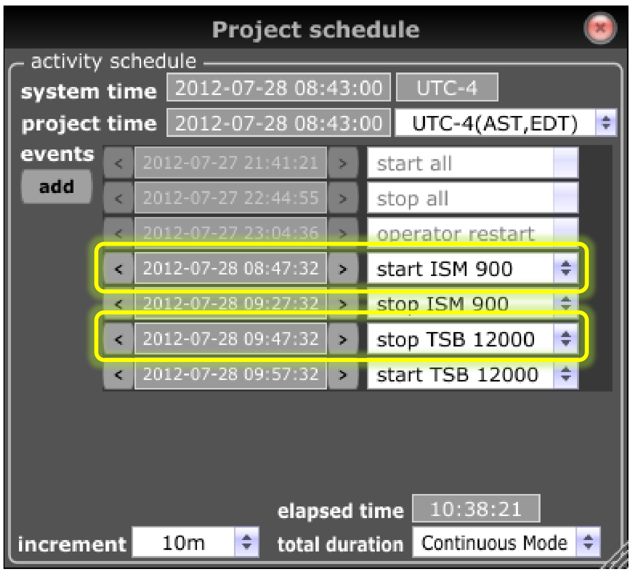
As the technical operator moves | FORWARD | in time to 08:50:03 identified as (Trace 329) on the UI, the DATE / TIME stamp provides a reference when the Trace Reference Marker (TRM) directly intersects the break reference overlay.



Show WFD Breaks | v1.35xx

As the technical operator moves | BACKWARD | in time to 08:23:10 identified as (Trace 310) on the UI, the DATE / TIME stamp provides a reference when the Trace Reference Marker (TRM) ™ directly intersects the break reference overlay and can determine the precise time gap within the collection process.

The technical operator can also account for Project Scheduler time gap in data collection due to active programming of the Activity Schedule feature for this spectrum band as illustrated in the following Project Schedule dialog window.



Project Schedule | v1.35xx

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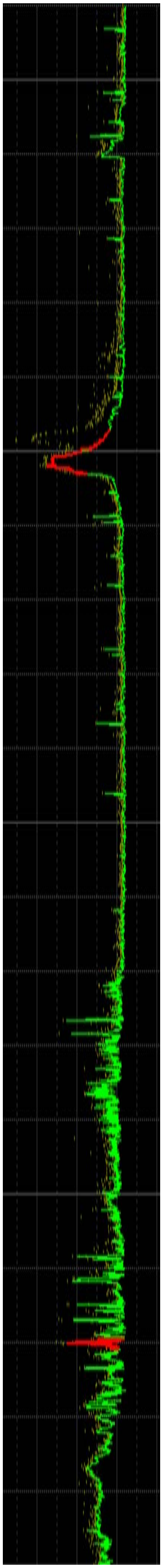
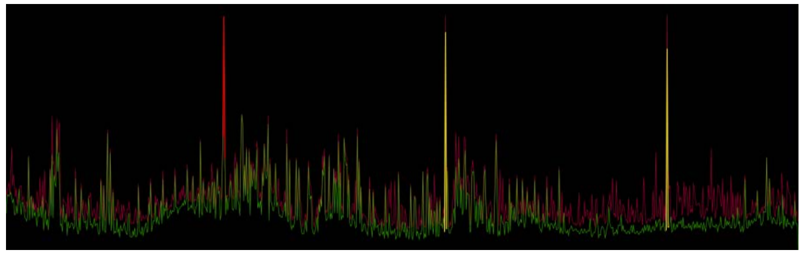


Chapter 10

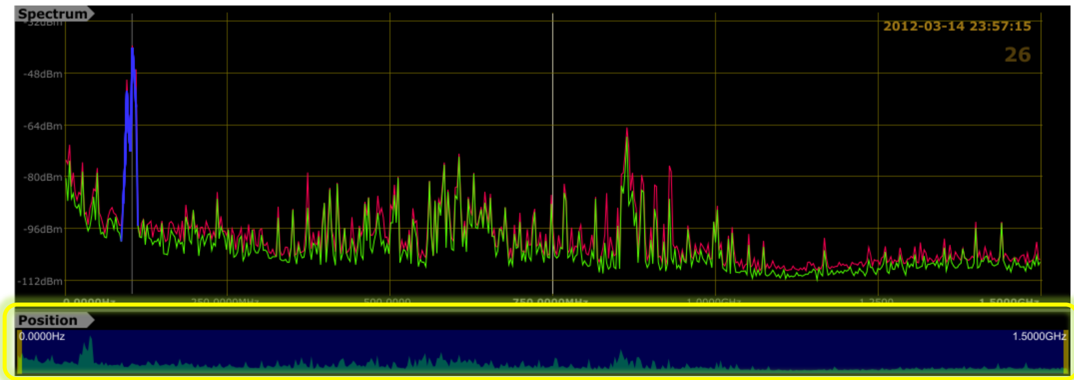
Positional Zoom Control (PZC)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Positional Zoom Control (PZC) ™

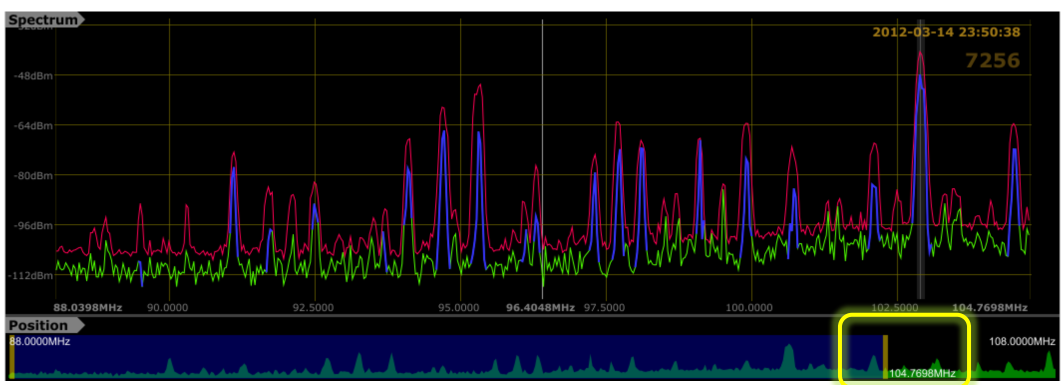
The Positional Zoom Control (PZC) ™ and the ability to continuously pan and zoom provides the technical operator with a very powerful spectral navigation tool that contributes significantly to the Kestrel TSCM ® Professional Software workflow management and discrete signal analysis.



Zoom (0%) | v1.35xx

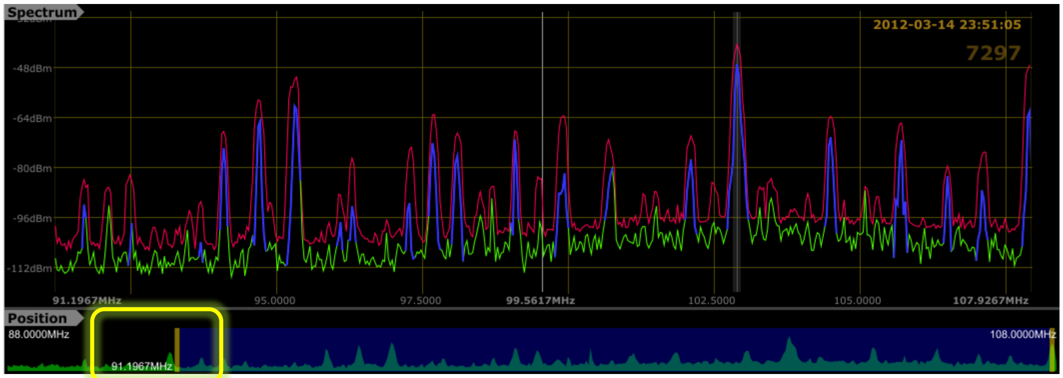
Our spectral zoom functionality allows the technical operator to utilize the mouse wheel to zoom IN and OUT within the actual spectral display window and continuously Pan and Zoom during runtime and when reviewing historical project files.

Assuming that the full ROI is displayed, placing the cursor on the LEFT side of the spectral display window and rotating the mouse wheel backward causes the window to zoom RIGHT focusing attention on the lower part of the ROI.



Zoom Right | v1.35xx

Assuming that the full ROI is displayed, placing the cursor on RIGHT side of the display and rotating the mouse wheel backwards causes the window to zoom LEFT focusing attention on the upper part of the spectrum.



Zoom Left | v1.35xx

The cursor may be placed at any point on the spectral display and the mouse wheel utilized to focus the zoom point at any specific location within the spectral display window.

The zoom affects both the RF Spectral Display (RSD) and the WFD window.

TIP: It may be necessary to adjust the reference level (Manual / Auto Range) at extreme zoom factors. This may be accomplished by pressing the Auto Range button, using the slider bar or entering a value into the reference level input boxes.

Position Window

The position control tab window contains the Positional Zoom Control (PZC) display and functionality.

The Position Zoom Control (PZC) group window can be displayed or hidden by double mouse click on the POSITION tab to display or hide the control.

It is also possible to move the Position Zoom Control (PZC) group to any vertical position within the UI as a matter of technical operator preference.

Spectral Reference

The Positional Zoom Control (PZC) provides the technical operator with a quick view Spectral Reference Trace (SRT) that closely mimics the RF Spectral Display (RSD) Graticule.

The technical operator can quickly identify the concentration of RF energy at any given location within the ROI or current zoom window.

Changes to the reference level affect the WFD, RSD and SRT display.

Spectral Range Annotations

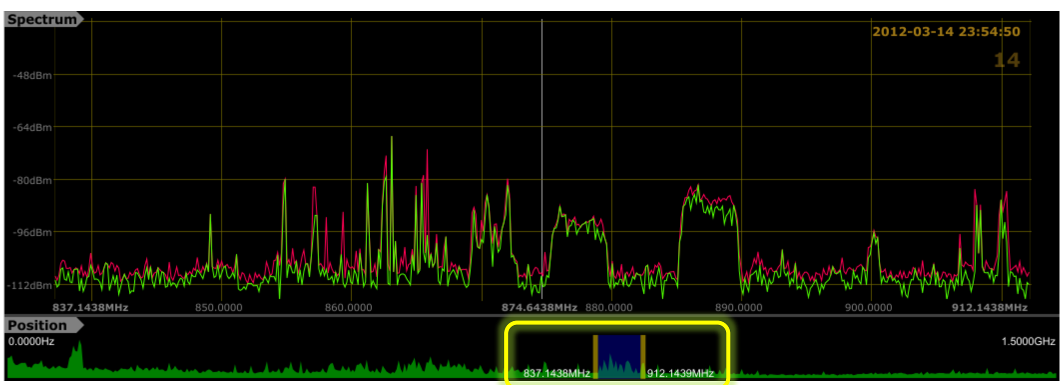
The START / STOP frequency for the selected ROI are displayed on the RIGHT and LEFT side of the Positional Zoom Control (PZC) window.

These annotations are fixed and will indicate the ROI and are not affected when a Positional Zoom Factor (PZF) is applied.

Zoom Control

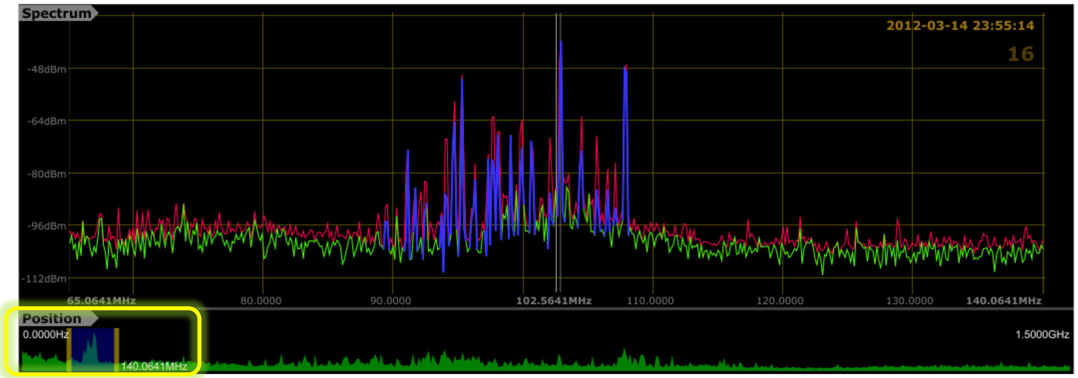
The Positional Zoom Control (PZC) is a very powerful tool designed to quickly activate and control a number of important zoom control functions.

Double clicking on any specific mouse over location within the Positional Zoom Control (PZC) display window results in an immediate (20x), zoom factor at the cursor location.



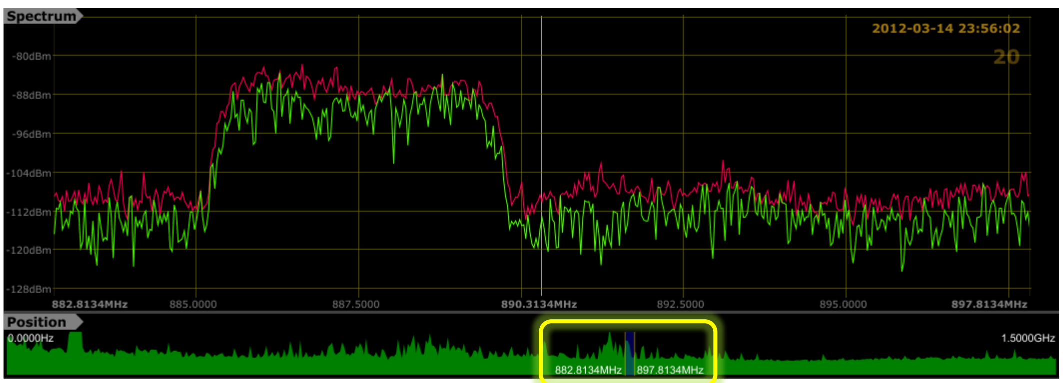
20x Zoom | v1.35xx

The ability to utilize the mouse wheel or buttons allows the technical operator to instantly achieve a 200x Zoom Factor at any point within the currently displayed RF Spectrum Display (RSD).



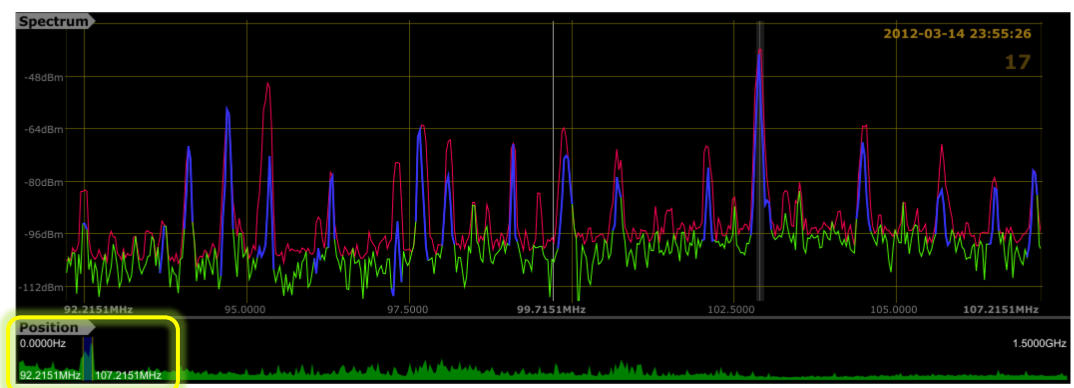
20x Zoom | v1.35xx

Double clicking a second time on any specific mouse over location within the Positional Zoom Control (PZC) display window results in a (100x), zoom factor at the cursor location.



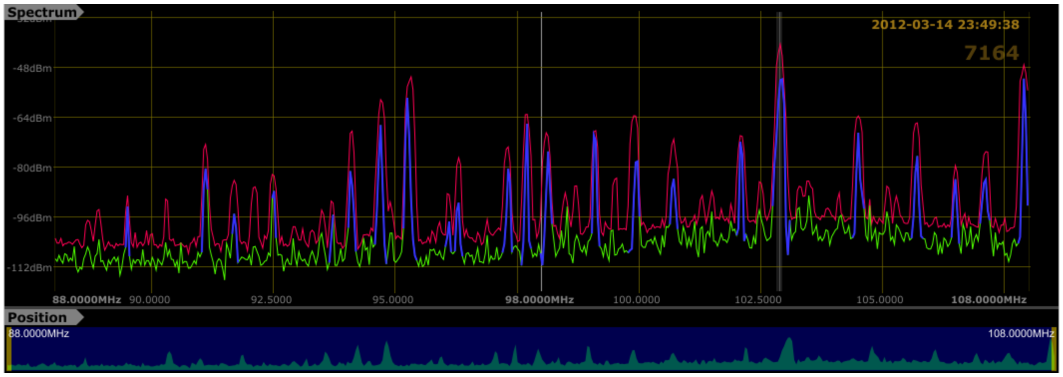
100x Zoom | v1.35xx

The ability to utilize the mouse wheel or buttons allows the technical operator to instantly achieve a 100x Zoom Factor at any point within the currently displayed RF Spectrum Display (RSD).



100x Zoom | v1.35xx

Double left mouse clicking a third time within the Positional Zoom Control (PZC) display window results in a full ROI (no zoom) reset.



Zoom 0% | v1.35xx

The zoom position marker box may be captured using the left mouse button and dragging the box to the LEFT or the RIGHT to view other areas of the ROI without altering the current zoom factor.

Positional Zoom Control (PZC) - Mouse Functionality	
1st Double Mouse Click (Left Button)	Result = 20x Zoom Factor
2nd Double Mouse Click (Left Button)	Result = 100x Zoom Factor
3rd Double Mouse Click (Left Button)	Result = Reset to Full ROI

Spectral Marker | v1.35xx

When the PZC is reset to view the full ROI the position display is BLUE with a LIGHT BLUE, Spectral Reference Trace (SRT).

When zoom is active, the position display is BLACK with a GREEN; Spectral Reference Trace (SRT) and the position box will display BLUE with GOLD drag handles on each side of the position box.

The technical operator can also capture the RIGHT or LEFT drag handles to increase or decrease to current zoom factor and corresponding RF Spectral Display (RSD) range.

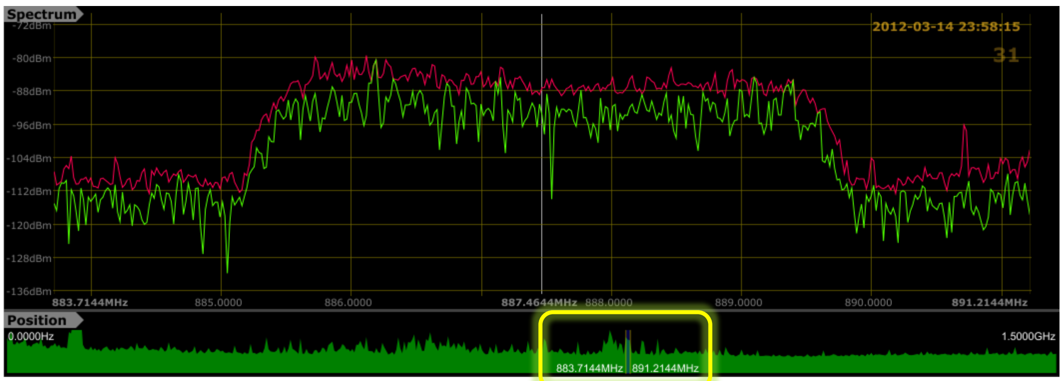
Using a single mouse click on any portion of the position display, outside of the position box, results in the position box centering on the single mouse click position.

Utilizing the mouse wheel on any portion of the position display, outside of the position box, results in the position box centering on the mouse over location.

Continuing to move the mouse wheel forward results in a decrease in the zoom factor and moving to mouse wheel backward results in an increase in the applied zoom factor.

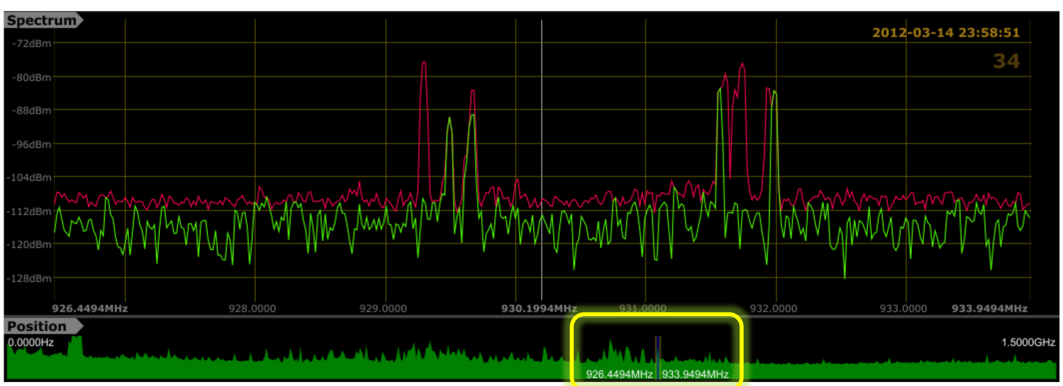
Zoom Position Marker

When the auto zoom, control is activated to the 20x or 100x zoom factor, the technical operator can manually zoom utilizing the mouse wheel to a maximum of a 200x zoom based on the current ROI.



200x Zoom | v1.35xx

The Kestrel TSCM ® Professional Software 200x continuous pan and zoom are fully supported during real-time collection deployment and during post analysis review of historical project files.



200x Zoom | v1.35xx

The following positional zoom charts provide examples of the expected zoom functionality based on common ROI settings.

Positional Zoom Control (PZC) Chart (1 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
1 GHz	No Zoom Factor	1 GHz
1 GHz	20x Zoom Factor	50 MHz
1 GHz	100x Zoom Factor	10 MHz
1 GHz	Up to 200x Zoom Factor (Manual)	5 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 1 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (3 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
3 GHz	No Zoom Factor	3 GHz
3 GHz	20x Zoom Factor	150 MHz
3 GHz	100x Zoom Factor	30 MHz
3 GHz	Up to 200x Zoom Factor (Manual)	15 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 3 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (4 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
4 GHz	No Zoom Factor	4 GHz
4 GHz	20x Zoom Factor	200 MHz
4 GHz	100x Zoom Factor	40 MHz
4 GHz	Up to 200x Zoom Factor (Manual)	20 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 4 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (6 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
6 GHz	No Zoom Factor	6 GHz
6 GHz	20x Zoom Factor	300 MHz
6 GHz	100x Zoom Factor	60 MHz
6 GHz	Up to 200x Zoom Factor (Manual)	30 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 6 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (8 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
8 GHz	No Zoom Factor	8 GHz
8 GHz	20x Zoom Factor	400 MHz
8 GHz	100x Zoom Factor	80 MHz
8 GHz	Up to 200x Zoom Factor (Manual)	40 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 8 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (10 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
10 GHz	No Zoom Factor	10000 MHz
10 GHz	20x Zoom Factor	500 MHz
10 GHz	100x Zoom Factor	100 MHz
10 GHz	Up to 200x Zoom Factor (Manual)	50 MHz

Positional Zoom | v1.35xx

When the operator utilizes a Range of Interest (ROI) of 10 GHZ, the above chart represents the Positional Zoom Control (PZC) options available.

Positional Zoom Control (PZC) Chart (12 GHz)		
Range of Interest (ROI) SPAN	**Active Zoom Factor**	**Displayed Bandwidth (SPAN)**
12 GHz	No Zoom Factor	12 GHz
12 GHz	20x Zoom Factor	600 MHz
12 GHz	100x Zoom Factor	120 MHz
12 GHz	Up to 200x Zoom Factor (Manual)	60 MHz

Positional Zoom | v1.35xx

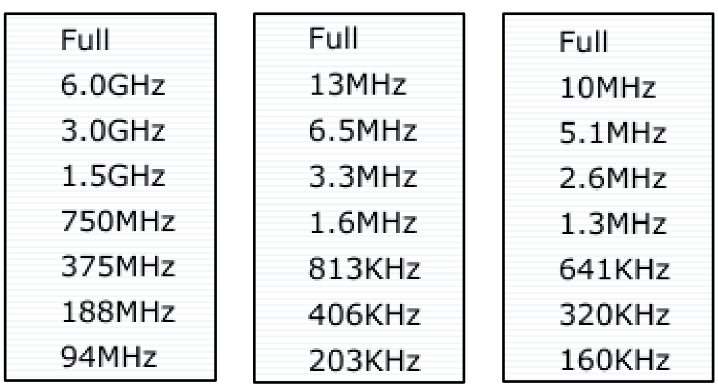
When the operator utilizes a Range of Interest (ROI) of 12 GHz, the above chart represents the Positional Zoom Control (PZC) options available.

Dynamic Zoom Menu

Right mouse clicking anywhere within the Positional Zoom Control (PZC) window, results in a zoom dialog option box that dynamically populates with a list of quick link zoom factors that adjust the SPAN based on the ROI CF position.

This tool is context sensitive and will provide different selectable options based on the receiver bandwidth, band allocation, or Range of Interest (ROI) utilized.

When the technical operator selects a Range of Interest (ROI) of (100 kHz to 12.4 GHz), (902 MHz to 928 MHz) and (100 MHz to 120 MHz), the following dynamic zoom factors are available by right mouse click within the PZC window.



Dynamic Zoom Menu | v1.35xx

Moving the positional zoom box over a specific area of RF Energy, or left clicking the mouse button and right clicking the mouse at the new location, selecting a quick zoom factor from the list results in the zoom factor SPAN centered at that specific location.

When the technical operator drags a shaded area over a signal or range of block spectrum visible on the Graticule, a menu is displayed with various extended functionality and tools.

The ability to zoom in on the region of the spectrum as selected by the technical operator, will zoom to a factor equal to the Graticule width, up to the maximum legal value for the ROI.

Zoom In | Out Menu | v1.35xx

The | ZOOM OUT | option located on the right click menu structure, serves as a reverse control for the | ZOOM IN | menu option.

Zoom in, is accomplished via the normal "mark and drag" menu, and the zoom out feature is accessed via the right click menu.

The zoom feature retains a memory stack of | ZOOM IN | locations, and the | ZOOM OUT |, steps backward until the stack is clear.

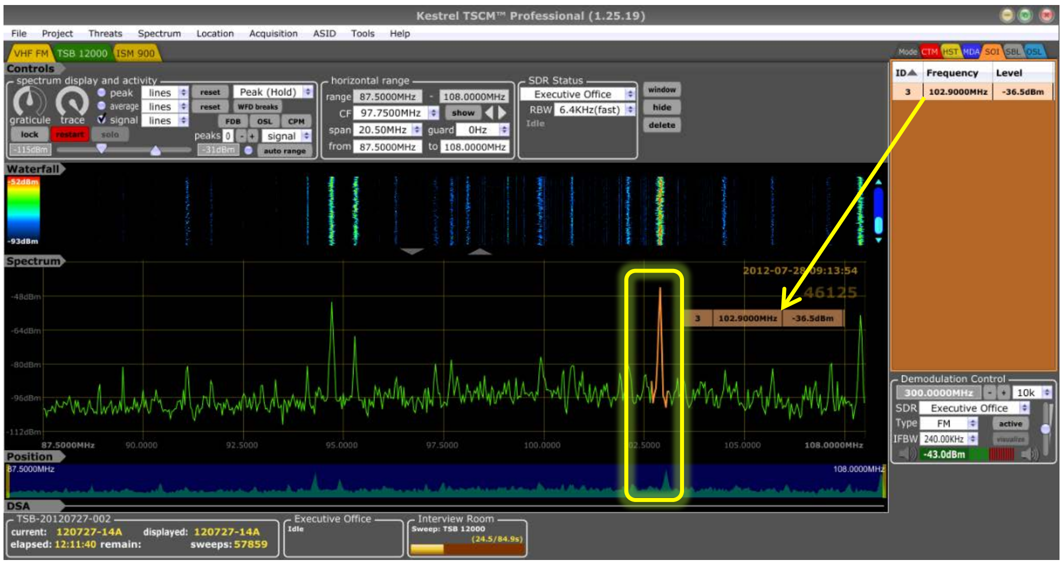
Positional Zoom Box - Annotation

When the Positional Zoom Control (PZC) is activated the positional zoom box displays the current START / STOP frequency equal to the RF Spectral Display (RSD) window.

Drag and Drop Zoom + Demodulation

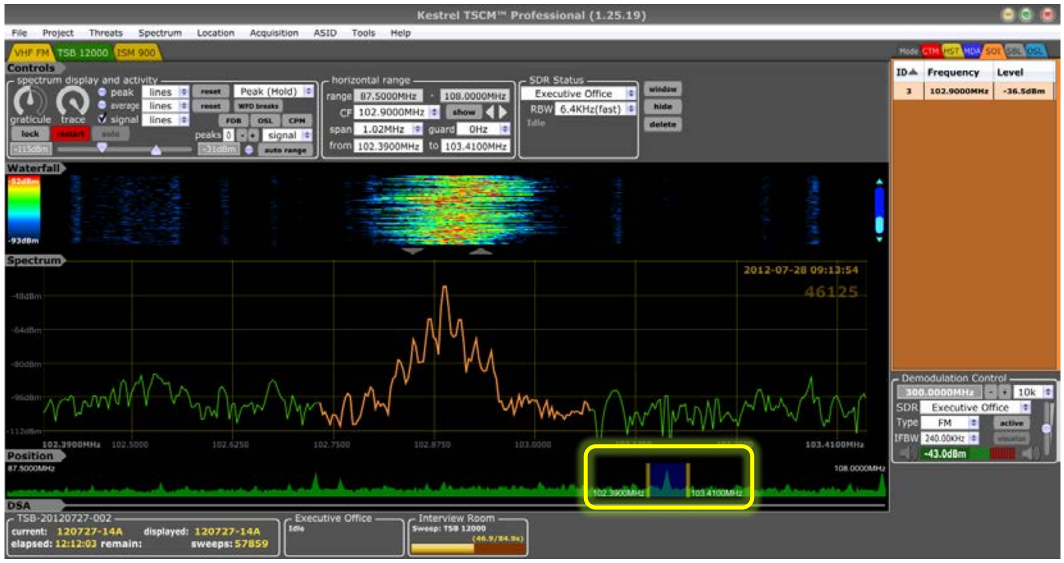
When the technical operator utilizes the mouse to capture, drag and drop, any signal entry located on any of the signal or threat lists on the RF Spectral Display (RSD) an automatic 20x Zoom Factor is applied and the SOI is placed at the CF position of the Graticule.

Our “Drag-and-Drop” technology permits the technical operator to drag any signal event from the Automatic Threat List (ATL) directly to the Demodulation Control group.



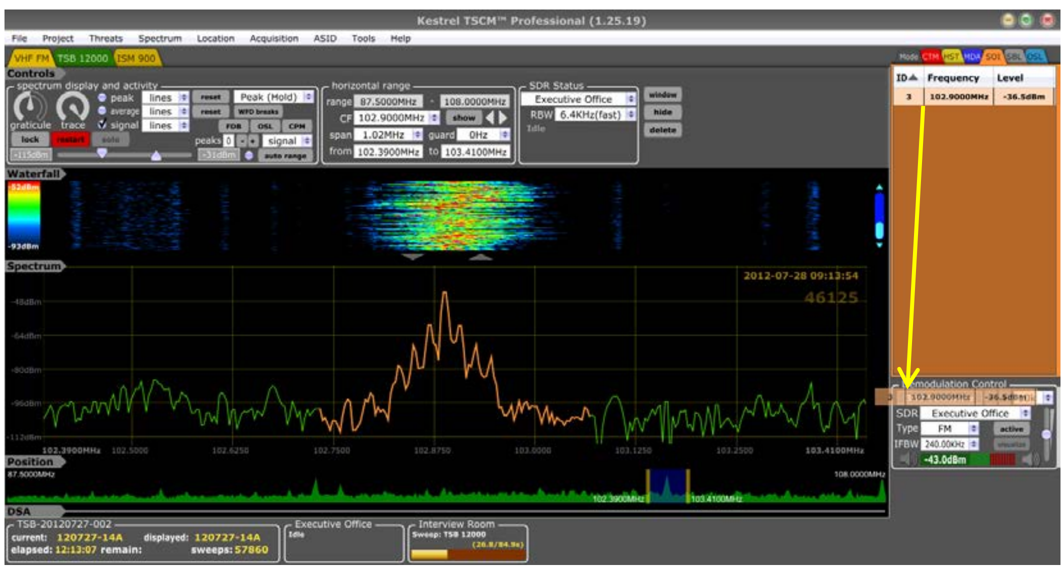
Drag and Drop Zoom | v1.35xx

The technical operator may utilize the Kestrel TSCM ® Professional Software, “drag-and-drop” feature to focus attention of the RF Spectrum Display (RSD) at the signal level in a 20x zoom window.



Drag and Drop Zoom | v1.35xx

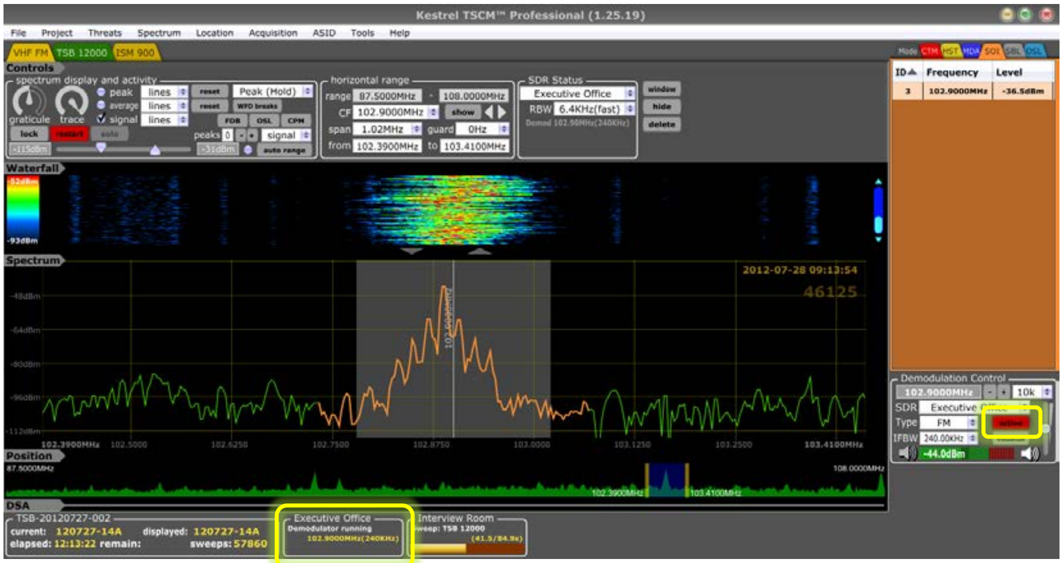
The above example illustrates the “Drag-and-Drop” feature from the SOI signal list onto the Graticule, providing a 20x zoom factor, placing the Signal of Interest (SOI) at the Center Frequency (CF) position.



Drag and Drop Demodulation | v1.35xx

The same “drag-and-drop” method can be utilized by the technical operator to activate the demodulator.

Any signal event captured on the CTM, HST, MDA, SOI, SBL, or OSL signal or threat lists may be dragged directly to the demodulator control group.



Drag and Drop Demodulation | v1.35xx

The demodulation process is automatically activated when any ATL or MATL signal list event is dragged to the Demodulation Control group.

Horizontal Range Control (HRC) ™

The HRC is a powerful profile-based extension of the Positional Zoom Control (PZC) ™ feature, providing advanced navigational display capability, based on any operator defined | Spectrum Profile File (SPF) ™ | database entry dynamically selected from the HRC option list.

The HRC method of direct, band profile, horizontal navigation can be used to display any existing SPF database entry, or range profile as a powerful navigation and analytical tool, to quickly display with absolute precision, any working spectrum band within the Range of Interest (ROI).

All standard navigational functions remain active and available, and any operator initiated navigational input will immediately override the HRC selection, maximizing real-time navigational options.

To add navigation options to the HRC selection window, the technical operator must add, delete, or edit the | Spectrum Profile Database (SPF) ™ | and after application restart, will automatically display as a new HRC option.

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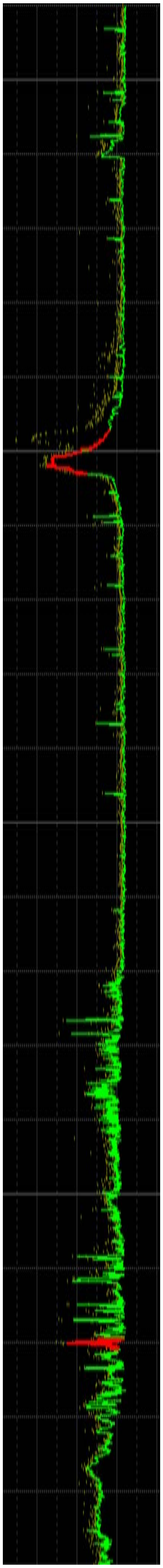
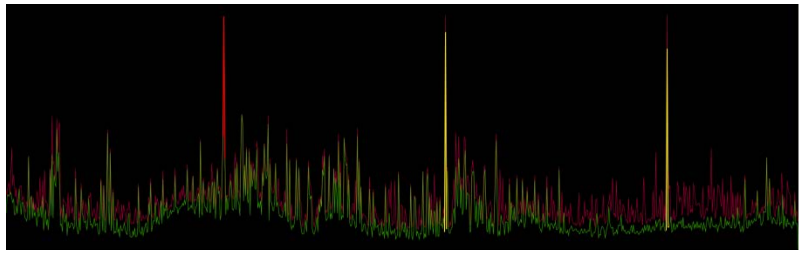


Chapter 11

Threat Detection Algorithm (TDA)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Threat Detection Algorithm (TDA) ™

There are three (3) levels of active and passive signal and threat detection that interact together or operate independently to provide significant technical operator control during deployment.

Threat Detection | v1.35xx

The Kestrel TSCM ® Professional Software active signal and threat detection algorithms are based on sophisticated artificial intelligence, predictive logic and complex control protocols that may be utilized independently or together to provide a wide range of detection strategies.

In the event that a Signal of Interest (SOI) is intermittent in nature, the Peak Envelope Capture (PEC) will remain displayed (when selected active by the technical operator) and the signals previous location will be visible by a Blue, Yellow, or Red marker clearly displayed within the | Ambient Noise Floor (ANF) | during zoom.

Spectral Marker Flag - Colour

The following table summarizes the various threat criteria levels for visual identification on the Graticule during runtime.

Spectral Marker Flag | Colour Identification		
CTM	**RED**	Software indication of positive confirmation of the presence of an analog audio transmitter within the target area. The technical operator must confirm that the signal event is hostile or a potential false hit, which can occur for any number of reasons.
HST	**YELLOW**	A harmonic relationship has been identified relating to a fundamental signal event flagged as hostile when the Chirp Threat Mode (CTM) is active. When the HST mode is active all harmonic levels are flagged, without recognition of CTM hits.
MDA	**BLUE**	The signal event has met or exceeded the Minimum Detection Amplitude (MDA) level set by the technical operator during runtime.
SBL	**GRAY**	The signal event has met or exceeded the Spectrum Baseline Logging (SBL) level set by the technical operator when the SBL feature is selected active.
SOI	**ORANGE**	The signal event has been manually added to the Automatic Threat List (ATL) by the technical operator as a Signal of Interest (SOI).
OSL	**LIGHT BLUE**	The signal event has been manually added to the Operator Signal List (OSL) database by the technical operator. The OSL signal list spans multiple Kestrel Project Files (KPF). Data does not remain with any given project and is retained by the application.
ISE	**HIGHLIGHT GLOW**	When the Ignore Signal Event (ISE) is selected by the technical operator, ISE causes the spectral marker flag for the affected signal event to highlight on the Graticule and become highlighted as ignored on the Master ATL and sidebar signal list. "Ignored" signal events can be restored using the "Un-ignore" option.

Spectral Marker Flags | v1.39xx

Level I | Minimum Detection Amplitude (MDA)

The Minimum Detection Amplitude (MDA) can be defined by the technical operator and must be consistent with the actual or perceived threat level and the ambient RF signal environment encountered.

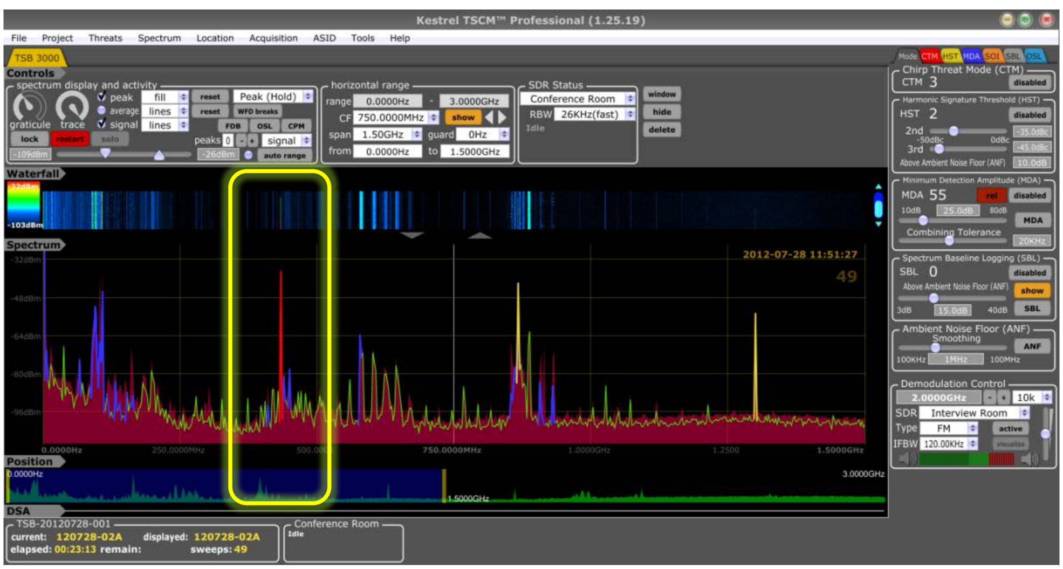
Operator familiarity and experience are key operational factors, as is an informed understanding of the relevant Threat Level and risk factors involved.

If the MDA level is set to high, virtually every signal at or above the noise floor will be captured and analyzed when the CTM and / or HST feature is active, significantly increasing the sweep time.

The MDA feature should not be selected active until after the third runtime spectrum sweep is complete, as the software is designed to automatically strobe the | AUTO RANGE | control at the completion of the third runtime trace.

This issue is significant on slow sweeping receivers and analyzers as three (3) traces represents several minutes before the technical operator is able to select the MDA feature active.

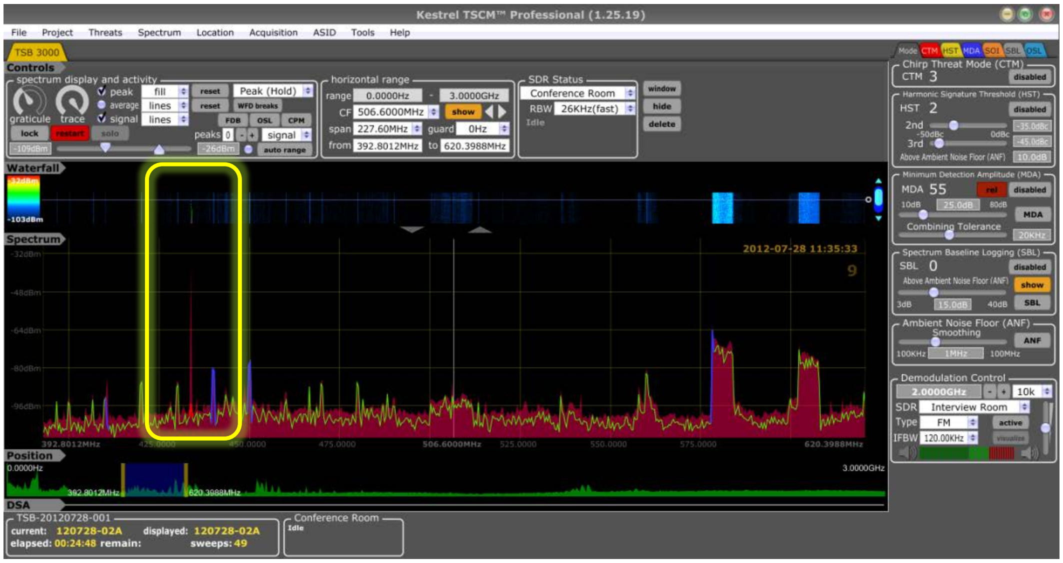
Allowing the automatic, auto range control to complete, stabilizes the trace display for a more accurate MDA setting.



MDA Signal Events | v1.35xx

The above (BLUE) Spectral Marker Flags identify all signal events that have met or exceeded the Minimum Detection Amplitude (MDA).

The (RED) and (YELLOW) marker flags confirm the presence of an analog audio transmitter and associated 2nd and 3rd harmonic signals.



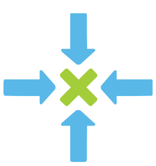
MDA Signal Events | v1.35xx

The Minimum Detection Amplitude (MDA) serves two (2) important functions; the first is the ability to identify all signals within the programmed ROI that have either met or exceeded the MDA (dBm) level within an active range of -140 dBm to 0 dBm as selected by the technical operator.

The MDA feature is a totally passive detection mode and will not provide any signal analysis or characterization beyond the ability to identify continuous or periodic signal events.

The second function of the MDA feature is to act as a signal sorting and qualification protocol.

Only signal events that meet or exceed the MDA will be analyzed by the active CTM and HST Threat Detection Algorithm (TDA).



There is a significantly greater risk of friendly signals being flagged and added to the Threat List (TL) when the MDA is set too low to the Ambient Noise Floor (ANF). The MDA function simply flags any signal that meets the minimum amplitude selected by the operator during the initial setup or during runtime adjustments. If signals such as ATSC Broadcast signals are encountered, the software will flag multiple spikes within the (6 MHz) signal and automatic signal combining and manual signal combining are fully supported.

If the MDA setting is too high above the Ambient Noise Floor (ANF), only the strongest signals will be analyzed, significantly decreasing the Probability of Detection (POD) of low power or distant hostile signals.

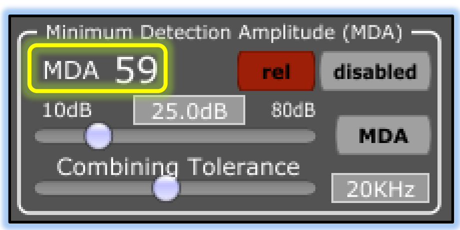
The technical operator needs to consider the Ambient Noise Floor (ANF) level when determining the best operator setting for the search range desired and select either Absolute (ABS) or Relative (REL) mode to best represent variations in the ANF level.

The average Ambient Noise Floor (ANF) will not be consistent across the full extended operational range of the search receiver or spectrum analyzer.

It will sometimes be necessary to limit the operational bandwidth to obtain a more consistent noise floor and help to prevent unnecessary noise floor clutter from being added to the MDA signal list structure when attempting to "deep dig" the spectrum for low level signal events.

MDA Signal Count

The MDA signal count displays the number of signals that are currently on the MDA signal list.



MDA Signal Count | v1.35xx

The MDA signal count will update in real-time during the collection process as additional signals meet or exceed the MDA criteria, even if momentarily in the case of intermittent signal events.

The Signal Combining Tolerance (SCT) feature may automatically combine wideband signal events and remove combined artifacts resulting in only the CF being displayed on the Automatic Threat List (ATL).

MDA Enable Button

The technical operator will need to accept or set the following MDA control options before enabling the MDA control algorithm.

MDA Input Box (dBm)

The technical operator can enter the MDA level (dBm) or utilize the MDA Slider Bar to set the desired detection level threshold prior to activating the MDA mode.

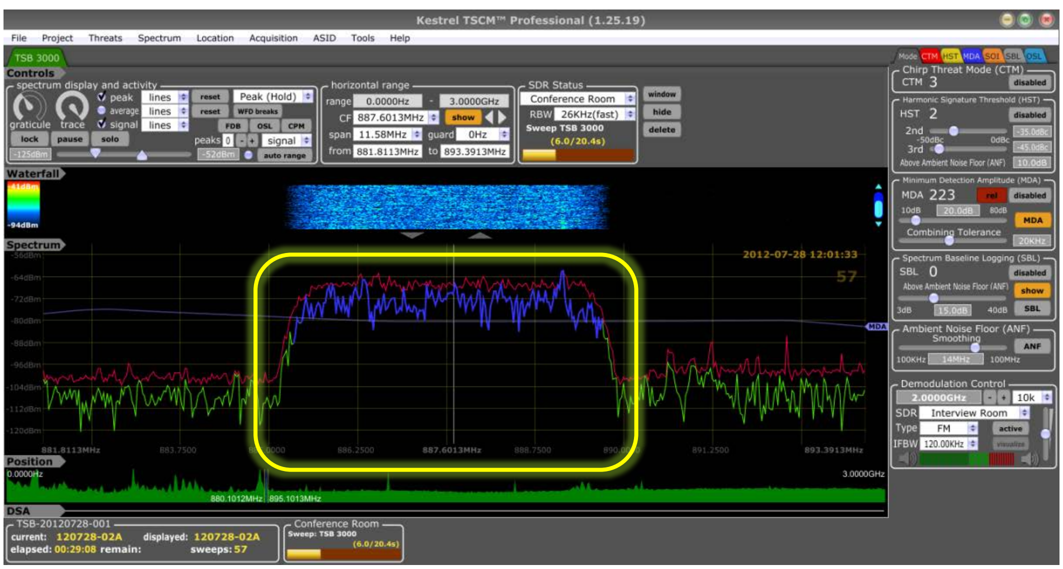
MDA Slider Bar

The MDA Slider Bar may be utilized to adjust the detection threshold manually.

Signal Combining Tolerance (SCT)

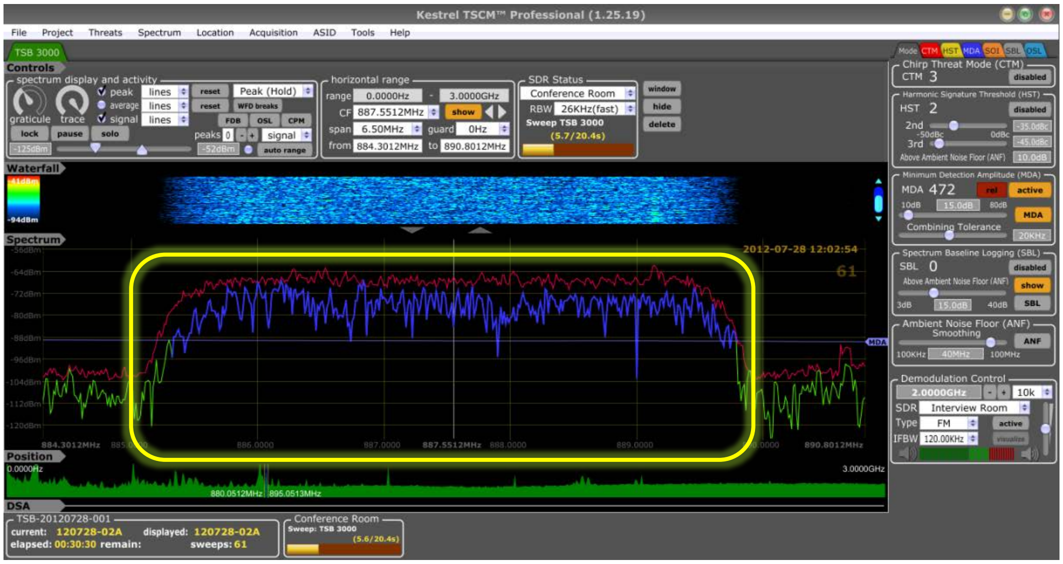
The Signal Combining Tolerance (SCT) control (-50 kHz 50 + 100 kHz) provides the operator with a very powerful wide bandwidth signal detection and identification tool.

The Kestrel TSCM ® Professional Software advanced artificial Intelligence algorithm can recognize wide bandwidth signals such as GSM, CDMA, ATSC, DSSS, LTE, DAB, and other similar signals and combine what might appear to be many separate signals into one signal event.



Signal Combining Tolerance (SCT) | v1.35xx

Should any part of such a signal event even momentarily meet the MDA, the Signal Combining Tolerance (SCT) algorithm will attempt to determine the actual bandwidth of the signal and combine what might normally display as dozens of individual MDA peak captures into one signal entry based on the CF of the combined wide bandwidth signal.



Signal Combining Tolerance (SCT) | v1.35xx

The Signal Combining Tolerance (SCT) results will vary and are dependent on the MDA and SCT settings as well as the separation of individual signal peaks.

The consistency of the amplitude of the signal event across the entire bandwidth is yet another factor.

The technical operator can accept the default combining tolerance or adjust the SCT control setting in an operational range of (-50 kHz - Signal Overlap) and signal peaks up to (100 kHz) apart.

The Default setting for active signal combing is 20 kHz.

Manual SCT Selection

The ability of the technical operator to manually select a partially detected wideband signal event is fully supported.

When certain conditions exist such as not all of a wideband signal event uniformly meets the Minimum Detection Amplitude (MDA) and is not flagged as a single combined signal event, the technical operator can manually select the signal and utilizing the displayed menu option | MDA COMBINE SIGNAL |, can properly categorize the SOI as a single combined signal event.

This would normally be accomplished during a technical operator review and analysis of the captured spectrum or during the actual runtime collection process.

Once the technical operator has visually confirmed that any particular signal event has not properly combined during the MDA capture process, resulting in multiple frequency entries on the MDA Automatic Threat List (ATL), the technical operator can select the signal and utilize the MDA Combine Signal menu option to manually combine the signal event into a single combined signal event.

This operation will clean up the Automatic Threat List (ATL) entries and all displayed individual threat list entries within the manually selected range are then “ignored” and a new threat list entry is generated based on the selected Center Frequency (CF) of the signal.

It is important to note that the originally captured signal events are displayed as a darker shade and will eventually be removed automatically, leaving only the signals Centre Frequency (CF).

The MDA Combine Signal option is a technical operator, manual analysis tool that can reduce the number of MDA Automatic Threat List (ATL) frequency hits by 50% or more.

Show MDA

The MDA threshold limit line can be controlled by the technical operator and may be either displayed or hidden as desired to reduce screen clutter.

TIP: Even when the MDA limit line is hidden, detection will occur whenever the MDA feature is enabled.

Level II | Harmonic Signature Threshold (HST)

The ability to identify Near-Field harmonic based signal events and display this information, significantly enhances the Probability of Detection (POD) of oftentimes very low level, out of band images and several predictable harmonic signals that might be over-looked or missed entirely by the technical operator.

Harmonic identification adds an important awareness level to the overall threat detection process of the Kestrel TSCM ® Professional Software.

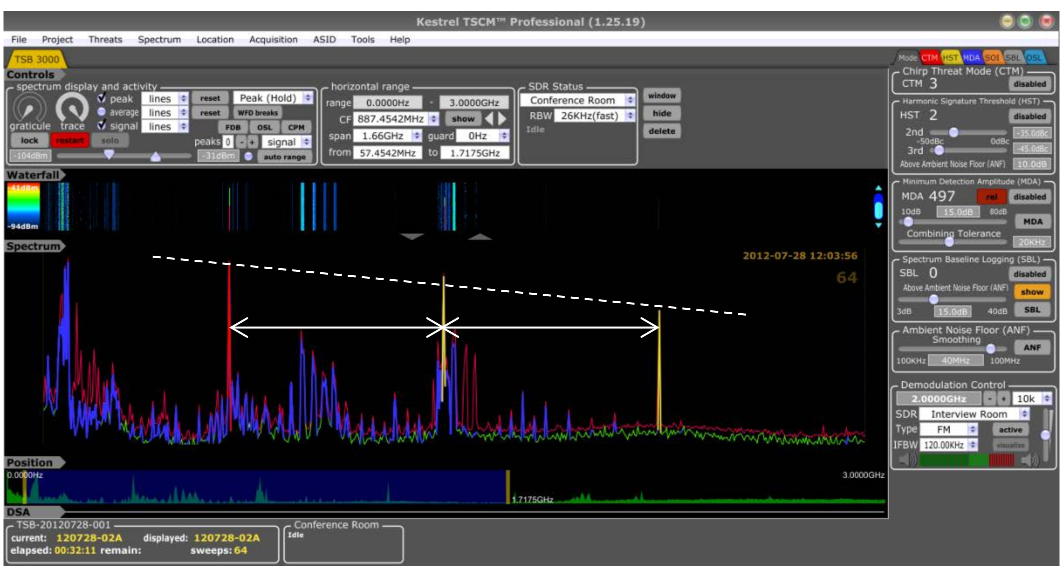
The Fast Fourier Transform (FFT) of a Sine Wave results in a single peak at a specific fundamental frequency.

For most applications, a single peak at a specific fundamental frequency is the desired outcome for RF designers and manufacturers of wireless communication and control transmitters.

In the TSCM world, the technical operator prefers poorly designed and poorly shielded transmitters and high transmit power levels to best exploit the common (normally undesirable) effect of harmonic artefacts for the detection and identification of potentially hostile signal events.

The following example, captured by the Kestrel TSCM ® Professional Software, clearly illustrates a (RED) single fundamental frequency, a (YELLOW) 2nd harmonic and a (YELLOW) 3rd harmonic.

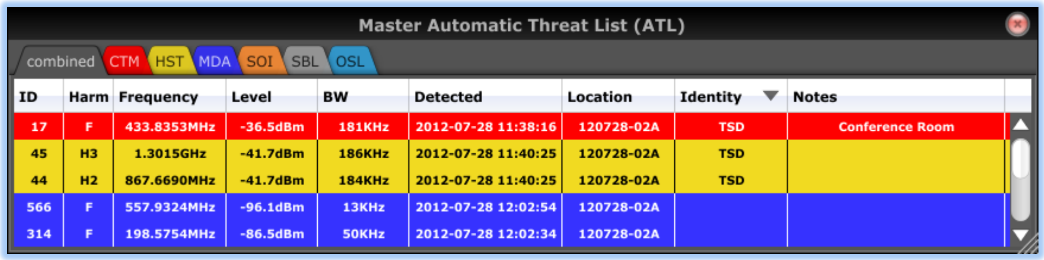
A technical review of the spectrum plot indicates the presence of a Near-Field fundamental with 2nd and 3rd harmonics, all containing active room audio.



CTM + HST Threat Detection | v1.35xx

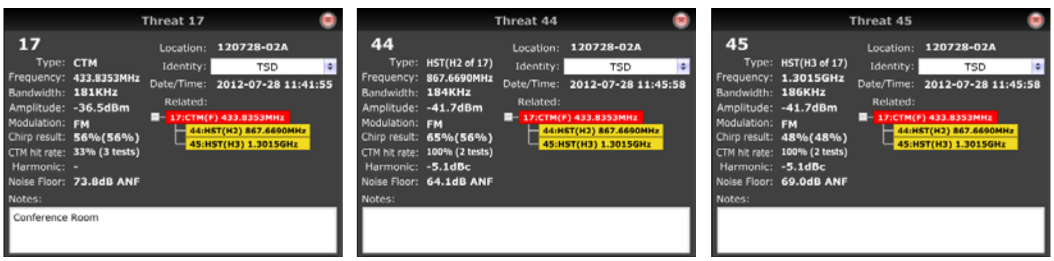
The Kestrel TSCM ® Professional Software initially identified all three (3) prominent signal spikes as CTM threats (containing active analog room audio) and displayed all signals in (RED).

During the next two (2) subsequent sweep cycles, the software automatically resolved and moved the 2nd and 3rd harmonic signals to the HST threat list (YELLOW).



M-ATL | v1.35xx

The signal details are displayed for each of the fundamental, 2nd harmonic and 3rd harmonic signal events.



Signal Profile Editor (SPE) | v1.35xx

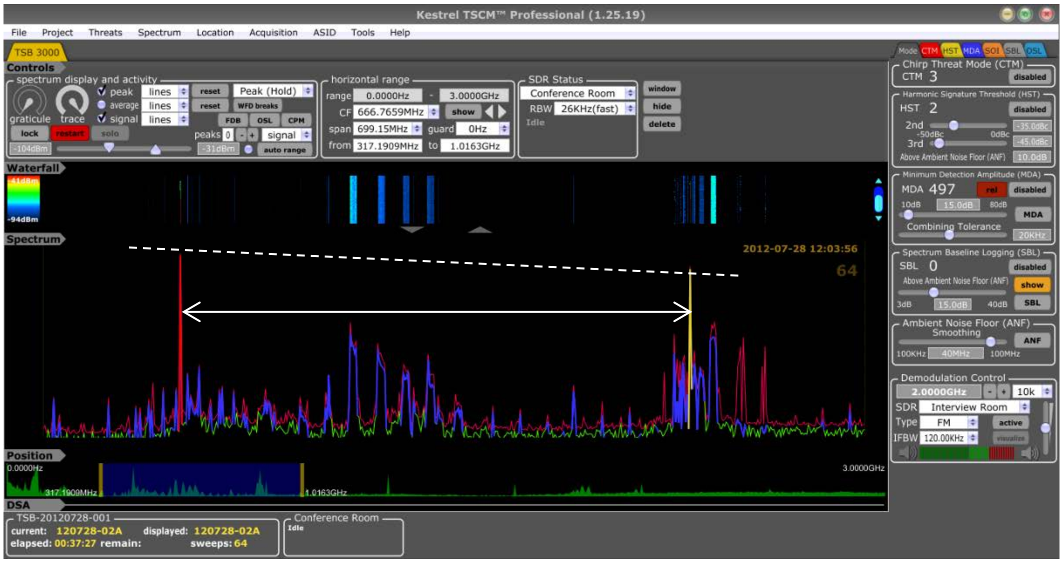
In real-world applications, non-linear elements and noise result in a vast array of spectral imperfections.

When a signal of a particular frequency, referred to as the Fundamental passes through a non-linear system, the resulting output of the non-linear system consists of the Fundamental Frequency and associated undesirable artefacts including harmonic content referred to as H2, H3, H4, H5, etc.

Harmonic distortion is a measure of the amount of power contained in the harmonic components of the Fundamental (F1) referred to as the Signal of Interest (SOI).

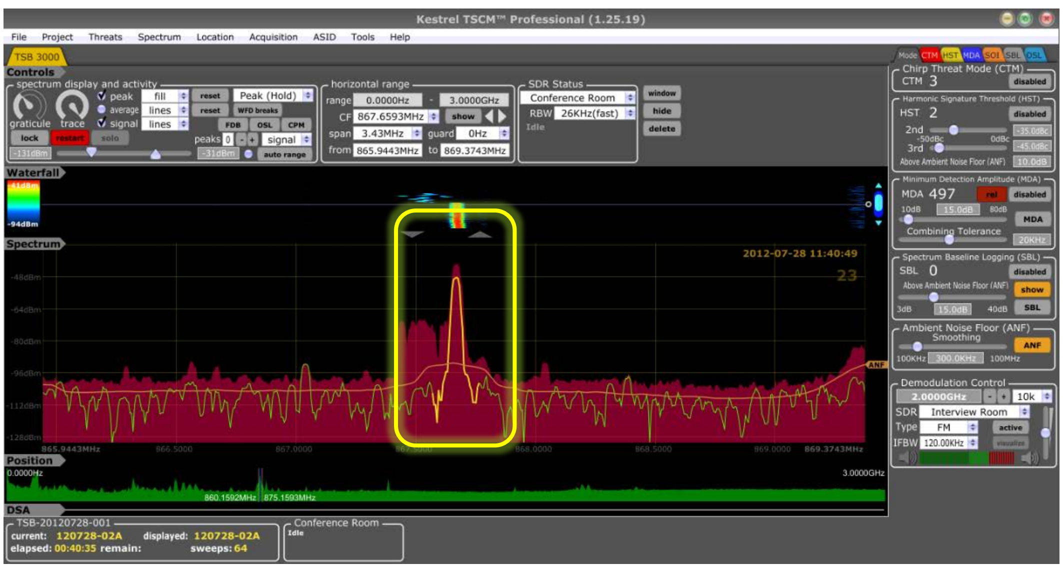
Harmonics are inherent to any device and systems that exhibit non-linear characteristics

The more non-linear the device is, the greater its harmonic distortion.



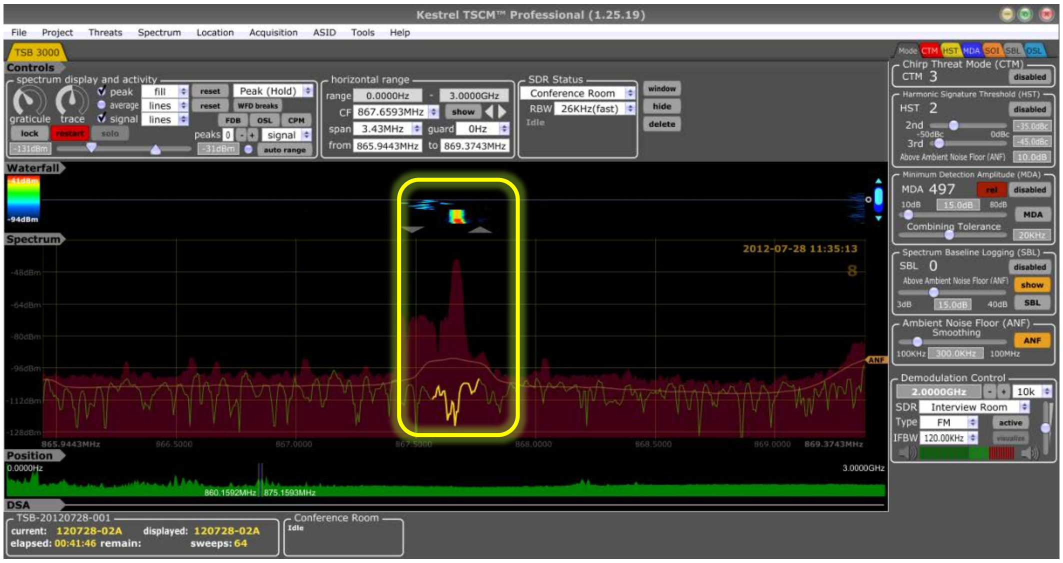
CTM + HST Threat Detection | v1.35xx

The above Fundamental Frequency (F1) and the 2nd Harmonic, illustrates a (RED) single fundamental frequency, a (YELLOW) 2nd Harmonic.



Active Harmonic | v1.35xx

The above Spectral Marker Flag illustrates the 2nd Harmonic of the CTM detected fundamental frequency.



Terminated Harmonic | v1.35xx

The above (YELLOW) Spectral Marker Flag illustrates the 2nd Harmonic of the CTM detected fundamental frequency signal event which has terminated.

The signal is identified by the Peak Envelope Capture (PEC) trace and the Spectral Marker Flag within the Ambient Noise Floor (ANF).

It is entirely possible that the technical operator may miss the fundamental signal on initial review; only to stumble onto the 2nd, 3rd (or higher) harmonic and discover active target area room audio.

The Kestrel TSCM ® Professional Software Artificial Intelligence (IA) algorithm can determine and resolve the logical order of signals having harmonic content or relationships.

The ability to complete a harmonic analysis of signal relationships over a period of time is an advance concept well beyond traditional thinking and is only found in the Kestrel TSCM ® Professional Software.

HST | Signal Count

All signal events identified by the Kestrel TSCM ® Professional Software, as having harmonic content or relationships are added to the HST threat count.

HST Signal Count | v1.35xx

There are two (2) separate operational modes, including the CTM Mode (Recommended) and the HST Mode.

The CTM Mode provides the ability to narrow the harmonic search to only those signals that have been captured on the Chirp Threat Mode (CTM) threat list and the HST Mode expands the search and capture of all harmonic relationships (not necessarily threat based).

TIP: In the event that a signal is confirmed by the CTM mode as containing active target area room audio, the signal will first appear on the CTM signal list and subsequent sweeps will likely resolve the harmonics and move them to the HST threat list automatically.

Enable | CTM Mode

When the HST CTM Mode is selected, only signal event that have been confirmed as potentially hostile are analyzed for harmonic content or relationships.

Enable | HST Mode

When Harmonic Signature Threshold (HST) Mode is selected, all signals meeting the MDA criteria are analyzed for harmonic content or relationships.

TIP: When HST is utilized for a large ROI, it is possible for a large number of signals to be identified as having harmonic relationships, particularly, when the software is deployed in a complex ambient signal environment. This is normal as it is common that signal of coincidence will occur and be flagged (rightly so) as having harmonic relationships.

Disabled

The HST algorithm is disabled.

Signals (potentially of a harmonic nature) may be identified by the CTM as hostile and will display as fundamental frequencies in the signal list, but will not be moved to the HST list, when the HST control is disabled.

The harmonic signals will simply be flagged as CTM fundamental frequencies.

2nd HARM Slider + Input Box (dBc)

The 2nd Harmonic Detection Level Sensitivity may be adjusted by the technical operator or the default value may be utilized.

The active range for harmonic detection is (-50 dBc to 0 dBc).

3rd HARM Slider + Input Box (dBc)

The 3rd Harmonic Detection Level Sensitivity may be adjusted by the technical operator or the default value may be utilized.

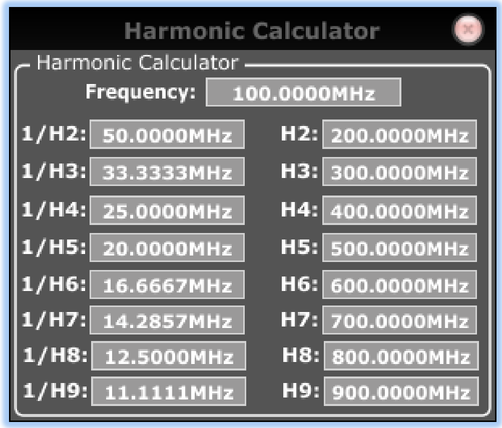
The active range for harmonic detection is (-50 dBc to 0 dBc).

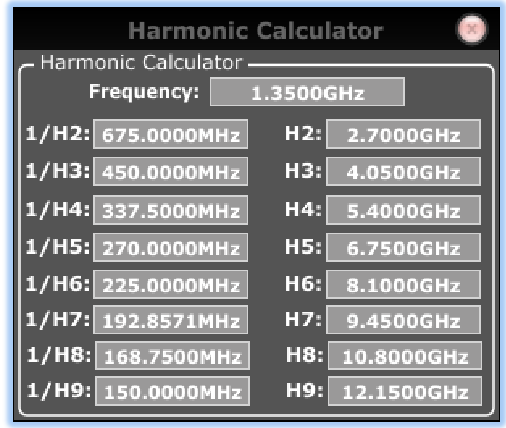
(Above) Ambient Noise Floor (ANF) dB

The technical operator can set the ANF Detection Limit to avoid noise floor clutter as being identified as coincidental harmonic signal events.

Harmonic Calculator Tool (HCT)

The Harmonic Calculator Tool (HCT) is an advanced RF engineering feature designed to assist the technical operator in quickly observing, selecting, demodulating and visually verifying the presence of significant | Sub-harmonic | and | Harmonic | signal events that are either associated with or otherwise attributed to a specific | Fundamental | frequency.





HCT | v1.35xx

The above images of the Harmonic Calculator Tool (HCT) illustrate the automatically populated or by direct operator manual entry and the resulting Sub-harmonic and Harmonic calculations relative to the Fundamental frequency.

Utilizing the Harmonic Calculator, it is possible to calculate and display the fundamental / harmonic relationship values from 1 / H2 to 1 / H9 and up from H2 to H9, even if these values fall outside of the operator defined Range of Interest (ROI).

Understanding Sub-Harmonics

Sub-Harmonic signal events are frequencies that appear below the main Fundamental frequency of a Signal of Interest (SOI).

Sub-Harmonic signal events are those frequencies below the fundamental frequency of an oscillator in a ratio of (1 / n) with (n) being a positive integer number.

If the Fundamental Frequency of an oscillator is 440 Hz, the sub-harmonics include 220 Hz (1/2) and 110 Hz (1/4) and are mirror images of the harmonic events that appear above the Fundamental Frequency.

Our advanced universal “Drag-and-Drop” capability allows the technical operator to “Drag-and-Drop” any captured signal event that is currently displayed on the Automatic Threat List (ATL) structure directly into the “Frequency” text input box within the Harmonic Calculator window.

The Harmonic Calculator will automatically populate the | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | and | 9th | Sub-Harmonic and Harmonic event values for the Fundamental Frequency of interest.

The technical operator is also able to "Drag-and-Drop" the Fundamental frequency, Sub-Harmonic, or Harmonic value directly to the RF Spectrum Display (RSD) to focus attention on the signal event with a (20x) zoom factor utilizing our Positional Zoom Control (PZC) feature.

The operator can also utilize the "Drag-and-Drop" capability to move the currently displayed frequency from the demodulation control text dialog box, directly to the Harmonic Calculator Tool (HCT) or move the currently displayed Fundamental, Sub-Harmonic or Harmonic signal within the Harmonic Calculator Tool (HCT) directly to the demodulator control group, is fully supported and will update the standby demodulation Centre Frequency (CF).

Manual HST Confirmation

The RF signal environment is extremely complex and adding automatic threat detection adds another level of complexity and uncertainty.

The Kestrel TSCM ® Professional Software utilizes a Threat Detection Algorithm (TDA) to detect analog transmitters referred to as the Chirp Threat Mode (CTM) and the associated harmonic events referred to as Harmonic Signature Analysis (HST).

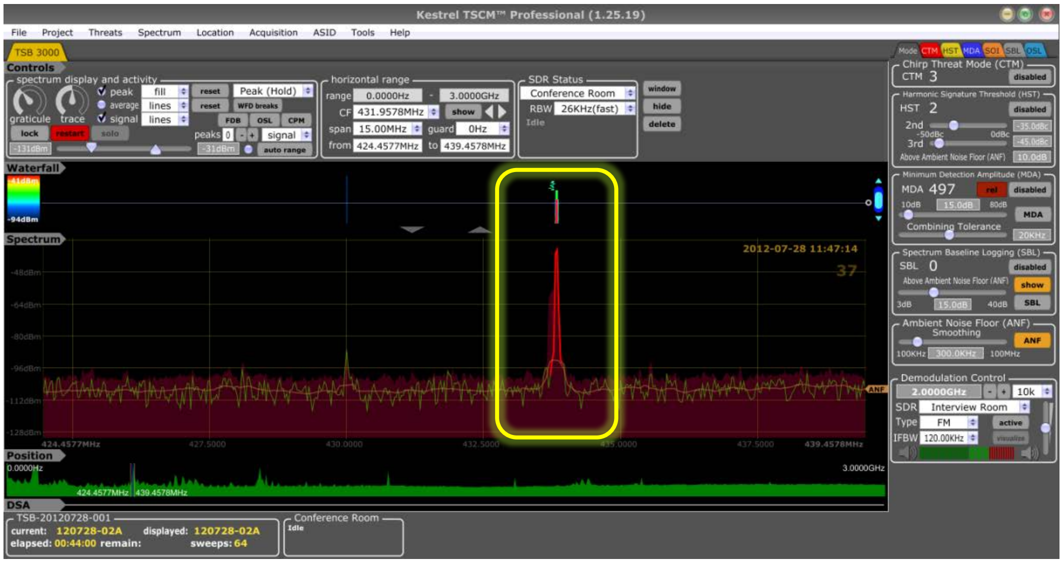
It is not unusual for the TDA to detect a harmonic value first, rather than the fundamental signal event or flag the 2^{nd} harmonic and say the 4^{th} harmonic and not detect the 3^{rd} harmonic for any number of reasons and is simply not seeing the signal event as a threat in the software.

It is for the above reason that the technical operator must always conduct a manual review and analysis of all signal events whether or not they are captured or otherwise identified by the software.

The ability of the technical operator to manually select, capture and display an HST threat list entry manually is fully supported as a signal event analysis tool.

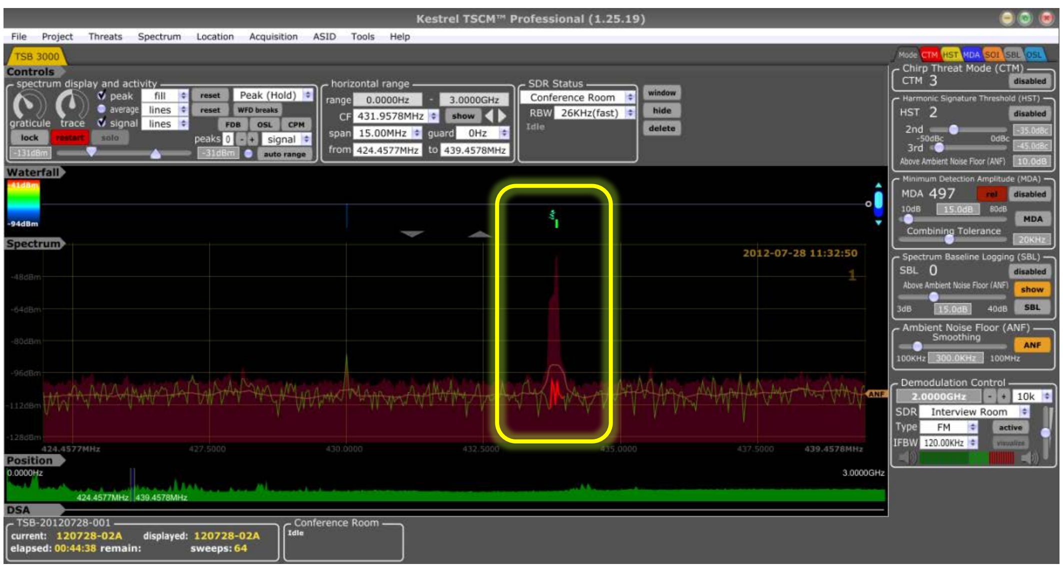
Level III | Chirp Threat Mode (CTM)

The Chirp Threats Mode (CTM) is a powerful detection and identification algorithm that can confirm the presence of room audio within the immediate or extended target area by actively chirping the room or area with a unique combination of specifically selected | Audio Frequency Tones | and processing the possible result at the software integration level.



Active CTM Signal Event | v1.35xx

The above | Spectral Marker Flag | illustrates an active CTM fundamental signal event.



Terminated CTM Signal Event | v1.35xx

The above Spectral Marker Flag illustrates a terminated CTM fundamental signal event, however the signal is identified by the Peak Envelope Capture (PEC) trace and the (RED) Spectral Marker Flag within the Ambient Noise Floor (ANF).

The CTM is designed to identify signals that contain target area room audio.

The CTM actively chirps the immediate or extended target area and can positively identify and display any analog audio signal, out of band image or near-field harmonic signal that contains room audio.

When a Signal of Interest (SOI) has met both the Minimum Detection Amplitude (MDA) criteria, the CTM provides confirmation of an active Analog based Technical Surveillance Device (TSD) within the immediate Target Area or extended target area when advanced Chirp Threat concepts are utilized.

When using the CTM function the operator must ensure that the audio level of the computer is sufficiently high enough for the size and structure of the target area.

Utilizing additional amplified external speakers and / or advanced Chirp Threat concepts may be required to enhance the threat detection capability.

The threat detection algorithm including the | CTM | HST | will not run unless the | ANALYZE | control column is selected for the specific receiver or analyzer in the | ANALYZER CONTROL | dialog window.

CTM Threat Count

The CTM threat count provides the total number of signals currently displayed on the CTM list.

It is important to note that the fundamental, one (1) or more harmonics and even a positive hit (out of band image) below the fundamental might be captured and displayed on the CTM list.

CTM Signal Count | v1.35xx

Every signal on this list needs to be carefully evaluated by the operator, as SOI on this list have been determined by the software to contain target area room audio.

Enable Button

Activates and includes the CTM in an alerting mode by chirping all signals that meet the MDA level established by the technical operator.

It is recommended that the technical operator run the system for several cycles and manually review the spectrum in a non-alerting mode prior to activating the CTM feature, to avoid alerting person's unknown that might be monitoring the target area.

It is essential that the technical operator remember that the CTM is designed to identify and confirm analog room audio only.

It is entirely possible that digital signals containing room audio may be present and will not be confirmed as hostile by the CTM feature.

Manual CTM

The RF signal environment is extremely complex and adding an Automatic Threat Detection (ATD) module adds another layer of complexity in practice.

The Kestrel TSCM ® Professional Software utilizes a Threat Detection Algorithm (TDA) to detect analog transmitters, referred to as the Chirp Threat Mode (CTM) and also for the identification of associated harmonic events, referred to as Harmonic Signature Analysis (HST).

It is not unusual that the TDA may not detect the fundamental signal event initially and flag the 2nd harmonic as a confirmed fundamental signal event.

Artificial intelligence will attempt to resolve and properly categorize both the fundamental and harmonics on subsequent sweeps; however, there is no 100% guarantee that this will always be the case.

This is completely normal and expected and it is for this reason that the technical operator must always conduct a manual review of the signal environment and analyze all signal events whether or not they are captured or otherwise identified by the software.

Another common issue is the presence of digital transmitters which cannot be chirped utilizing the Chirp Threat Mode (CTM). The | USER CTM | and | USER HST | can be utilized to manually flag digital signal events.

Utilizing the Harmonic Calculator Tool (HCT) is an easy way to identify the actual fundamental frequency and associated harmonics and to quickly review and navigate to the CF of each signal event for the purpose of verification and analysis.

The ability of the technical operator to manually select and flag any manually confirmed analog or digital CTM or HST signal event captured on the MDA signal list is a fully supported analysis tool.

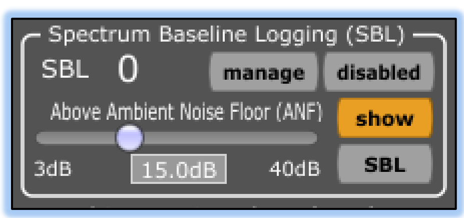
Spectrum Baseline Logging (SBL) ™

The Kestrel TSCM ® Professional Software fully supports an advanced Spectrum Baseline Logging (SBL) feature that allows the technical operator to capture and display a clean, and independent signal list without any threat detection or software analysis taking place.

Multiple SBL database signal lists can be captured, cleared, and exported to .CSV file format.

This feature is an ideal companion for use with the Differential Signal Analysis (DSA) feature across multiple locations to maintain a separate database of threshold-based signal events captured at each DSA ™ location.

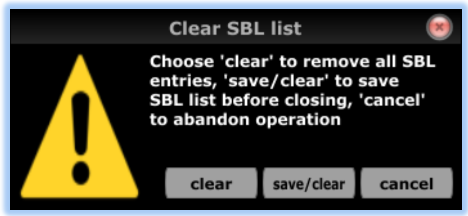
The SBL ™ feature provides an excellent method of capturing a baseline reference trace, and a detailed signal database list, of all ambient signals for future comparative purposes.



SBL Signal Count | v1.35xx

When the operator presses the | MANAGE | button, a warning dialog is displayed to choose | CLEAR | the database, and remove all SBL entries, or select | SAVE / CLEAR | to save the SBL database before clearing the database, selecting | CANCEL | abandons the operation.

The | SAVE / CLEAR | option will (export) the current SBL database signal list to CSV format and clear all SBL database entries.



Clear SBL Signal List | v1.35xx

The technical operator can hide the | Spectral Marker Flags | by unchecking the SBL Signals from the | THREATS | SHOW SBL SIGNALS |, located on the main menu, and hide the | Spectral Marker Flags | by toggling the | SHOW | button.

The | SBL | button toggles the SBL threshold reference line to display, and supports grab and drag, to adjust the operator defined detection threshold value.

The ability to adjust the detection threshold level with reference to the Ambient Noise Floor (ANF) via a control slider bar or direct entry, permits the technical operator to select any value between 3 dB and 40 dB | Above Ambient Noise Floor (AANF) |.

Ambient Noise Floor (ANF)

The ability to calculate and display the | Ambient Noise Floor (ANF) | is an essential TSCM specific feature.

It is absolutely critical to know what the ANF is for the currently displayed spectrum window, and for the entire Range of Interest (ROI).

During the sweep process the | Ambient Noise Floor (ANF) | is automatically and precisely calculated and is utilized as part of the threat detection and process.

The ANF control group contains three (3) primary control elements that allow considerable flexibility for the technical operator.

ANF Control Group | v1.35xx

The | ANF | button permits the technical operator to display, or hide, the horizontal ANF reference marker trace overlay.

This is a global setting and affects all open spectral windows as part of the sweep collective

The default (smoothing) detection sensitivity slider bar, averaging is 1 MHz (1000 kHz) and may be adjusted by the technical operator.

Detection Sensitivity | Slider Bar

The range of the averaging (smoothing) slider bar is 100 kHz to 100 MHz and may be utilized to provide quick changes to the ANF detection sensitivity.

Lower settings follow the spectral display peaks more closely and therefore fewer discrete signals will be flagged when the SBL or HST features are active.

Higher settings intersect the spectral display peaks more sharply and therefore capture a larger number of discrete signals when the SBL or HST features are active.

Detection Sensitivity Input Box

The technical operator can utilize the text input box to set a specific Detection Sensitivity Level between 100 kHz to 100 MHz and is utilized to input the desired ANF sensitivity level.

The following chart describes the basic operation of the Ambient Noise Floor (ANF) Control Group and effect on detection sensitivity.

Ambient Noise Floor (ANF) | Control Group		
Detection Sensitivity	Minimum Detection Sensitivity **Result** - Closely follows peak signal level	Maximum Detection Sensitivity **Result** - Sharply intersects peak signals
Default Settings	***Default*** = 1 MHz	Default = 1 MHz
Averaging (Smoothing) Sensitivity Control - Slider Bar	100 kHz	100 MHz
Averaging (Smoothing) Sensitivity Control - Input Box	100 kHz	100 MHz
ANF (Show / Hide) Button	Displays ANF level trace on the Graticule Globally affects all open spectral windows	Displays ANF level trace on the Graticule Globally affects all open spectral windows

ANF Control Group | v1.35xx

The ANF control group provides a sensitivity level component for the SBL and HST features.

This control ability is represented as “Above Ambient Noise Floor” and provides the actual detection level (Sensitivity or Depth) above ANF when active.

ANF Defaults - SBL / HST	
SBL	15 dB Above ANF
HST	10 dB Above ANF

ANF Control Group | v1.35xx

The purpose of the ANF averaging (smoothing) sensitivity control is to adjust the detection sensitivity and minimize the detection of noise floor clutter, low level spurious signals and other signal spikes that are below the desired detection level.

The button is GRAY when not currently active and the ANF trace level will not be displayed on the Graticule.

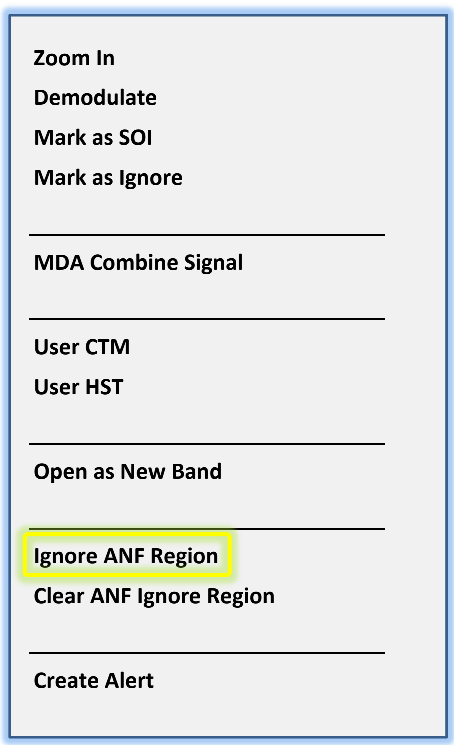
The button is GOLD when active and the ANF trace level will be displayed globally on the Graticule of each currently active spectral window.

The actual trace will appear within the Ambient Noise Floor (ANF) and represents the average noise floor. The ANF trace reference marker is displayed as a BEIGE trace.

Ignore ANF Region

The | Ignore ANF Region | menu option allows the technical operator to artificially lower selected regions of the current spectrum, removing the specified region from the | Ambient Noise Floor (ANF) | calculation.

The technical operator selects the signal event or region of the spectrum, and selects the | Ignore ANF Region | menu option.



Ignore ANF Region| v1.35xx

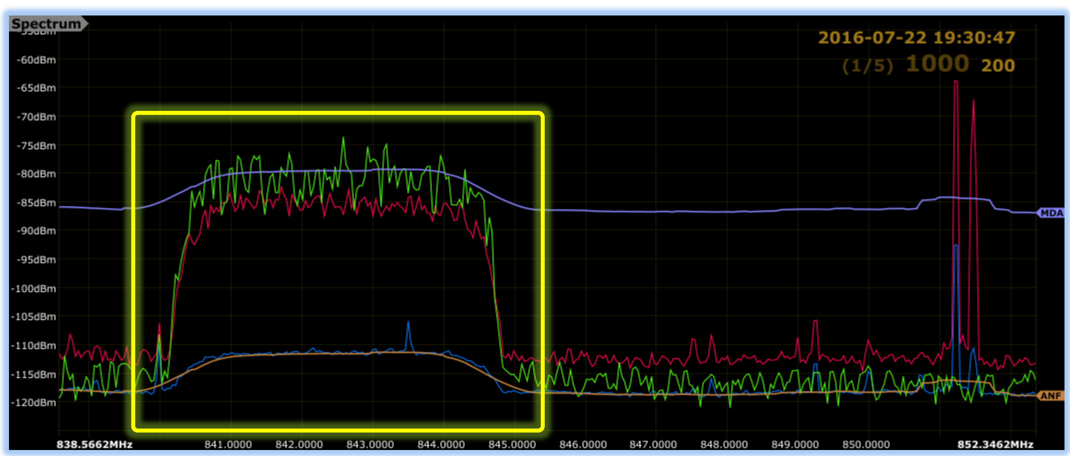
This feature is global across multiple spectrum windows when spectrum overlap is present, and the feature can be utilized with the | Minimum Detection Amplitude (MDA) | Relative Mode | and the | Spectrum Baseline Logging (SBL) | feature to provide an enhanced detection capability when continuous high amplitude signal events are present across a wide Range of Interest (ROI), and are in-effect raising the Ambient Noise Floor (ANF) above the operator defined | MDA Relative Mode |, detection limit.

The | Ignore ANF Region | feature is also useful where considerable variations in the | Ambient Noise Floor (ANF) | level are present and need to be balanced out for accurate signal capture across an entire extended Range of Interest (ROI).

The | MDA Relative Mode | and SBL capture features are directly coupled to and dependent on the | Ambient Noise Floor (ANF) | calculation, from a detection and signal event list logging perspective.

The | Ignore ANF Region | tool fully supports the ability to set multiple “Ignore” regions across the Range of Interest (ROI) providing the unique ability to effectively alter the | Ambient Noise Floor (ANF) | at any given location where detection and capture might otherwise not occur when a wide frequency SPAN is being swept and analyzed.

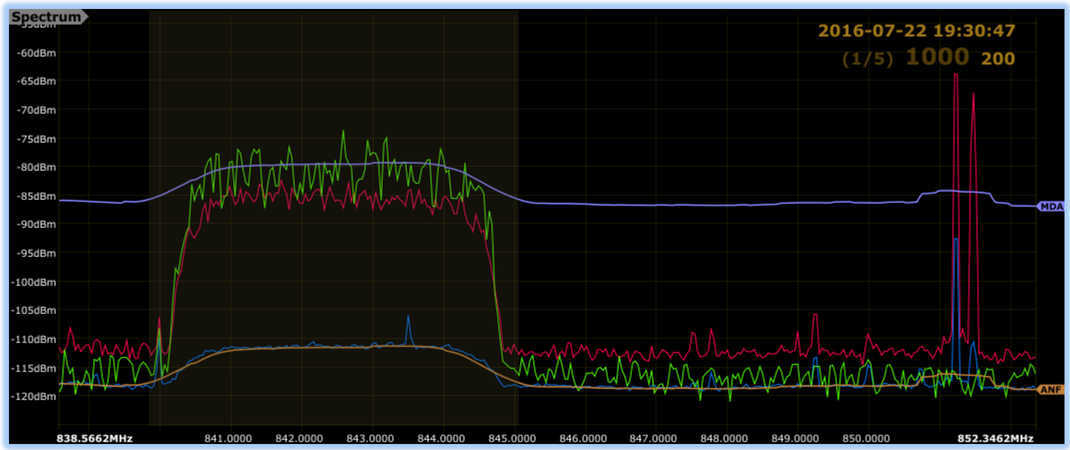
This feature is often utilized at the discrete signal level, but can also be utilized for wide bandwidth areas of spectrum.



Ignore ANF Region | v1.35xx

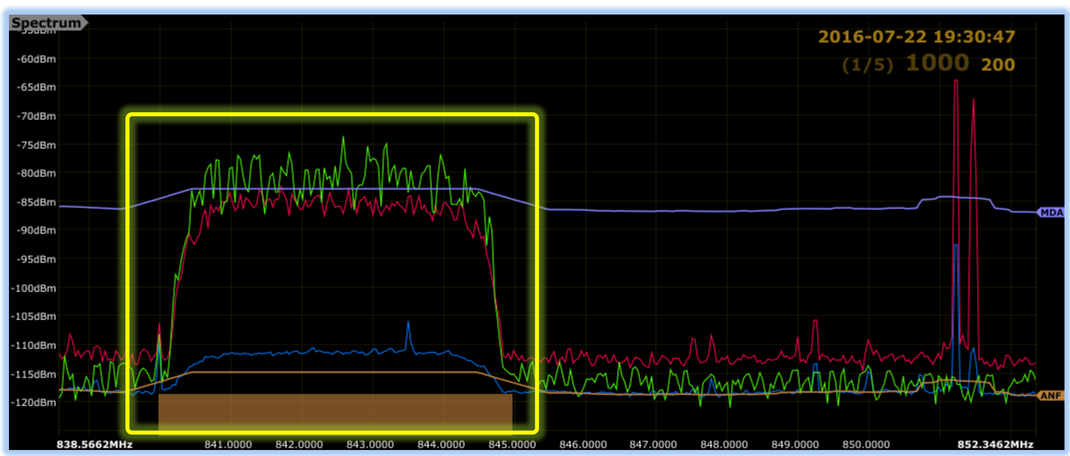
The above image illustrates a high amplitude signal event and resulting noise floor calculation.

The technical operator utilizes the left mouse to capture and drag a shaded area over the specific area of interest and selects the | Ignore ANF Region | from the menu dialog when the left mouse button is released.



Ignore ANF Region | v1.35xx

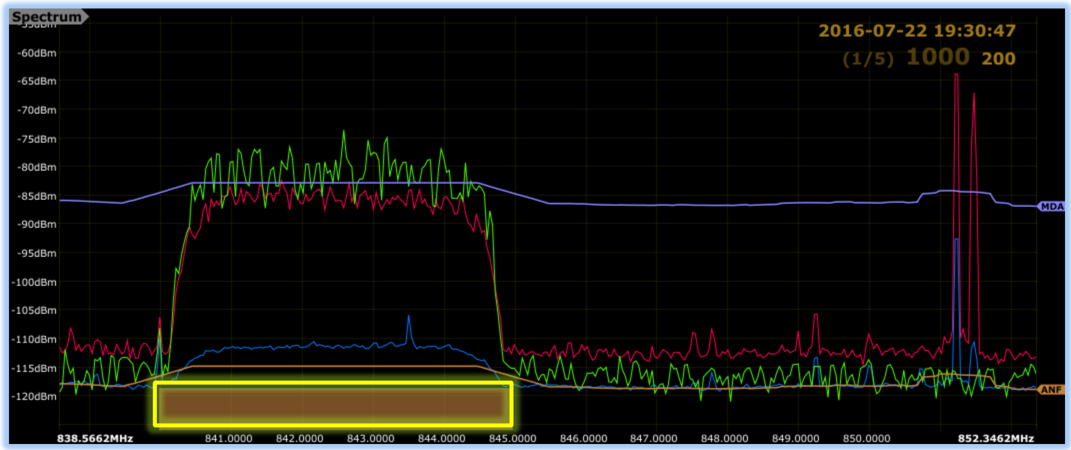
The following image illustrates the effect of the utilizing the | Ignore ANF Region | to effectively artificially lower the Ambient Noise Floor (ANF), which in turn also lowers the | Minimum Detection Amplitude (MDA) | Relative Mode | reference to better capture and analyzer the signal event.



Ignore ANF Region | v1.35xx

The same method is utilized by the technical operator to | Clear ANF Ignore Region | at any time to remove the | Ignore ANF Region | and restore normal Ambient Noise Floor (ANF) operation.

Any area that is selected by the technical operator and flagged as | Ignore ANF Region | will display a shaded area directly below the ANF reference line and provides excellent visual evidence that the | Ambient Noise Floor (ANF) | calculation has been altered for capture and analysis purposes.



Ignore ANF Region | v1.35xx

It is recommended that the ANF reference line be actively displayed on the UI or any | Ignore ANF Region | markers will not be actively displayed.

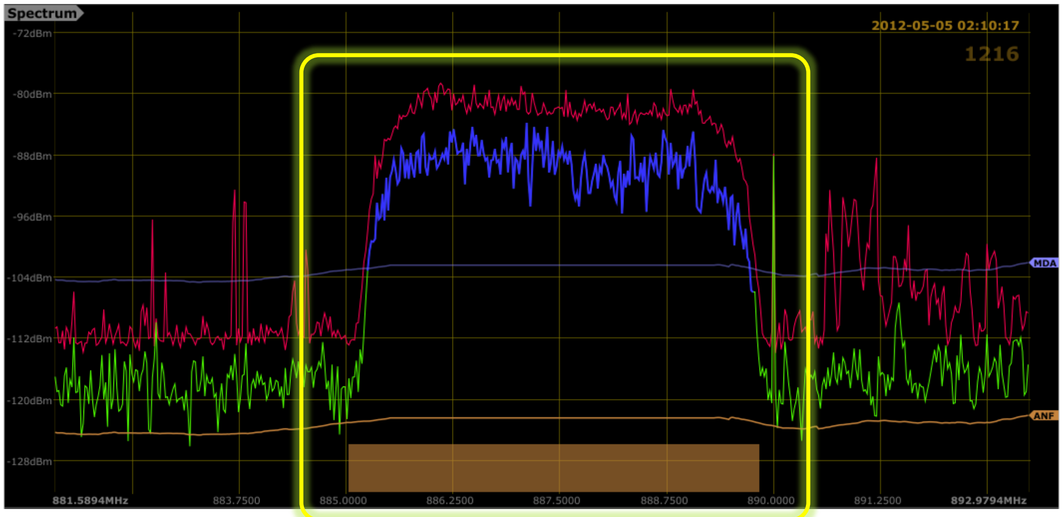
This is accomplished by pressing the | ANF | button within the | Ambient Noise Floor (ANF) | control group located on the sidebar menu structure.

ANF Control Group | v1.35xx

The | Ignore ANF Region | feature has no effect on the Threat Detection Algorithm (TDA), Chirp Threat Mode (CTM), or Harmonic Signature Analysis (HST) beyond the Minimum Detection Amplitude (MDA) ability to flag any given signal event for analysis or capture.

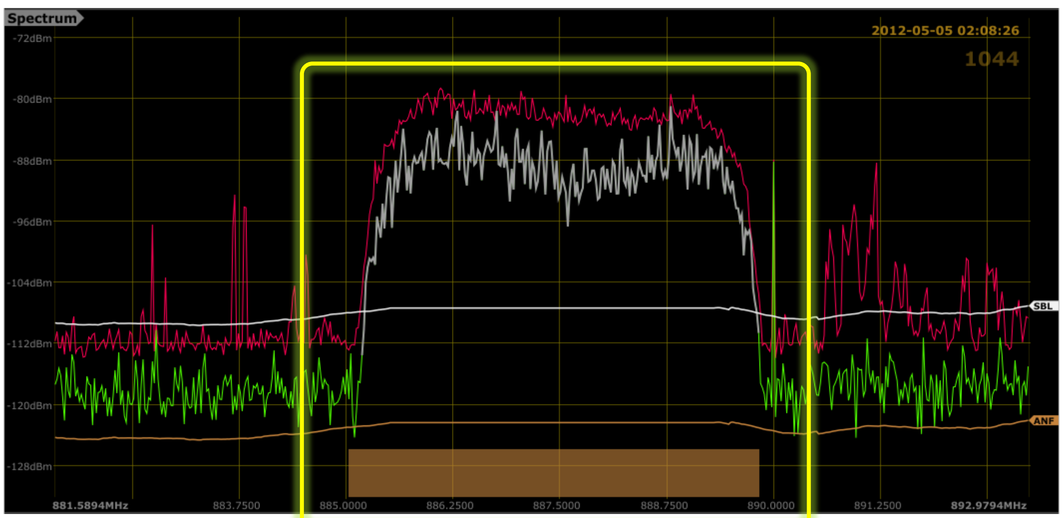
The detection and capture ability are significantly enhanced during operation of the MDA, or (MDA + CTM + HST) combination.

Likewise, the detection and capture ability is significantly enhanced during operation of the | Spectrum Baseline Logging (SBL) | feature when the | Ignore ANF Region | is selectively utilized during deployment.



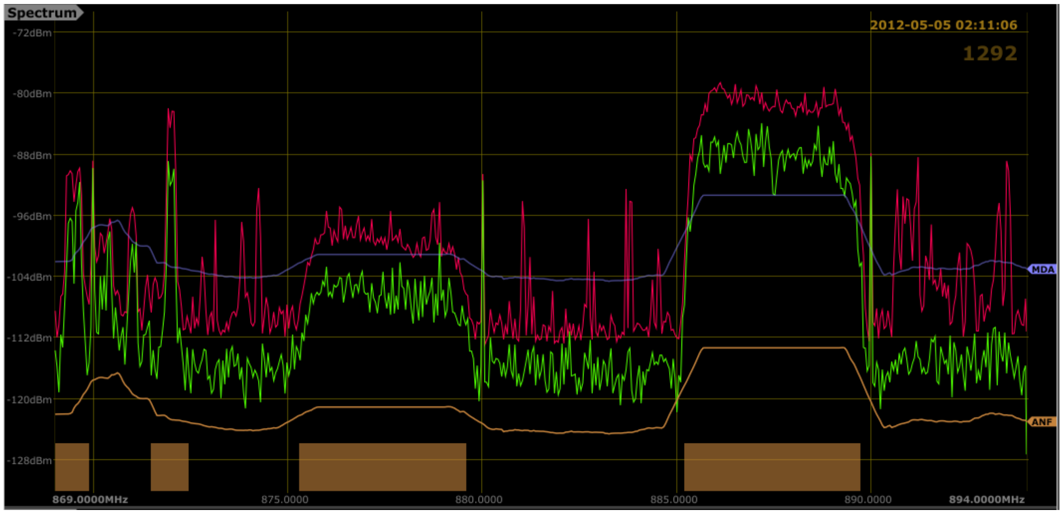
Ignore ANF Region | v1.35xx

Any area of the spectrum that has been “ignored” by the technical operator will remain in this state even when the project is closed and opened again during post analysis review and must be manually cleared by the technical operator.



Ignore ANF Region | v1.35xx

As illustrated in the above images of the MDA and SBL spectrum plots, the effect of utilizing the Ignore ANF Region permits continuous, high amplitude signal events to be detected, captured and processed during the analysis cycle.



Ignore ANF Region | v1.35xx

The above image illustrates the ability to select multiple Ignore ANF Regions during active deployment.

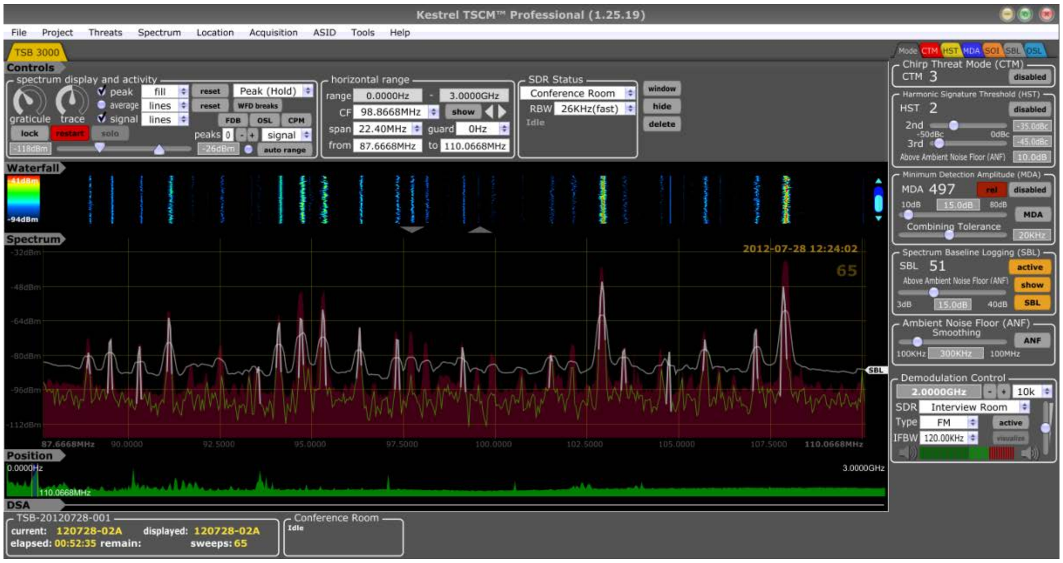
Spectrum Baseline Logging (SBL)

Spectrum Baseline Logging (SBL) refers to a concept specifically developed for the Kestrel TSCM ® Professional Software and involves the automated capture of the ambient RF signal environment continuously over a period of time and is utilized as a general capture and recording function to generate a detailed signal list and visual trace.

It is important to understand that no active threat detection occurs when the SBL mode is selected by the technical operator.

Spectral data captured during the operation of the SBL feature is specifically collected for the purpose of comparative baseline signal analysis, operator training and familiarization.

The capture of generic Graphical Area Review (GAR) data can easily be captured utilizing the Spectrum Baseline Logging (SBL) feature and utilized as a comparative baseline when shared between assignments in the same geographical area or in many cases, the same multi-tenant buildings.

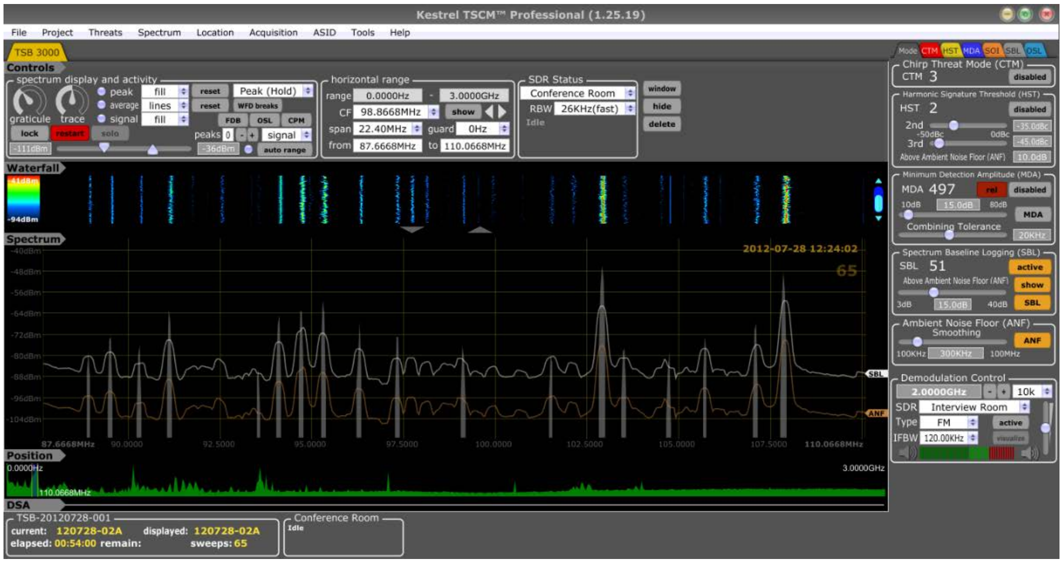


SBL | v1.35xx

All signals spikes at or above the operator set Above Ambient Noise Floor (ANF) reference level (dB) are captured and logged on the Spectrum Baseline Logging (SBL) signal list.

SBL | v1.35xx

All signals meeting the SBL (Above) Ambient Noise Floor (ANF) reference level (dB) are captured and recorded, providing a detailed picture of the ambient RF signal environment over a period of time.



SBL | v1.35xx

The SBL feature allows the operator to create a comprehensive list of all signals (continuous or intermittent) within the spectral range selected by the technical operator.

The SBL control group provides a standalone capture tool that is utilized to generate a clean signal list of all signals and associated signal levels present in relation to the target area.

When active, a signal list is automatically generated based on the ANF control group averaging (smoothing) sensitivity setting and the | ABOVE ANF | detection level or depth setting within the SBL control group.

When active signals meet the detection criteria, they are immediately added to the SBL signal list and the | MASTER ATL | signal list.

Additional discrete signal parameters may be viewed and edited with the Signal Profile Editor (SPE).

The technical operator has the option to show or hide the GRAY spectral marker flags on the Graticule.

When the button is GRAY, the spectral marker flags are not displayed on the Graticule placing emphases on other spectral marker flags that may be associated with the MDA, HST or CTM functionality.

When the button is GOLD, the GRAY spectral marker flags are displayed on the Graticule.

The button is utilized to display the SBL level | ABOVE ANF | and mirrors the ANF trace whether or not it is currently displayed.

When the SBL button is GRAY the SBL trace is not displayed on the Graticule.

The button is utilized to display the SBL level | ABOVE ANF | and mirrors the ANF trace whether or not it is currently displayed.

When the SBL button is GOLD the SBL trace is displayed on the Graticule.

The GRAY spectral marker flags represent each discrete signal that has automatically been added to the SBL signal list structure.

It is recommended that the SBL be the first step; by completing a Geographical Area Review (GAR).

This allows the technical operator to capture one (1) or more SBL captures, at points outside of the influence of the target area.

The actual number; of discrete signals that have been captured are displayed on the SBL signal count display for technical operator reference.

The SBL enable button begins the collection process and may be stopped to adjust settings and restarted as required.

This action will not affect data that has already been captured.

Harmonic Signature Threshold (HST)

The 2nd Harmonic Level must be defined by the operator.

This value is expressed in dBc.

This means that the 2nd Harmonic Level is -30 dB below the SOI Carrier Power Level (CPL).

The default is -35 dBc.

The 3rd Harmonic Level must be defined by the operator.

This value is expressed in dBc.

This means that the 3rd Harmonic Level is -40 dB below the SOI Carrier Power Level (CPL).

The default is -45 dBc.

The HST control group includes an HST signal count indicator that displays the number of discrete signals automatically added to the HST list structure.

The multi-function button is by default, disabled and the technical operator may select two (2) active detection modes.

The CTM Mode will only analyze signals that have met the MDA, have been chirped and added to the CTM list.

Subsequently, these CTM signals are analyzed by the HST algorithm and added to the HST list structure if found to contain harmonic content or relationships.

Once the HST analysis completes, one (1) or more of the CTM signals will automatically move to the HST list and display as YELLOW spectral marker flags on the Graticule, if they are determined to have harmonic content or relationships.

This process is totally automated, but may require several sweeps to complete analysis and accomplish list transfer updates, depending on the Range of Interest (ROI) and other sweep parameters.

The result will be CTM signals flagged RED and HST signals flagged YELLOW.

It is not uncommon that one (1) or more signals will be flagged as CTM or HST that do not appear in a logical CTM or HST sequence for any given fundamental frequency.

This is due to the ability of the software to also analyze out of band images, spurious signals, near-field affects, etc.

Often there may be a signal detected and placed on the CTM list that is actually below the fundamental frequency.

If such signals are identified they will generally be found to contain room audio, if they have been placed on the CTM or HST list.

Oftentimes, these signals are of very low amplitude at or even observed to be well within the Ambient Noise Floor (ANF).

Harmonic Signature Threshold (HST) Control Group			
HST Signal Count Indicator		Provides the Number of Signals captured during analysis	Provides the Number of Signals captured during analysis
CTM / HST Control Mode Button	Disabled	CTM Mode	HST Mode
2nd Harmonic (dBc) Slider Bar	Default = -35 dBc	-50 dBc to 0 dBc	-50 dBc to 0 dBc
3rd Harmonic (dBc) Slider Bar	Default = -45 dBc	-50 dBc to 0 dBc	-50 dBc to 0 dBc
Above ANF Input Box	Default = 10 dB	3 dB to 20 dB	3 dB to 20 dB

HST Control Group | v1.35xx

The HST Mode analyzes all MDA signals for harmonic content and will likely generate considerably more harmonic relationships given the greater number of signals present that will potentially have logical mathematical relationships within the ROI.

The technical operator may set the detection level (dBc) for the 2nd and 3rd harmonic or accept the default settings.

It is essential to understand that the HST and CTM modes, respond to the MDA level set by the technical operator.

Unless the MDA is active, no threat analysis will occur.

TIP: It is essential that the operator fully understand the difference between dBm and dBc when setting the Harmonic Signature Threshold (HST).

Understanding dB-Carrier (dBc)

In addition to the actual Signal of Interest (SOI) referred to as the carrier at any given frequency, an oscillator will produce several other signals that are considered to be undesirable oscillator by-products generated within both the transmitter and receiver.

An oscillator generates harmonics and will also output signals at other arbitrary frequencies referred to as spurious emissions, or spurs.

Generally, harmonic emissions and spurs will have significantly lower levels than the Signal of Interest (SOI) main carrier power.

TIP: It is entirely possible to observe signals below the carrier signal frequency in the form of what appear to be sub-harmonics, spurs and arbitrary noise. Oftentimes these signals will contain room audio and will be identified as confirmed hostile signals when chirped by the Kestrel TSCM ® Professional Software.

We reference the power level of harmonics, spurs and images in dBm.

However, often what we are interested in is not what the harmonic or spur power level is specifically, but rather what the power of the harmonic level is, in relation to the carrier power level at the moment of detection or for the purposes of threat analysis.

“dBc” is the measurement of Decibels (dB) relative to the carrier and is used to describe in dB how far down, harmonic, spurious and noise levels are relative to a known reference; namely the SOI main carrier signal power at a given moment in time.

The actual “dBc” level is referenced for a signal in the frequency domain, like “dBi” (Isotropic) is utilized for antenna patterns.

The measurement of “dBm” and “dBc” are completely different so there is no conversion between the two (2) units of measure.

In simple terms, “dBm” indicates the power measurement relative to 1 mW and dBm is the relative difference referenced to a fixed power level of 1 mW.

On the over hand, “dBc” indicates the power level relative to the power level of the SOI fundamental carrier frequency and is typically used to describe harmonics, spurs, noise, channel crosstalk and inter-modulation signal events, which can interfere with the main carrier.

In practice, it is not really possible to transmit a signal that is a pure frequency, without any noise, spurs or harmonic artefacts.

Specifically, we need to look at the power level ratio between the carrier, noise, spurious and harmonic signal levels.

We can define how far down the Harmonic or (spur / noise) signal is next to the carrier power level.

The measurement standard is referenced as (dBc).

For example, -30 dBc means that the harmonic level is 30 dB below the instantaneous SOI main carrier, using the carrier power level as a reference at a given moment in time at capture or threat analysis.

A significant percentage of harmonics detected in Near-Field TSCM applications involve relatively high (-30 dBc to -40 dBc) levels for the 2nd harmonic and somewhat lower levels for the 3rd harmonic.

Even lower levels can be expected for the 4th, 5th or higher order harmonics, if present during detection or threat analysis.

It is not unusual for Kestrel ® to detect harmonic levels that may appear to be within the noise floor.

Minimum Detection Amplitude (MDA) ™

The MDA control group includes a signal count indicator, MDA Enable button, MDA detection level slider bar, display MDA limit line button, combining tolerance slider bar (-50 kHz to 100 kHz) and a direct entry combining tolerance input box.

The technical operator sets the MDA capture level based on the ROI and ANF.

Setting the MDA too low will result in the capture of virtually every signal, as well as those at or within the noise floor.

Setting the MDA too low to the noise floor is not productive and will result is noise floor spikes being flagged as MDA signals.

Setting the MDA too high will result in the possibility of hostile signals not being flagged for threat analysis.

Signals are added to the MDA list and displayed with a BLUE spectral marker flag on the Graticule.

Chirp Threat Mode (CTM) ™

The CTM Count Indicator displays the number of confirmed hostile signals containing target area room audio.

The CTM Enable button activates the CTM capture mode.

TIP: CTM is an active audible chirp mode and causes the target area to be chirped with an alerting audio tone. Do not activate the CTM Mode until you have completed your non-alerting sweep priorities. Make sure that the host computer sound control is active and set at a high enough audio level to be clearly heard throughout the target area.

CTM signals are added to the CTM signal list and may be automatically transferred to the HST list if the algorithm determines signals are determined to harmonic content or relationships.

Spectral Marker Flag | Behaviour

At any time, the technical operator may display the SBL spectral marker flags to quickly determine how many SBL signals did not meet the MDA.

The SBL spectral marker flags will be GRAY and the MDA spectral flags will be BLUE and over-ride any SBL GRAY spectral marker flag; where there is signal detection overlap.

The SOI signal list over-rides any SBL spectral marker flags where signal overlap occurs.

SOI spectral marker flags do not over-ride MDA marker flags where signal overlap occurs.

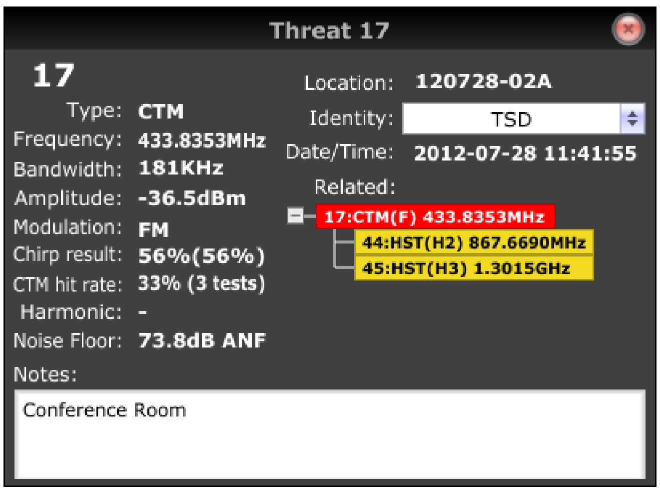
Correlation Confidence Factor (CCF)

The Correlation Confidence Factor (CCF) is displayed in the signal profile dialog window for each signal event on any of the threat and / or signal lists.

The CCF default values will be displayed in the signal profile dialog window along with a range of additional signal event detail, including | Chirp Result: 0% (0%) | and | CTM Hit Rate: 0% (0 Tests) | as a useful point of reference in quantifying the potential that any given signal event is an analog based Technical Surveillance Device (TSD) of a hostile nature.

The | Chirp Result: 0% (0%) | may be interpreted as a percentage with the first number indicating the “best” chirp level and the second number indicating the last Chirp Threat Mode (CTM) result.

The | CTM Hit Rate: 0% (0 Tests) | may be interpreted as a percentage with the first number indicating the successful CTM hits with the second number indicating the total number of Chirp Threat Mode (CTM) tests.



Signal Profile | v1.35xx

The above image illustrates a positive indication of a hostile (analog) audio based Technical Surveillance Device (TSD) operating within the immediate target area with a fundamental frequency of 433.8353 MHz, a 2nd harmonic of 867.6690 MHz and 3rd harmonic at 1.3150 GHz.

Ignore Signal Event (ISE)

Ignoring a signal event is fully supported in the Kestrel TSCM ® Professional Software.

The technical operator must actively select a Signal of Interest (SOI) that is currently displayed with a spectral marker flag on the Graticule, or by selecting the actual signal entry from the Master ATL or sidebar signal list; utilizing a right mouse click on the signal event to display the option dialog window.

An option dialog window will display and the technical operator can select the "Ignore" option from the menu list, you will note that the "Un-Ignore" option is currently grayed out at this time assuming the signal selected is not already on the "Ignore" list.

This action causes the signal event to display a highlight replacing the spectral marker flag as originally displayed on the Graticule.

A review of the Master ATL or sidebar signal list will reveal that the highlight is also present for the signal event selected by the technical operator.

This is a powerful analysis feature that allows the technical operator to mark and clearly identify any signal event that has been reviewed and / or cleared as being a friendly signal during the technical operator assisted analysis process, providing better focus on other signal events that have not yet been properly analyzed by the technical operator or have been confirmed as hostile or potentially hostile in nature.

The Kestrel TSCM ® Professional Software supports the ability to print a separate list of "Ignored" signal events within the session report structure.

Advanced Chirp Procedure (ACP)

There are a number of Advanced Chirp Procedure (ACP) methods that have been specifically developed for use with the Kestrel TSCM ® Professional Software that significantly enhance the ability to detect and correctly identify hostile signals even within architecturally complex target areas or facilities.

Options include the use of additional audio-based chirp sounders coupled to the host computer audio output and the use of on-site audio distribution and telephone system conference capability to enhance chirp distance, range and capability.

To maximize the ability of the Kestrel TSCM ® Professional Software in the detection and identification of analog audio based Technical Surveillance Devices (TSD), the operator can feed the laptop audio output to an external audio network in several ways to enhance results.

The operator can feed the audio output of the host computer into an existing Public Address (PA) system.

The operator can also create an audio-conferencing session within several areas of the target area, by utilizing conferencing or paging features of the telephone infrastructure to extend and significantly enhance the overall Chirp Threat Mode (CTM) effectiveness.

Alternatively, the operator can utilize a number of portable amplified hard-wired speaker units that have been strategically placed within the target area or facility, to enhance the chirp audio level and extend the chirp tone sequence beyond the immediate target area in which the Kestrel TSCM ® Professional software, Signals Intelligence Support System (SISS) ™ is operating.

TIP: The principle of utilizing the enhanced Chirp Threat Mode (CTM) is based on the fact that oftentimes, the RF transmission capability of a typical Technical Surveillance Device (TSD) is detectable at a considerably greater distance than is the devices actual ability to hear the Chirp Tone.

Dynamic Alert Annunciator (DAA) ™

The DAA feature can be utilized to ensure RF compliance with existing wireless policies and / or to verify the integrity of a Secure Compartmented Information Facility (SCIF), or other security zone, where wireless devices are not typically permitted.

The Kestrel TSCM ® Professional Software, threat detection strategy, includes a "GO / NO GO" alerting feature that permits the technical operator to establish a "RED / GREEN" threshold alerting capability.

This feature allows the technical operator to establish an unlimited number of standby, and active alerting zones, across multiple receivers, and spectrum band allocations, permitting detection of entire blocks of spectrum, or point-point precision at the individual signal level, within an operator centric work environment.

The Dynamic Alert Annunciator (DAA) is specifically designed to provide signal exceedance detection and logging, signal loss detection and logging, or both exceedance and loss detection and logging based on precision operator parameters.

The ability to establish signal exceedance and signal loss parameters within the same Alert Zone and maintain any number of custom Alert Zones across multiple bands and multiple receivers another significant development milestone.

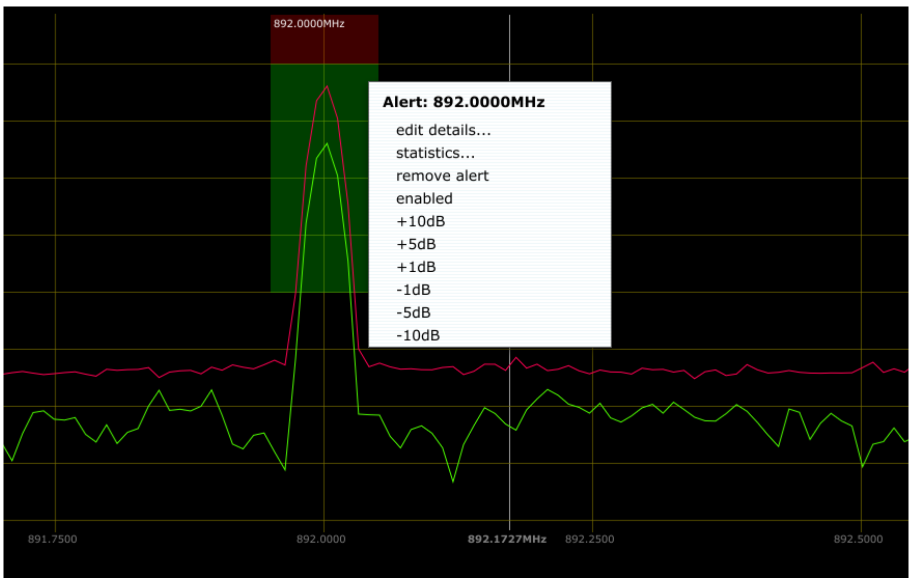
Our graphical "drag to adjust" capability permits the technical operator to "grab and move" an alert zone region (left mouse click within the alert zone), to adjust the horizontal position of the alert zone, relative to any particular Signal of Interest (SOI), or bandwidth allocation.

The ability to left mouse click and drag the right, or left boundary of the alert zone, permits the alert zone region bandwidth, to be increased or decreased by the technical operator.

The ability to "grab and drag" the boundary between EXCEED (red) and NORMAL (green) region allows the EXCEED / LOSS detection sensitivity level to be adjusted relative to the Signal of Interest (SOI) conditions.

The ability to "grab and drag" the boundary between THRESHOLD (lower end of the green) range, allows the technical operator to precisely adjust the minimum detection and logging level, Signal of Interest (SOI) LOSS parameter.

The ability to "grab and drag" the lower and upper edges of the NORMAL (green) alert zone regions permits significant deployment flexibility for signal integrity monitoring and compliance, and for new signal detection.



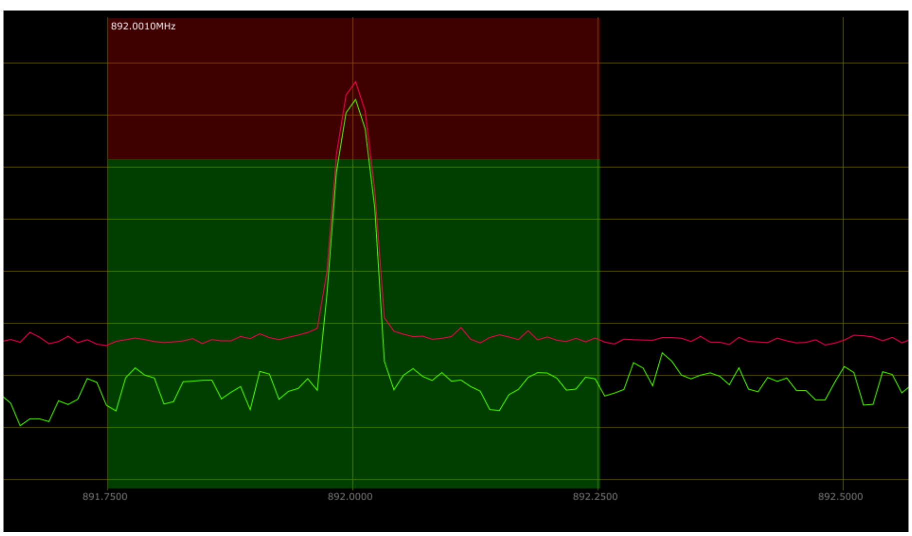
DAA Alert Zone menu | v1.35xx

Operator programming is accomplished graphically on the Graticule, or by accessing the menu structure, to provide alert zone parameters, detection sensitivity, exceedance or loss event, capture and logging.

DAA Alert Zone menu | v1.35xx

The technical operator must first select the desired alert "trigger" zone on the Graticule using the left mouse to "click-and-drag" and display a shaded box over the desired "trigger" zone and select the | CREATE ALERT | menu option.

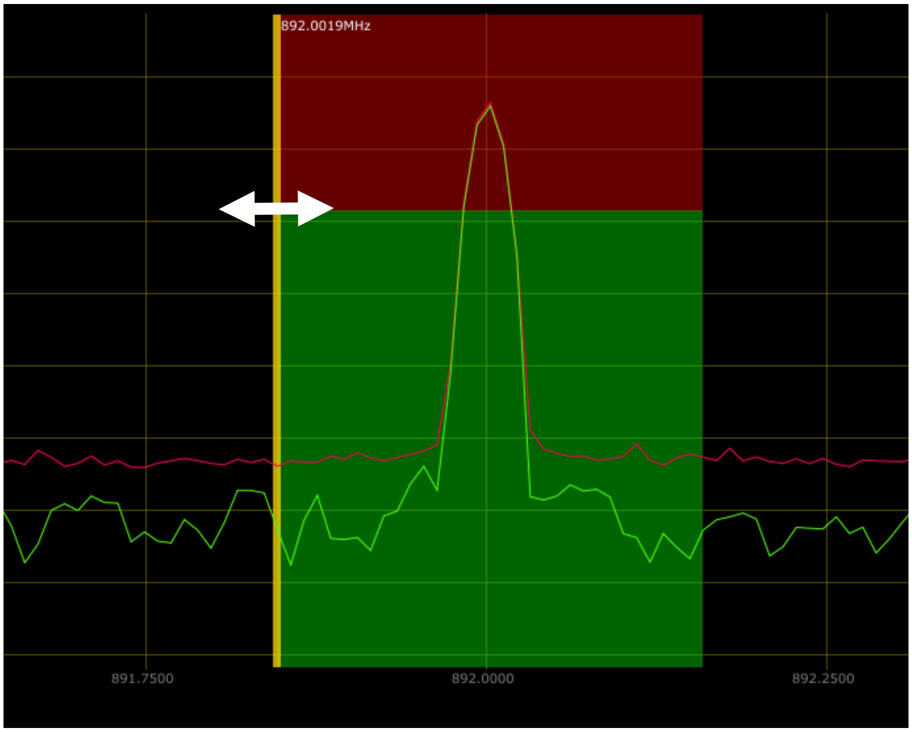
This procedure places a "standby" alert zone on the Graticule and the technical operator can adjust the detection sensitivity for signal event EXCEEDANCE, or signal LOSS conditions.



DAA Alert Zone Region | v1.35xx

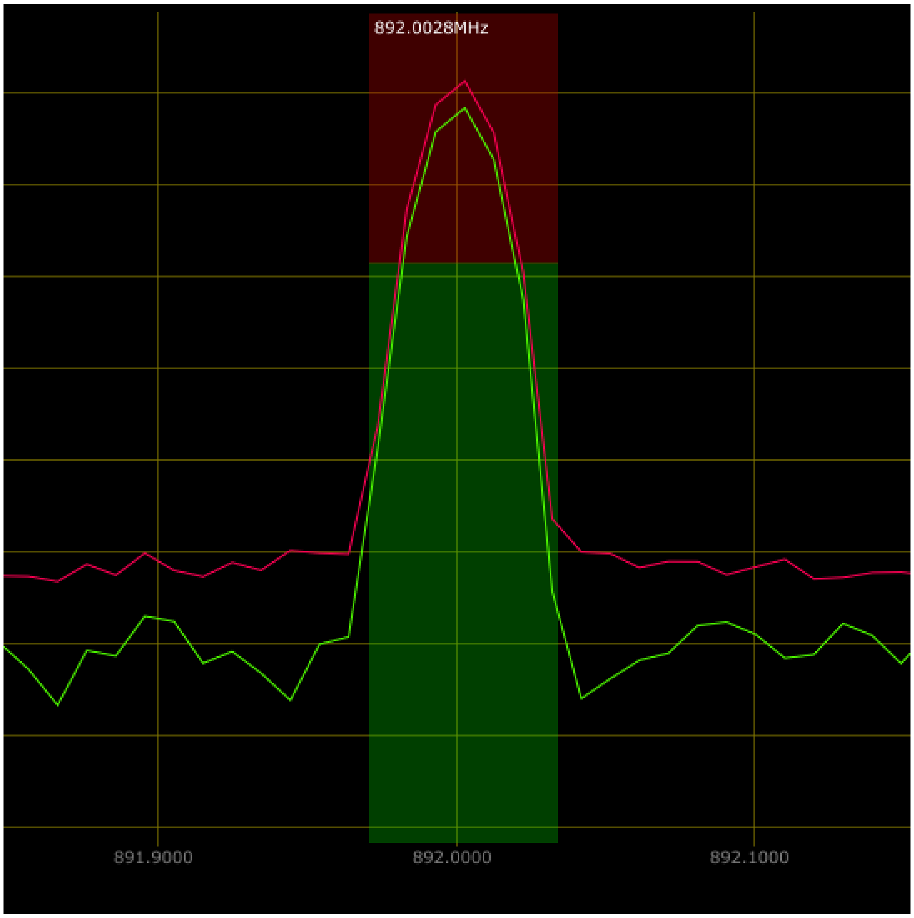
The technical operator may use the menu structure to adjust the alert zone region, or the on screen, drag and move, drag and adjust, to alter the alert zone region bandwidth, using grab and drag on the right or left alert zone boundary.

Drag and adjust the right bandwidth boundary to increase or decrease the alert zone bandwidth.



DAA Alert Zone Region | v1.35xx

Drag and adjust the left bandwidth boundary to increase or decrease the alert zone bandwidth.



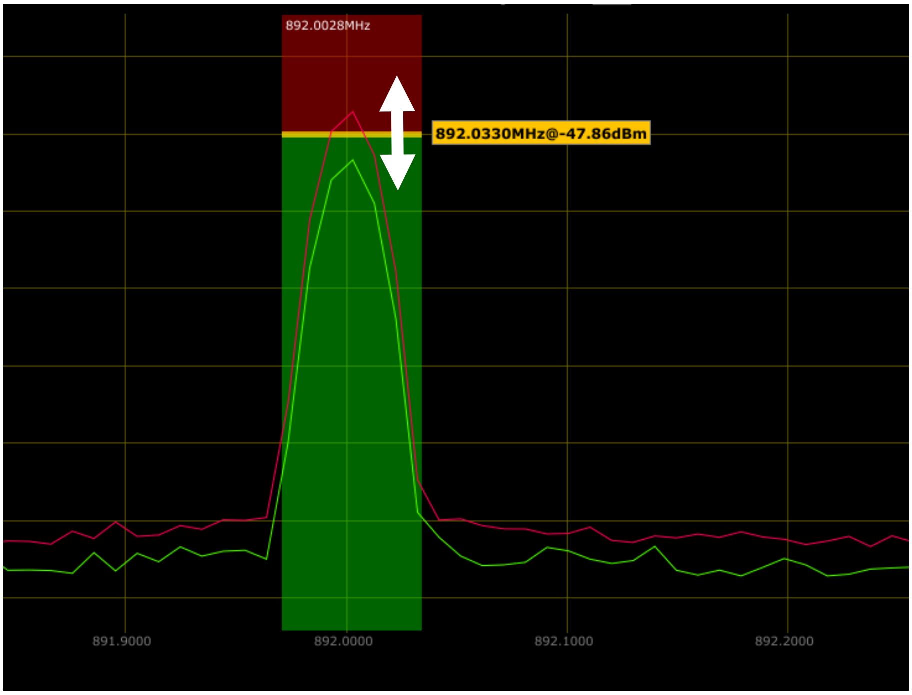
DAA Alert Zone Region | v1.35xx

Once the alert zone bandwidth is set, and the horizontal position of the alert zone, is adjusted by the technical operator, the detection sensitivity can be established for signal exceedance, and / or loss.

This is accomplished by grab and drag of the upper and lower boundary of the GREEN zone and adjusting the NORMAL range to include the UPPER (EXCEED) limit, and the LOWER (LOSS) limits.

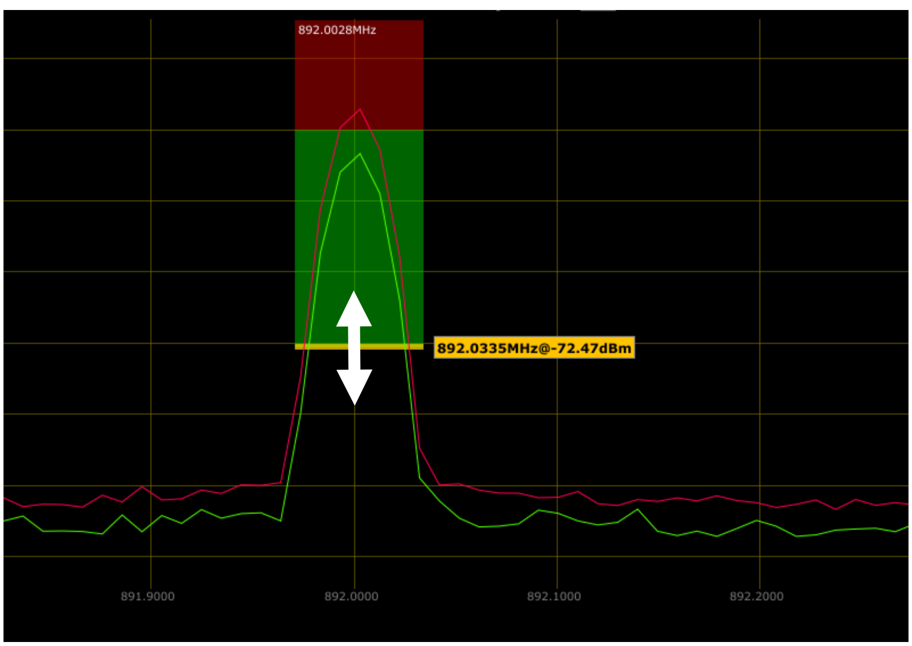
The following image illustrates the grab and drag of the UPPER (EXCEED) limit and setting it to -48 dBm.

This setting will become the DAA capture and logging threshold for signal level EXCEEDANCE once the alert zone is active.



DAA Alert Zone Sensitivity | v1.35xx

Next the technical operator uses grab and drag to adjust the LOWER (LOSS) signal limit as illustrated below at -72 dBm.

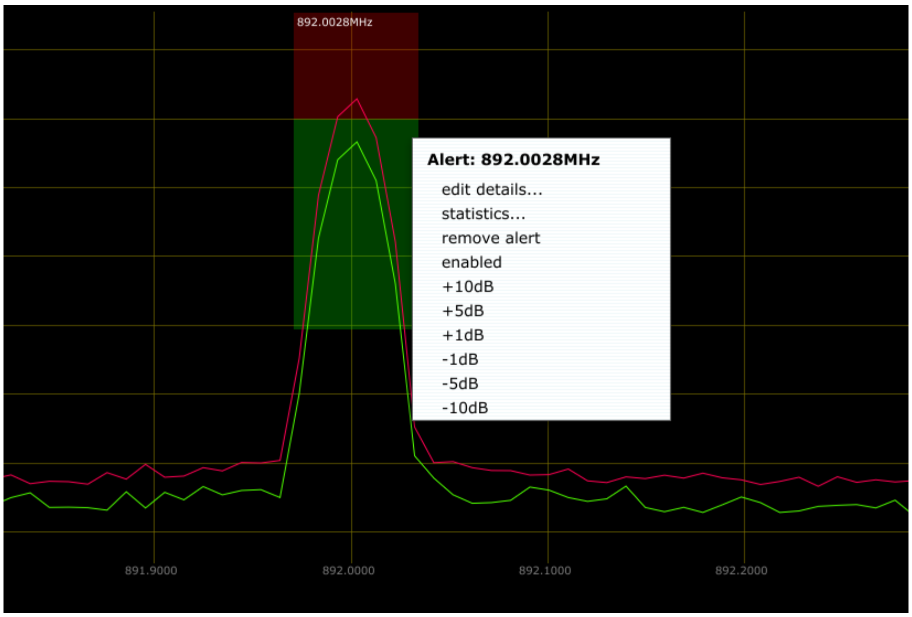


DAA Alert Zone Sensitivity | v1.35xx

Should the monitored signal event level drop below -72 dBm the event will be captured and logged accordingly.

Alternatively, the technical operator can program any new or existing alert zone, utilizing the programming menu structure.

Right mouse click on the alert zone to display the DAA programming menu structure.



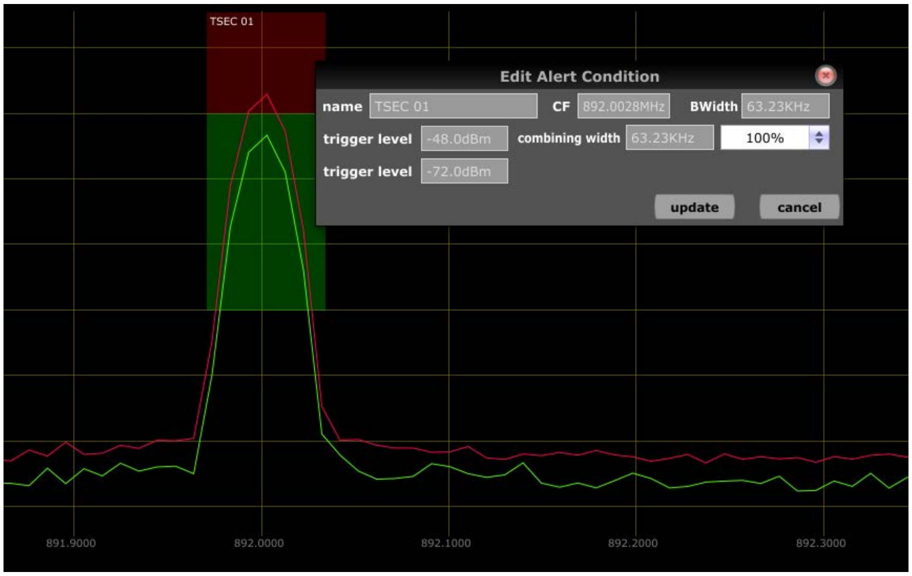
DAA Alert Zone Menu | v1.35xx

This menu includes several important capabilities and is context sensitive to each individual alert zone selected, beginning with the default alert zone name equal to the Centre Frequency (CF).

The default alert zone name can be edited by selecting the | EDIT DETAILS | menu option, along with other programming features.

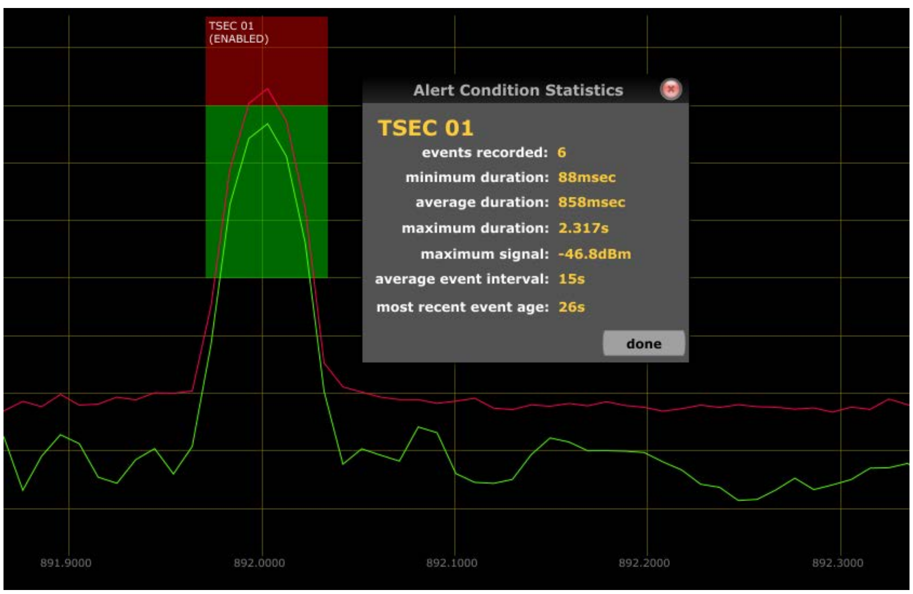
The following image illustrates the ability to change the default alert zone name to TSEC 01 within the | EDIT ALERT CONDITION | dialog window.

This dialog window displays the current | CENTRE FREQUENCY | BANDWIDTH | EXCEED TIGGER LEVEL | LOSS TRIGGER LEVEL | and provides the ability to apply a | SIGNAL COMBINING | value.



DAA Edit Alert Condition | v1.35xx

The menu also includes an option to display Alert Condition Statistics for the Signal of Interest (SOI) that trigger the alert condition.



DAA Alert Condition Statistics | v1.35xx

This includes the | NUMBER OF EVENTS RECORDED | MINIMUM DURATION | AVERAGE DURATION | MAXIMUM DURATION | MAXIMUM SIGNAL LEVEL | AVERAGE EVENT INTERVAL | MOST RECENT EVENT AGE | for the Signal of Interest (SOI).

Additional programming features located on the right click menu, include the ability to | REMOVE | the alert zone.

The alert zone may also be | ENABLED |, and there are a number of fixed sensitivity step levels of | +10 | +5 | +1 | dBm, and | -1 | -5 | -10 | dBm for precise detection and sensitivity control of independent alerting zones across multiple frequency band allocations and any number of search receivers or analyzers.

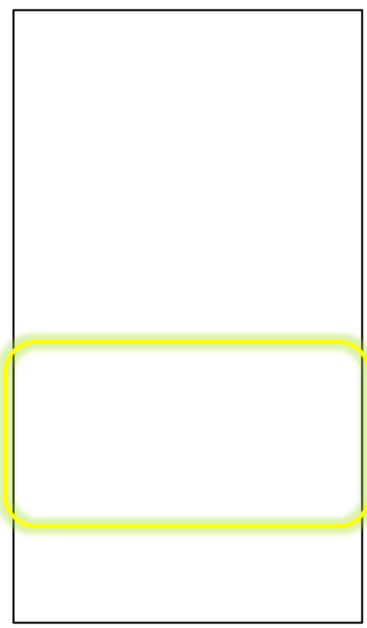
Each individual alerting zone is disabled by default and must be enabled by the technical operator to provide input to the DAA audio and visual annunciation output, and signal event logging.

The alerting zone will display as a shaded area when | DISABLED | and will appear brighter once | ENABLED | by the technical operator.

Once one or more alerting zones are created, and selected active, the technical operator must setup the Dynamic Alert Annunciator (DAA) control window.

The DAA control group is accessed from the | SPECTRUM | DYNAMIC ALERT ANNUNCIATOR | menu structure.

We have also included a | SPECTRUM | ENABLE ALERT | control which is co-located with the DAA menu structure and allows the feature to be quickly activated, or disabled.



DAA Alert Condition Statistics | v1.35xx

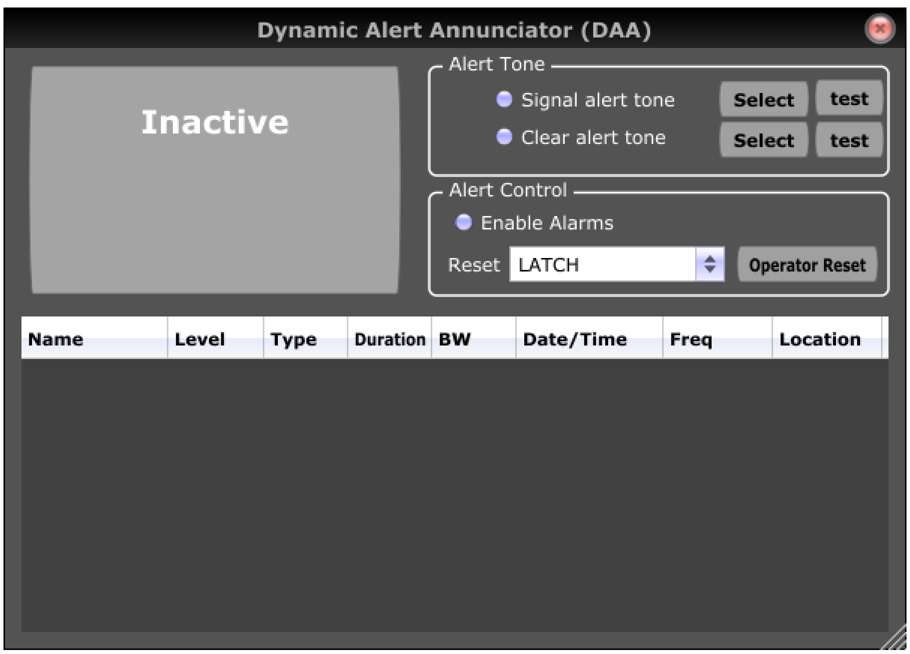
Selecting the | DYNAMIC ALERT ANNUNCIATOR (DAA) | menu option displays the main DAA dialog window.

The Kestrel TSCM ® Professional Software, Dynamic Alert Annunciator (DAA) ™ capability is particularly important during extended mission specific, secure meeting deployment, and for unattended remote spectrum surveillance and monitoring assignments.

The DAA feature is an excellent resource when utilized in a Sensitive Compartmented Information Facility (SCIF) environment, or other security zone, controlled by a wireless policy.

DAA design features include the ability to capture, log, identify, analyze and respond to unauthorized signal events in real-time, and provide working intelligence for the Technical Security Specialist (TSS) ™.

DAA design features include a user-friendly RED / GREEN decision-making alert structure that may be deployed and controlled, by the end-user conducting the actual meeting, or secure information session by simply installing a secondary display monitor within the meeting area.



Default DAA Dialog Window | v1.35xx

The DAA dialog window permits control of the type of alerts (audio / visual) and reset functionality.

The DAA alert dialog window can be co-located on a separate monitor within the actual target area for the meeting managers, discrete alert notification, in the event a Signal of Interest (SOI) is detected.

The DAA feature is totally independent of the Minimum Detection Amplitude (MDA) control group functionality and permits the technical operator to create any number of active or standby alert zones, by dragging a shaded area over the desired spectrum bandwidth.

Alert trigger zones may be setup in either a standby mode or active mode directly on the Graticule and enabled or disabled during runtime.

Once alerting zones are established and active, the Dynamic Alert Annunciator (DAA) is utilized to provide signal level capture and logging, as well as audio and visual alert outputs.

The DAA is utilized to automatically generate an alert based, signal list that includes the |ALERT ZONE NAME | SIGNAL LEVEL | TYPE | DURATION | BANDWIDTH | DATE | TIME | FREQUENCY | LOCATION |for each logged signal event.

TIP: Each individual alerting zone established by the technical operator, supports independent programming parameters.

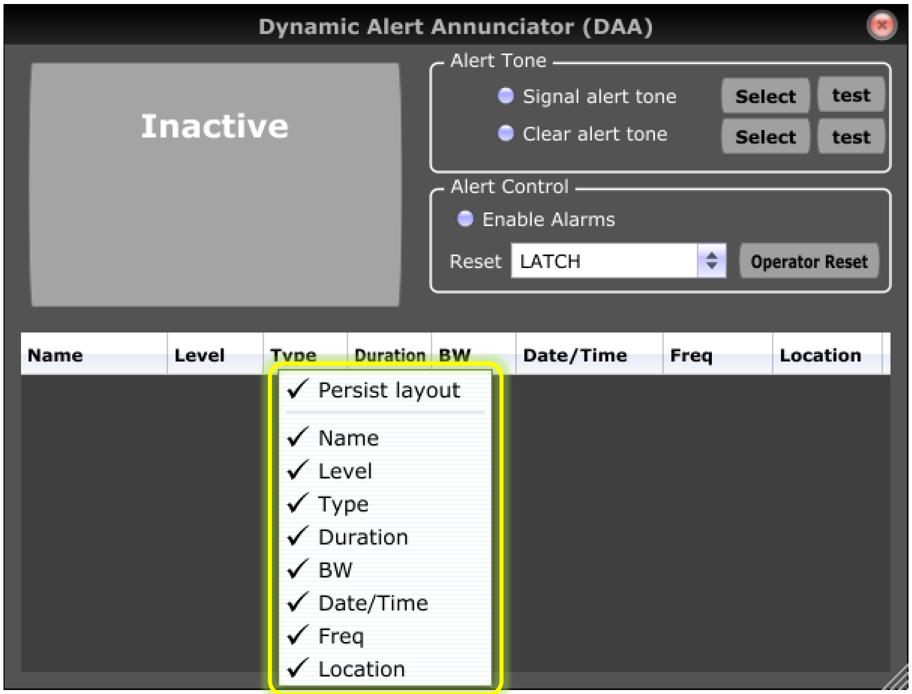
The DAA signal list table contains technical operator selectable data columns, and a | PERSIST LAYOUT | capability that allows columns to be displayed or hidden.

This capability allows the technical operator to display only those parameters of interest and hiding columns that are not required during deployment.

It is essential to understand that all data elements, whether or not, will be captured, and are therefore available during runtime or post event analysis.

Our “drag and drop” technology supports the DAA signal list table, allowing the technical operator utilize “drag and drop” to the GUI, harmonic calculator, demodulator, etc.

The “drag and drop” architecture allows other information such as bandwidth, to be passed, or interpreted, where applicable.



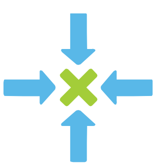
DAA Dialog Window | v1.35xx

Table column data may also be re-ordered accordingly, by mouse click and drag, within the table header, for any specific column, to provide an order of preference, and data priority for the table.

Visual Status Annunciator (VSA)

The DAA dialog window includes a large visual GRAY / RED / GREEN panel that is often referred to as a GO / NO GO status panel annunciator, also described as the Visual Status Annunciator (VSA).

The VSA displays real-time instantaneous Signal of Interest (SOI) alert particulars, including the | FREQUENCY | LEVEL | DATE | TIME | annotation flags on a RED alert background.



TIP: Technical operator programming permits customization of the displayed desired columns, as selected by the technical operator, and therefore not all of the above columns may be displayed by default.

When the Visual Status Annunciator (VSA) is disabled, the dialog window will display the | INACTIVE | flag annotation, on a GRAY background VSA panel, and will not log signal alerts, even if alert zones are established, and enabled.

VSA Disabled | v1.35xx

The technical operator should first complete all Dynamic Alert Annunciator (DAA) setup, and programming functions, before activating the | ALERT ZONE | to avoid capturing unintended data.

Setup and programming begins with the selection of the any number of desired alerting zones, with independent detection sensitivity levels above the Ambient Noise Floor (ANF).

Once an alert zone is established, it will consist of a lower (GREEN) shading, and an upper (RED) shading.

The (GREEN) zone is the | NORMAL RANGE |, and signal events dropping below the lower threshold (LOSS) will cause an alert to be logged.

The (RED) zone is the | EXCEEDANCE RANGE |, and signal events exceeding the upper threshold (EXCEEDANCE) will cause an alert to be logged.

When the DAA is active, and no threshold violation exists during runtime, the VSA will display the | ALL CLEAR | flag on a GREEN background VSA panel.

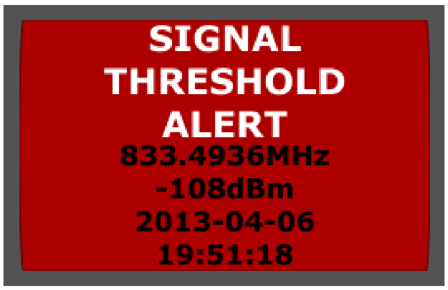
VSA Clear | v1.35xx

The DAA will visually and audibly alert the technical operator when any signal event exceeds any active alerting zone threshold.

Audio | ALERT |, and | CLEAR | tones are global across all established active alert zones, and search receivers.

The technical operator must remember that alert zones may be active on band allocations not currently displayed on the GUI.

When the DAA is selected active, and a threshold violation exists, the VSA will display | SIGNAL THRESHOLD ALERT | on a flashing RED background.



VSA Signal Alert | v1.35xx

The | FREQUENCY (MHz) | SIGNAL LEVEL (dBm) | DATE |, and | TIME | are displayed on the VSA and appended to the DAA signal list table.

Audio Alert Tone

The DAA includes separate user defined | ALERT |, and |CLEAR | audio based alert feature that may be configured with custom audio files recorded in (.WAV) format.

If you were wishing that Kestrel ® could talk, you wish has been granted, as we now support female and mail voice alerts for various audio alarm and alerting functions.

| Daisy | and | George | voice alerts for the DAA feature can be downloaded from the Technical Support Group (TSG) Resource Centre and added to the | AUDIO | directory located in the main Kestrel ® installation directory.

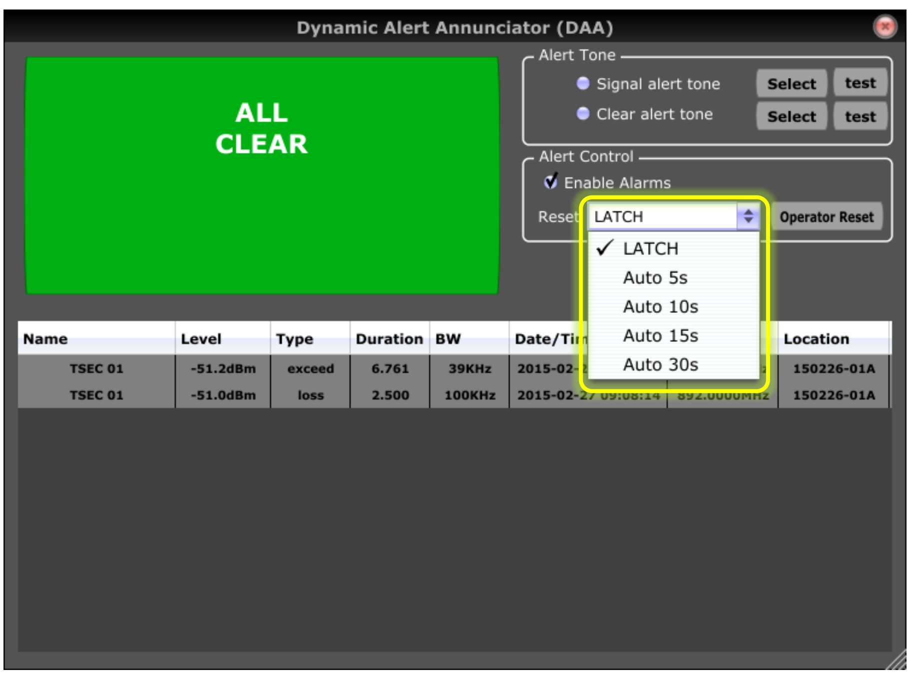
The default alert (.WAV) files are located in the default installation directory named | AUDIO |, and provides an audible | ALERT |, and |CLEAR | alert tone sequence.

Alert Tone | v1.35xx

Audio annunciation for the | ALERT |, and |CLEAR | signal events can be independently selected for "active" or "passive" alerting, and includes a | TEST AUDIO | button, to verify that the intended audio response will be present, and to assist in verifying the appropriate output volume level.

Alert Control

The DAA feature fully supports operator selectable "latching" and "automatic reset" with fixed auto reset options of | AUTO 100 mSec | Auto 300 mSec | Auto 500 mSec | Auto 1 Sec | Auto 3 Sec | Auto 5 Sec | LATCH |.



Alert Control | v1.35xx

When the | LATCH | option is selected, the | OPERATOR RESET | button allows the technical operator to clear the visual alert manually.

The VSA alert will not clear until technical operator intervention; however, the audio alert tone will respond to any currently active, or new signal events, and continue to log all new threshold alert violations to the DAA signal list.

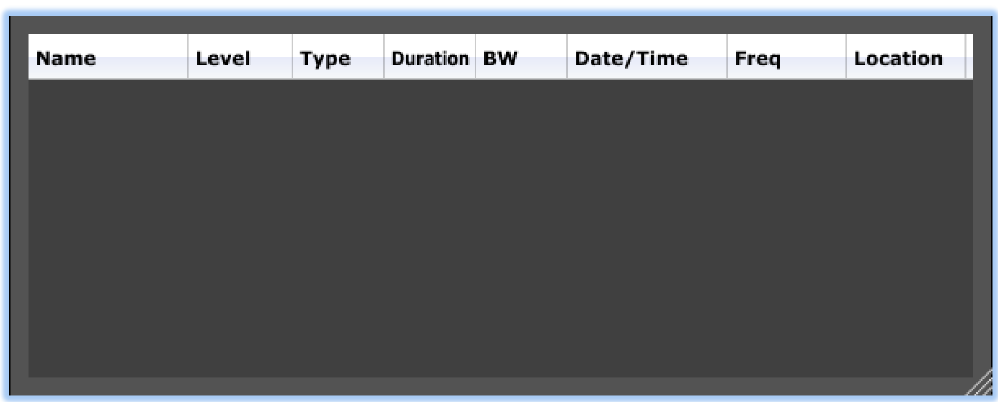
Pressing the | Operator Reset | button or a mouse click on the | RED VSA | window, will initiate | Operator Reset |.

The | ENABLE ALERTS | check box “enables” or “disables” the DAA functionality.

If an “alert” condition is registered, and is captured, while the reset control is set to | LATCH |, and the technical operator selects one of the auto reset options during an alert event, it will be necessary to select the | LATCH | option again momentarily and press the | OPERATOR RESET | to clear the previous alert condition, as the | OPERATOR RESET | button is disabled in auto reset mode.

Dynamic Threshold Alert (DAA) List

The DAA dialog window includes a DAA signal event list table with the | ALERT ZONE NAME | SIGNAL LEVEL | ALERT TYPE | DURATION | BANDWIDTH | DATE | TIME |, and | LOCATION | details.



DAA Table | v1.35xx

All signal events that exceed the operator defined “active” alerting zone threshold, are appended to the Dynamic Threshold Alert (DAA) threat signal list and can provide significant insight into the nature and characteristics of any unauthorized signal events.

All signal events that drop below the operator defined “active” alerting zone threshold, are appended to the Dynamic Threshold Alert (DAA) threat signal list.

Import Alert Conditions (.CSV)

Importing a set of predefined | ALERT CONDITIONS | is fully supported.

The | IMPORT ALERT CONDITIONS | feature, is accessed by the main |SPECTRUM | ALERTS | IMPORT ALERT CONDITIONS (.CSV) | menu option.

Any number of alert zone conditions, or profiles, can be created, maintained, and reused during future deployment to quickly set multiple | ALERT ZONES | without the need to create new profiles on an individual basis.

The technical operator can create commonly utilized profiles within an active Kestrel Project File (KPF), and export them to a (.CSV) file, or create one, or more (.CSV) files containing unique profiles for direct import into an active Kestrel Project File (KPF).

Export Alert Conditions (.CSV)

Exporting a set of currently defined | ALERT CONDITIONS | is fully supported.

This feature is accessed by the main |SPECTRUM | ALERTS | EXPORT ALERT CONDITIONS (.CSV) | menu option.

Selecting the Export Alert Conditions (.CSV) menu option displays a file save dialog window and prompts the technical operator to save the | ALERT CONDITIONS | as a (.CSV) file.

The (.CSV) file contains the | ALERT CONDITIONS | for each operator defined alert zone whether, or not it is in the | ENABLED | or | STANDBY |mode.

The exported file can be later utilized by the technical operator to open a defined set of preconfigured alert zone conditions, or profile groupings that can be readily imported into an active project file.

Clear Alert Conditions

The ability to clear the current set | ALERT CONDITIONS | is also supported.

This feature is accessed by the main |SPECTRUM | ALERTS | CLEAR ALERT CONDITIONS | menu option.

Selecting this menu option will permanently remove all current | ALERT ZONES |, and all associated | ALERT CONDITIONS |.

Edit Alert Conditions (EAC)

The Edit Alert Conditions (EAC) dialog window is accessed from the alert zone pop-up menu, and selecting the | EDIT DETAILS | menu option, to display the EAC dialog window.

Editable options include the ability to change the default | NAME | of the alert zone, which is the initial center-frequency of the alert zone.

The actual center-frequency of the alert zone may be edited to more precisely position the initial alert zone | CENTER FREQUENCY | as may be required.

The alert zone | BANDWIDTH | may also be adjusted to more precisely position the alert zone as required.

The alert zone | TRIGGER LEVEL | may also be independently adjusted, as well as the alert zone | COMBINING WIDTH | of the logging algorithm referred to as Alert Combining Technology (ACT) ™.

Alert Condition Statistics (ACS)

The Alert Condition Statistics (ACS) dialog window is accessed from the alert zone pop-up menu and selecting the | STATISTICS | menu option to display the ACS dialog window.

Alternatively, it is also possible to display the | ALERT STATISTICS | menu option by selecting any of the logged signal events, within the DAA table list structure.

The ASC dialog window provides statistical information specific to the selected signal event, including the alert zone | NAME|, number of unique | EVENTS RECORDED | MINIMUM DURATION | AVERAGE DURATION | MAXIMUM DURATION | MAXIMUM SIGNAL LEVEL | AVERAGE EVENT INTERVAL | MOST RECENT EVENT AGE |.

Alert Combining Technology (ACT)

The DAA feature includes an automatic, fixed, alert signal combining algorithm that can be utilized to minimize unnecessary signal list entries that might be captured as a result of modulation and amplitude variations.

The Alert Combining Technology (ACT) algorithm responds when one or more alert zones are established, and are active during runtime across one, or more active spectrum bands, and works globally across multiple receivers and / or analyzers.

The Alert Combining Technology (ACT) will combine all alerting Signal of Interest (SOI) events detected within | NO COMBINING | 1% | 2% | 5% | 10% | 25% | 50% | 100% | of the defined alert zone bandwidth, into a single alert event displayed on the alert table and avoid unnecessary signal event logging due to bandwidth variations caused by modulation and spectrum display anomalies attributed to the sweeping nature of the receiver.

The | NO COMBINING | option removes the Alert Combining Technology (ACT) and all signal events, exceeding the set threshold, are captured and logged.

Dynamic Alert Annunciator (DAA) Deployment

The DAA capability is particularly useful when sensitive meetings are conducted within a Secure Compartmented Information Facility (SCIF), and when a wireless policy is in force within established, or defined security zones.

The DAA feature is an effective resource for operator attended real-time spectrum surveillance and monitoring assignments, when multiple band allocations or Ranges of Interest (ROI) need to be continuously monitored for the appearance of potentially new hostile signal events.

The DAA feature is an excellent discrete signal surveillance and monitoring resource that can report loss of signal events.

The Dynamic Alert Annunciator (DAA) does not run during SOLO mode operation and will automatically pause, whenever SOLO mode is active.

The DAA will resume normal runtime operation once SOLO mode is terminated.

TIP: The Dynamic Alert Annunciator (DAA) fully supports runtime operation of the Differential Signal Analysis (DSA) mode and can detect “new” alerting signal events for the current active Antenna Location, when viewing the static DSA trace data window.

Export DAA List (.CSV)

The DAA signal list can be exported to a (.CSV) file for further analysis, storage, and formatting, with third-party productivity software such as Microsoft Excel or another spreadsheet application.

The export utility is accessed from the | FILE | EXPORT DAA List (.CSV) | menu option.

Clear DAA List Events

The DAA table list contains all captured exceedance / loss signal events, some of which might be duplicates of the same signal.

The software supports the ability to select and clear individual, or group selected list entries.

Use | CTRL + Left Mouse | click to select individual list entries, and the right-click menu option | CLEAR SELECTED ITEMS |, or the keyboard DELETE key to remove the unwanted signal list entries.

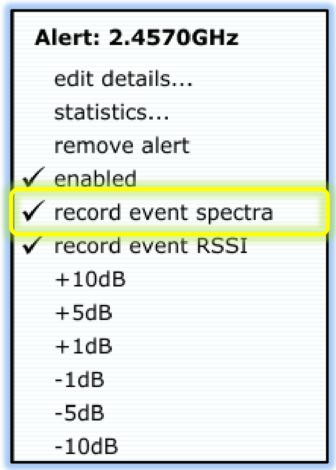
Use | SHIFT + Left Mouse | click to select the first and last signal list entries to clear a group of DAA signal list entries, and the right-click menu option | CLEAR SELECTED ITEMS |, or the keyboard delete key to remove the unwanted signal list entries.

Record Event (CSV) Spectra

The ability to record DAA alert based | SPECTRA | and export raw value data to CSV file format, is fully supported.

During runtime, raw value | SPECTRA | trace data is automatically recorded and exported to a CSV file for each independent, active | ALERT | zone.

The technical operator selects the desired bandwidth of one or more active alert zones.



Record Event Spectra | v1.35xx

The CSV File Naming Convention (FNC) is based on the Center Frequency (CF) of the established | ALERT | zone, | LOCATION | and includes the | SPECTRA | flag as part of the automatically generated file name.

The following examples illustrate the File Naming Convention (FNC) for two (2) separate operator defined zones.

Alert Zone 01: 2.4114GHz_150620-03A_SPECTRA.CSV

Alert Zone 02: 2.4582GHz_150620-03A_SPECTRA.CSV

Record Event (CSV) RSSI

The ability to record alert based | RSSI | data values, and export raw data to CSV file format is fully supported.

During runtime, raw value | RSSI | data is automatically recorded and exported to a CSV file for each independent, active | ALERT | zone.

The technical operator selects the desired bandwidth of one or more active alert zones.

Record Event RSSI | v1.35xx

The CSV File Naming Convention (FNC) is based on the Center Frequency (CF) of the established | ALERT | zone, | LOCATION | and | RSSI | flag.

The following examples illustrate the File Naming Convention (FNC) for two (2) separate operator defined zones.

Alert Zone 01: 2.4114GHz_150620-03A_RSSI.CSV

Alert Zone 02: 2.4582GHz_150620-03A_RSSI.CSV

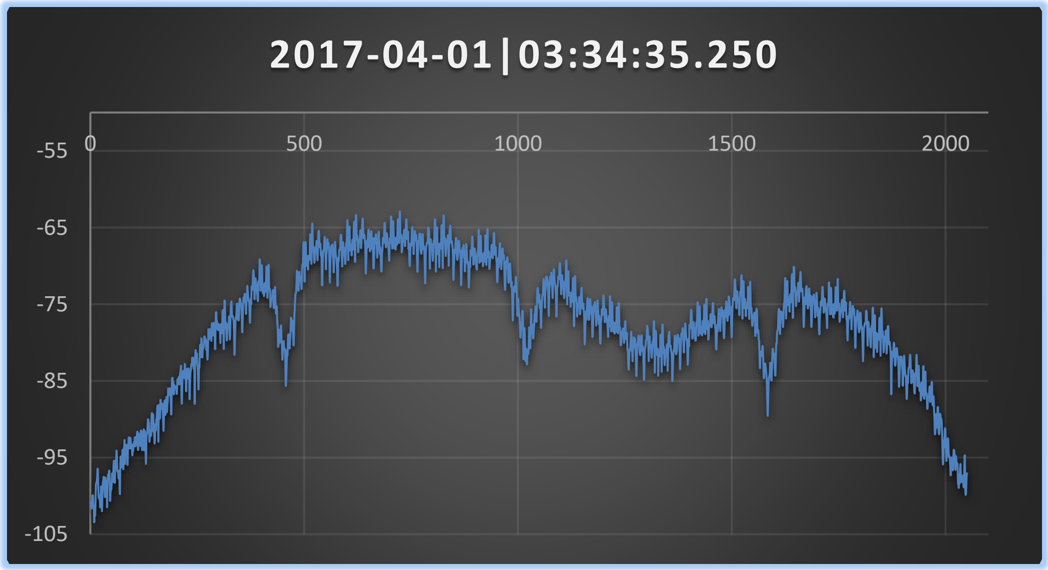
Third-Party Productivity Software

The ability to export collected | TRACE | and / or | RSSI | data to CSV file format allows the technical operator to arrange, select, edit, graph, chart and conduct a detailed analysis of raw Spectra and RSSI values.

The ability to generate customized graphical spectrum models for use in reports, briefings, and presentations is fully supported.

The following examples illustrate the ability to generate custom graphical representations using third-party productivity software, or scientific analysis applications.

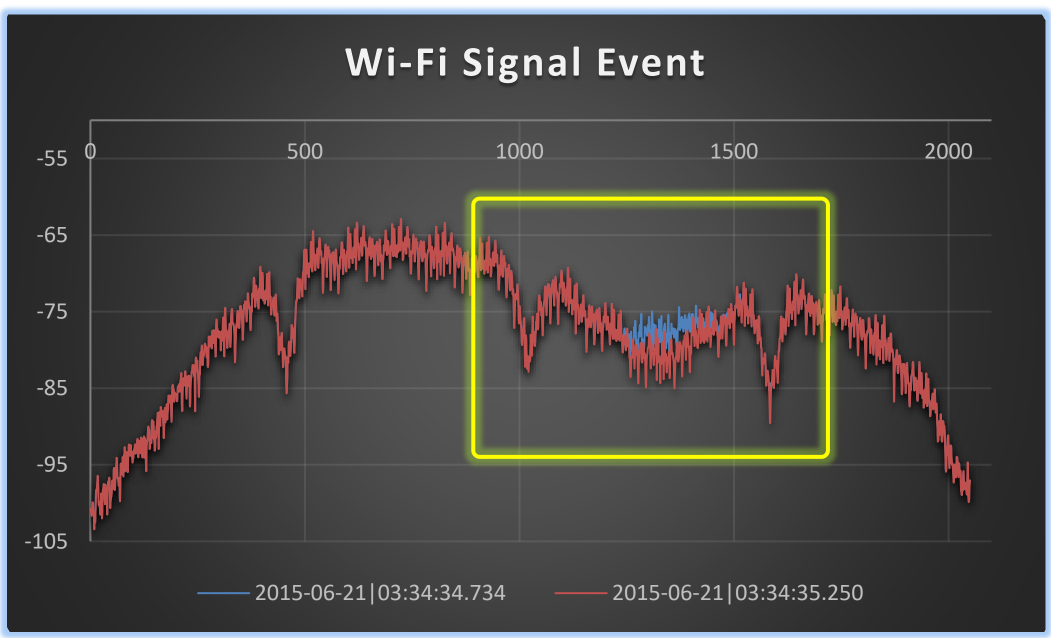
The following single trace raw data export | SPECTRA | plot represents the active | ALERT | zone bandwidth at a specific point in time.



Microsoft Office | Excel Graph | v1.35xx

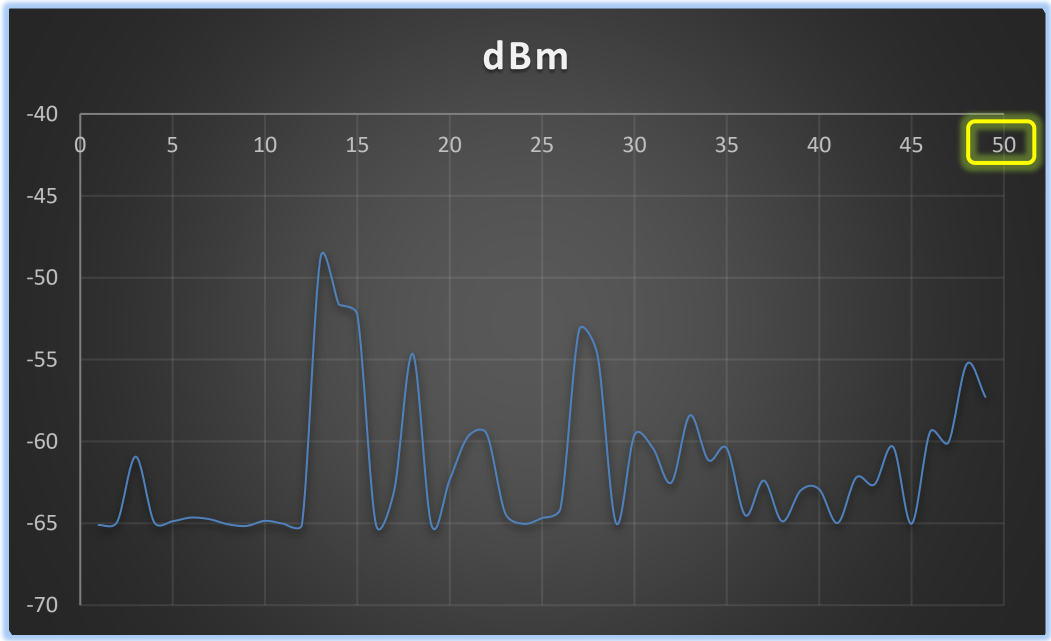
The technical operator can edit and utilize the raw | SPECTRA | and | RSSI | data files to build a working database of various signal and modulation types for reference, briefings and training.

The following example illustrates a comparative raw data | SPECTRA | traces based on 2 exported Spectra traces, exported as | ALERT | zone | CSV | format.



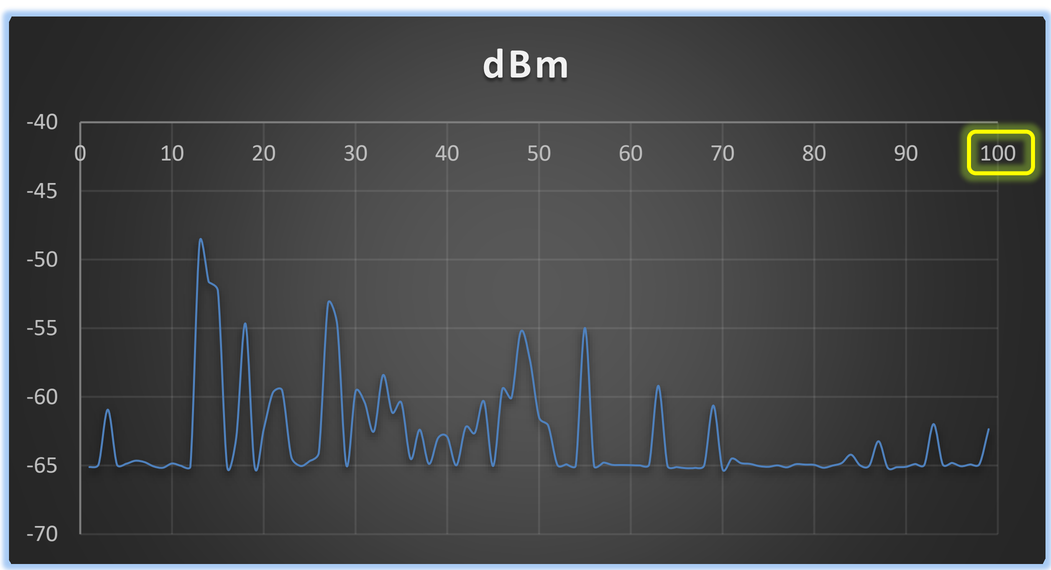
Microsoft Office | Excel Graph | v1.35xx

The following custom time plots represent the RSSI (dBm) over time, at 50 data points and 100 data points.



Microsoft Office | Excel Graph | v1.35xx

The above image represents the raw data, as selected and extracted for graphical modeling from the recorded | RECORD EVENT RSSI | CSV | file and represents 50 data points.



Microsoft Office | Excel Graph | v1.35xx

The above image represents the raw data, as selected and extracted for graphical modeling from the recorded | RECORD EVENT RSSI | CSV | file and represents 100 data points.

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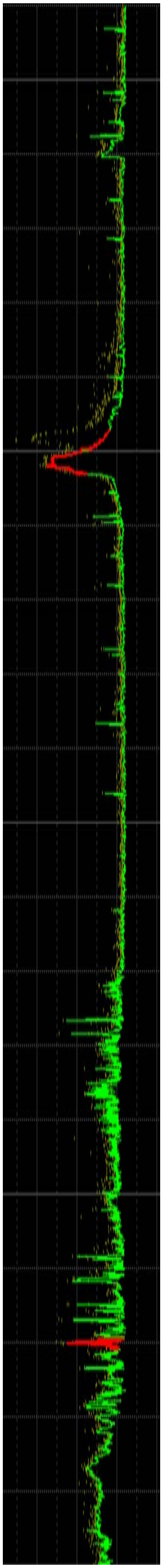
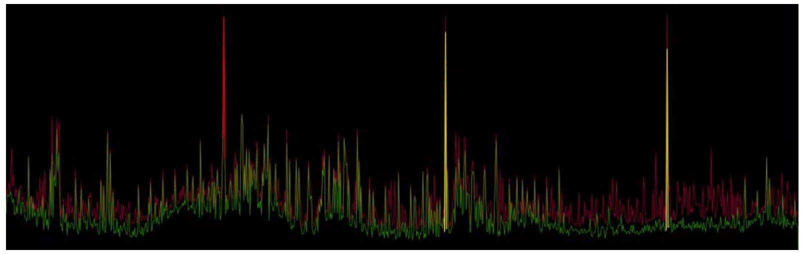


Chapter 12



Location Differential Signal Analysis (LDSA) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-04-04

Location Differential Signal Analysis (LDSA) ™

It is essential that the technical operator fully understand the concept, intent and operation of the | Location Differential Signal Analysis (LDSA)™ | functionality to advantage of all of the advanced features and functionality.

The LDSA™ feature permits the technical operator to create a continuous and uninterrupted, or (return to a historical job), master project file structure containing all or compressed peak spectral trace data from any number of individual locations within the immediate | Operator Defined Target Area (ODTA) ™ | including the capture of reference data from outside of the | Operator Defined Target Area (ODTA) ™ |, above, below or adjacent to the target area and from other historical collection dates as desired by the technical operator.

The Kestrel TSCM ® Professional Software fully supports and integrates the TSB 2000 (Technical) Standard ™ concept of a | Geographical Area Review (GAR) ™ | and in essence, geo-location techniques developed and practiced for the purpose of locating Emergency Locator Transmitters (ELT) and Emergency Locating Radio Beacons (EPIRB) since 1970 within civilian and military SAR deployment strategy.

The advancement of the Global Positioning System (GPS) capability added a new dimension of unique functionality nearly twenty (20) years later and permitted the integration of many widely practiced basic Radio Direction Finding (RDF) techniques and electronically assisted software-based integration to become the standard of practice.

Completing a series of standards-based control sweeps of the ambient RF spectrum environment (often outside of the influence of the operator defined target area or facility, but not always necessarily so), is fully supported in the Kestrel TSCM ® Professional Software application.

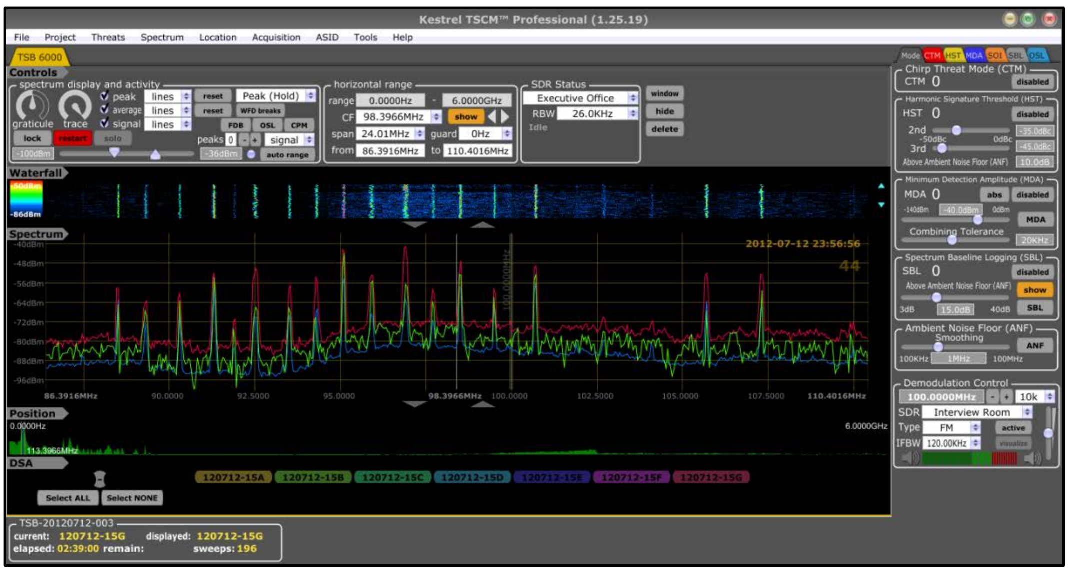
The ability to implement a standards-based | Geographical Area Review (GAR) ™ | outside of the | Operator Defined Target Area (ODTA) ™ |or the Near-Field zone; or Far-Field zone as based on the TSB 2000 (Technical) Standard ™ and utilize the collected peak spectral data as a powerful comparative with peak spectral data collected from various physical locations from within the target area, is fully supported by the Kestrel TSCM® Professional Software.

The technical operator can also import and utilize historical peak spectral data previously collected on another date, time or even location, by importing and overlaying peak files into the current Kestrel Project File (KPF)™ structure.

When | Live View Analysis (LVA) ™ | is combined with the LDSA ™ functionality, the technical operator has a very powerful technical operator centric, workflow oriented, TSCM specific resource that is designed to significantly enhance the Probability of Detection (POD) of potentially hostile signal events, and permit the technical operator to identify and confirm potentially hostile signal events, separate from the ambient signal events.

There are several significant elements associated with the LDSA ™ feature that must be understood by the technical operator.

The following example image represents the RF Spectral Display (RSD) ™ user-interface view after the technical operator has competed LDSA ™ deployment across a number of unique LDSA ™ antenna locations.



DSA | v1.35xx

The first important element is the ability to define any number of active antenna locations "on-the-fly" in advance during setup, as the sweep is conducted, or in advance during runtime deployment of the LDSA ™ feature by the technical operator.

The | Kestrel Project File (KPF) ™ | can be setup in advance or "on-the-fly" as desired, or a previous LDSA ™ trace data may be reopened at a later date or time and new LDSA ™ antenna location data can be collected, analyzed and compared to all previously collected data of the same profile.

Floor plan, vertical riser, geographical area map, photographic interpretation and photo realistic virtual reality integration can advantage GPS reference coordinates whenever a GPS signal is available, or coordinates can be manually entered by the technical operator as a global reference, or for each independent collection position.

TIP: An LDSA ™ antenna location is defined by the Kestrel TSCM ® Professional Software as the precise location of the SDR search receiver antenna for the purpose of spectral data collection and comparative analysis.

The SDR search receiver and / or the technical operator may in-fact, operate or control the collection process remotely from on-site or even off-site utilizing a remote network connection, or the SDR search receiver or spectrum analyzer might be located outside of the specified target area for any number of security or deployment considerations including live monitoring events.

TIP: It is absolutely essential to know precisely where the antenna is located during the collection process for meaningful and accurate data collection and post analysis review.

Antenna locations may be created "on-the-fly" during the collection process or may be predefined in preparation of deploying the LDSA ™ feature.

Antenna Locations | Project Level | RDSA ™

Normally, after the initialization process, the technical operator must enter the first antenna location as part of the Kestrel Project File (KPF) ™ setup process, unless the intended deployment is for the | Receiver Differential Signal Analysis (RDSA) ™ | feature.

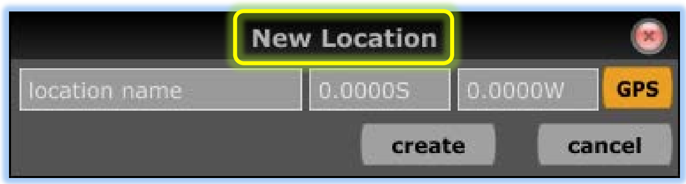
At the project level, locations are defined within the setup wizard, or at the application level.

However, in the event that the technical operator intends to deploy the software across multiple independent receiver locations, this capability is accomplished by defining the receiver location names within the | ANALYZER CONTROL | during the initialization process, before engaging the setup wizard.

Entering a location name for initialized hardware at the | Analyzer Control | level, causes each receiver to act independently, as a unique collection location, until such time as the technical operator removes (resets) the receiver location reference name, from the analyzer control | LOCATION | column.

The technical operator may also pre-define, or create "on-the-fly", any number of desired antenna locations by accessing the | LOCATION | NEW LOCATION | menu option from the setup wizard or from within the application, for non RDSA™ deployment.

There are three (3) elements to the | NEW LOCATION | menu structure, depending on the deployment mode or intended operation.



New Location | v1.35xx

The first control element is the ability to define a new physical location for LDSA™ collection process.

The second is the ability to SET the desired location for active LDSA™ collection and the third control element includes the ability to define a location for display or review by the technical operator, even while collection at the current LDSA™ location is in progress without interrupting the collection process.

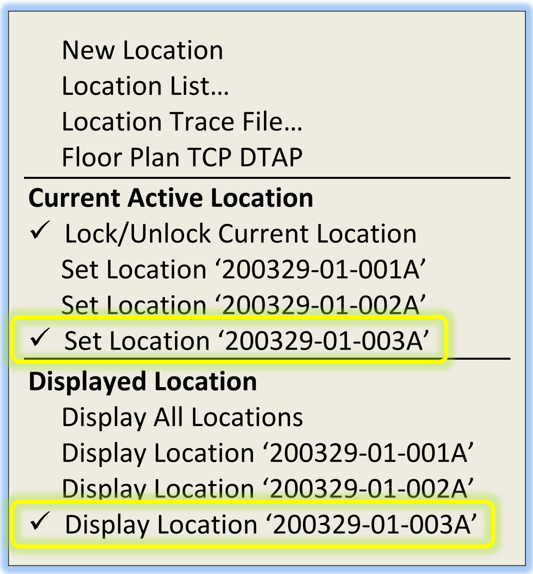
A sophisticated LDSA™ algorithm is combined with a simplified workflow-oriented control structure that provides the technical operator with a very powerful TSCM specific resource that integrates with many other application-level resources.

The Kestrel TSCM® Professional Software allows the widest range of collection and analysis options available.

Our LDSA™ feature is a powerful analysis tool that can be deployed in any combination of horizontal floor plate and vertical riser collection scenarios within even the most challenging and complex target area, facility, or site plot.

The image below illustrates the location control menu structure and the technical operator's three (3) locations for LDSA ™ analysis.

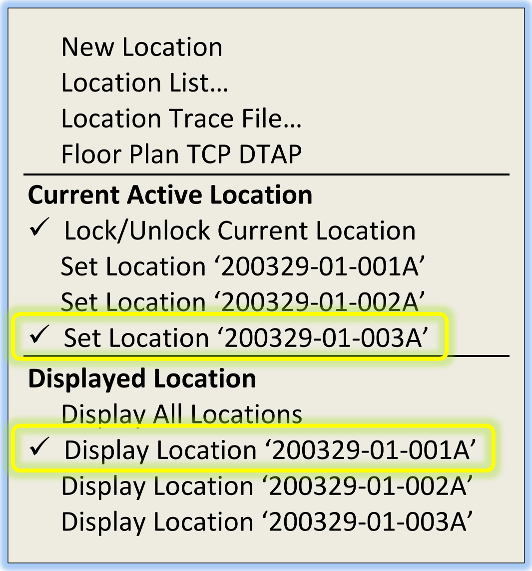
The operator is currently at ‘200329-003A’ and is actively collecting peak spectral data, having already completed active collection on the other target are antenna locations identified as ‘200329-01-001A’ and ‘200329-01-002A’ respectively.



Set / Display Location | v1.40xx

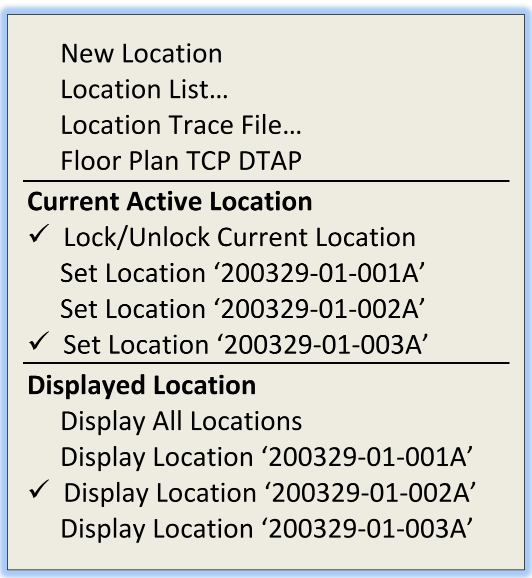
The | SET | location and | DISPLAYED | location are currently the same and the technical operator can view all signal events as they occur during collection on both the RF Spectrum Display (RSD) and the Waterfall Display (WFD).

It is also possible for the technical operator to actively collect current LDSA ™ data at one location while passively viewing historical LDSA™ data previously collected from another physical location by selecting a different | Displayed Location | for review as illustrated in the next two (2) images.



Set / Display Location | v1.40xx

The image above shows that the technical operator is collecting spectrum data at '200329-01-003A' and is currently displaying the historical spectrum data from location '200329-02-001A' for analytical review.



Set / Display Location | v1.40xx

The image above shows that the technical operator is collecting spectrum data at '200329-01-003A' and is currently displaying the historical spectrum data from location '200329-02-002A' for analytical review.

The | SET | location allows the technical operator to begin the data collection process for the current location, while the ability to define a different location for display, review and analysis, allows the technical operator to review historical data collected and locked from another operator defined historical antenna location.

The second LDSA ™ component is the ability to collect peak spectral data at each defined target area location and | LOCK | the peak trace prior to moving to the next defined deployment location.

This concept is deeply rooted in energy-based Radio Direction Finding (RDF) techniques, utilizing basic Triangulation, RSSI and Geo-Location principles that date back to the great wars.

It is recommended that the technical operator simply move the host computer (laptop), SDR search receiver and the antenna package to each new location in most cases; utilizing a small potable wheeled cart or a more portable tablet computer.

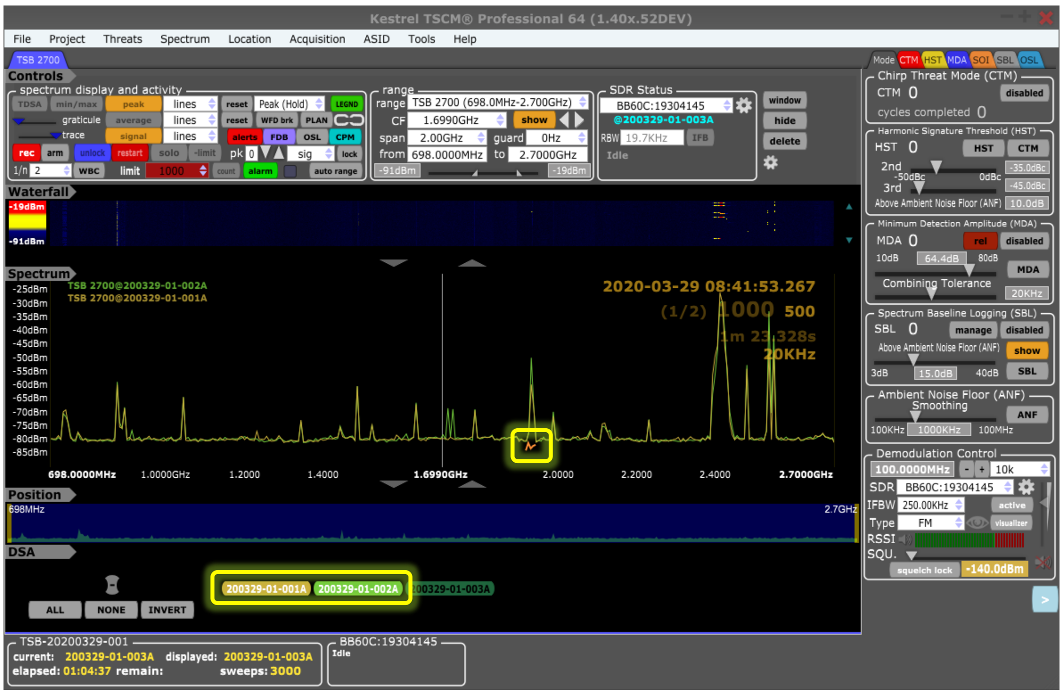
There are a number of additional remote deployment options available to the technical operator as described throughout this documentation and it is essential that the technical operator understand that the actual location of the receiving | ANTENNA | is a critical factor in the collection, comparative analysis and signal localization review process.

The above example illustrates the ability of the technical operator to display the advanced | Location Differential Signal Analysis (LDSA) ™ | window and independent location-based spectrum trace data, by location.

It is also possible to display the Signal of Interest (SOI) and other spectral flags to assist in the analytical process.

The technical operator can turn the spectral marker flags ON or OFF as desired, utilizing the | THREATS | menu option list and can adjust the display characteristics directly from the | Spectrum Display and Activity | control group.

The | Spectral Marker Flags | displayed in ORANGE are user defined Signals of Interest (SOI) selected for observation and comparative



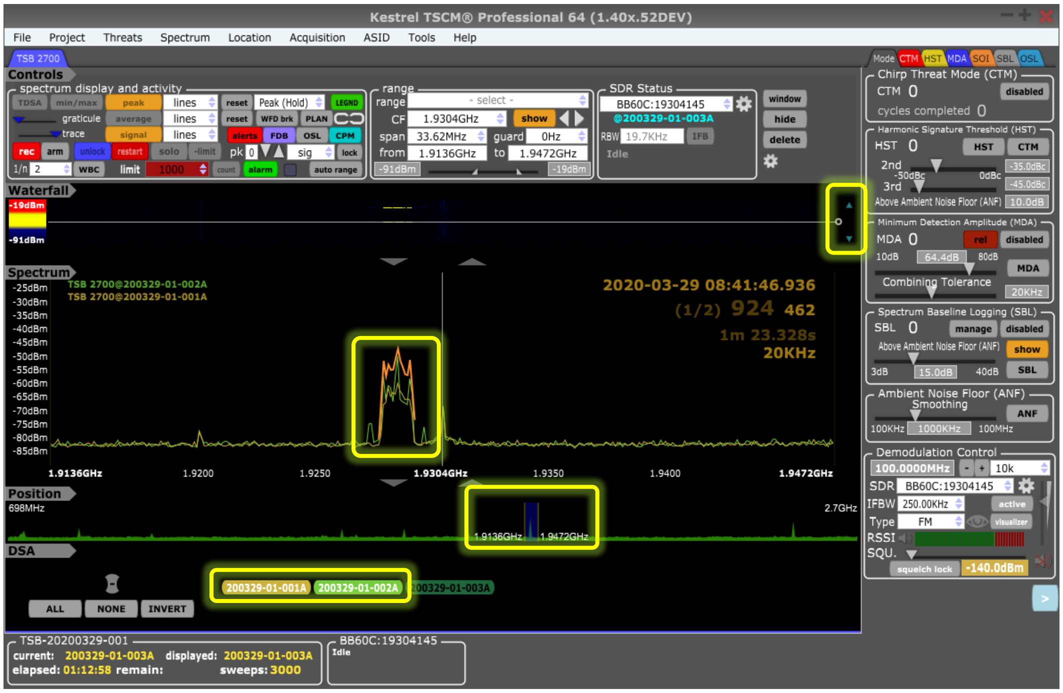
LDSA ™ | v1.40xx

The above example illustrates the ability to alter the LDSA ™ display.

The technical operator has selected the '200329-01-001A and '200329-01-002A' LDSA ™ collection location and a corresponding LDSA ™ trace immediately replaces the RF Spectral Display (RSD).

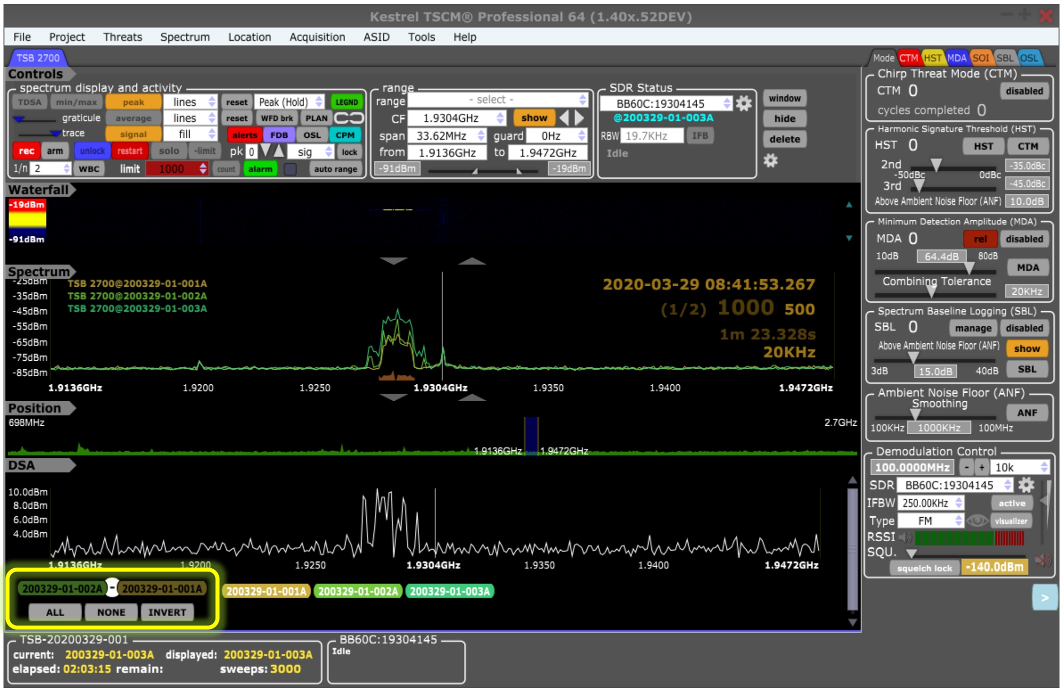
Any spectral marker flags will also be display as noted in the highlighted area in the above image.

The | Positional Zoom Control (PZC) ™ | can be utilized to bring focus to the any area of the comparative spectrum for analysis and our | Live View Analysis (LVA) ™ | allows the operator to go back in time to review historical SOI events.



LDSA ™ | v1.40xx

The ability to capture spectrum data at the current location and display historical comparative data at other locations during the process allows Signals of Interest (SOI) to be investigated in near real-time.



LDSA ™ | v1.40xx

The above example illustrates the technical operator's ability to "Drag-and-Drop" any available collection location ICON such as '200329-01-001A' and 200329-01-002A' to the trace math docking station to invoke a | A – B | or | B – A | trace math differential display for the entire Range of Interest (ROI) or channelized signal level frequencies.

LDSA ™ traces will normally be accomplished at various physical locations within and immediately outside, the defined target area by simply moving the host computer, search receiver setup and antenna package to each unique location of interest as the first step in the collection and analysis process.

TIP: It is the antenna placement that is of critical concern. For example, it is possible to complete LDSA ™ within a single room within the Operator Defined Target Area (ODTA) ™. The operator might simply setup in the center of the room and move the antenna to various points within the target room once the signal source is localized to a specific room or area within the target area. This technique eliminates the requirement of carrying a broadband receiver into the target area as an unnecessary secondary equipment resource.

The Kestrel TSCM® Professional Software platform | Location Differential Signal Analysis (LDSA) ™ | feature provides the technical operator with a powerful signal location resource that is significantly more accurate than a broadband detector when deployed in a complex and high ambient RF signal environment.

The use of advanced geo-location heat mapping allows faster and more accurate localization.

The Kestrel TSCM ® Professional Software can be utilized to locate a specific discrete signal source utilizing LDSA ™, or the software may be utilized to review any specific spectrum band allocation or Range of Interest (ROI) and define the results across a powerful geo-location heat map.

LDSA ™ | Multiple Session Deployment

The ability to utilize the Kestrel TSCM ® Professional Software to capture LDSA ™ Peak Envelope Capture (PEC) ™ trace data during successive or multiple deployment sessions and across dates for direct comparative analysis is fully supported in the Kestrel TSCM ® Professional Software.

The key to effectively managing multiple sessions and dates for multiple Antenna Location deployment of the Kestrel TSCM ® Professional Software during successive or multiple deployment dates and / or times, requires careful consideration and a consistent file naming convention that accurately describes a specific point in time and clearly defines the actual physical collection | Antenna Location |.

For example, combining the date and physical location, provides an excellent means of clearly identifying successive Peak Envelope Capture (PEC) ™ trace data for future comparative analysis.

DSA Multiple Session Deployment | Multiple Antenna Locations		
Main Boardroom	**Executive Office**	**Conference Room**
200128-01-001A	200128-04-001A	200128-07-001A
200213-01-001A	200213-04-001A	200213-07-001A
200329-01-001A	200329-04-001A	200329-07-001A

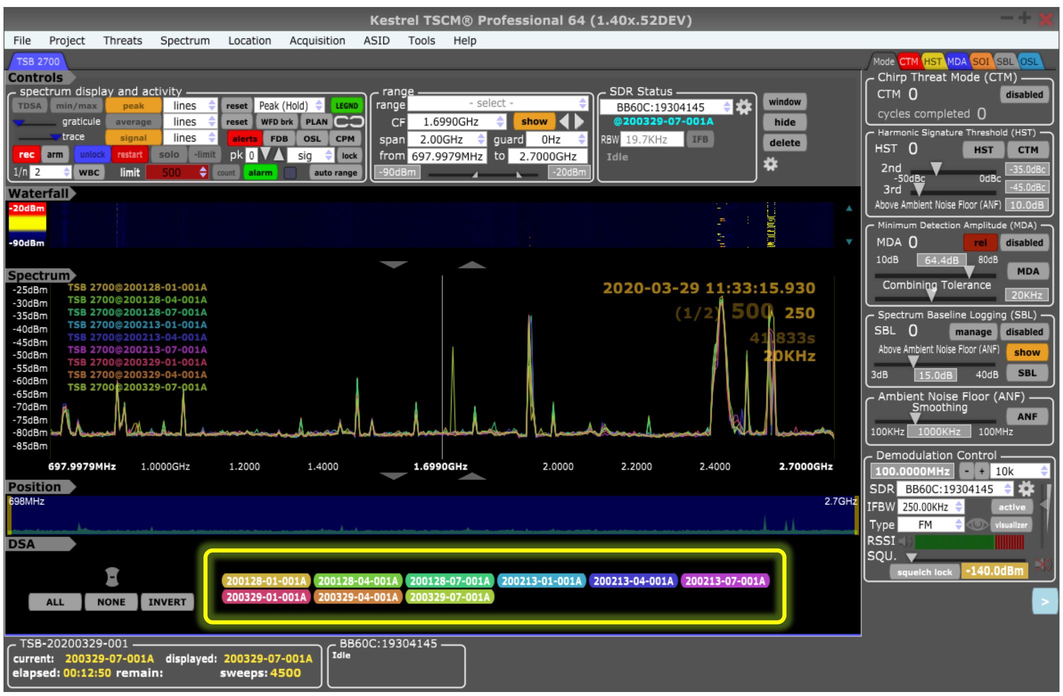
Multiple Sessions DSA | v1.40xx

Utilizing the above | File Naming Convention (FNC) | for a typical monthly inspection schedule over a three (3) month deployment period, allows the technical operator to directly compare LDSA ™ Antenna Location data for any of the three (3) specified sweep locations over any period of time.

The TSB (Technical) Standard ™ defines the recommended antenna location FNC as follows: 200329-28-001A

Where | 200329 | is the date (yymmdd), | 28 | is the facility floor level, | 001 | is the room identifier, and | A | is the specific collection area at the room level.

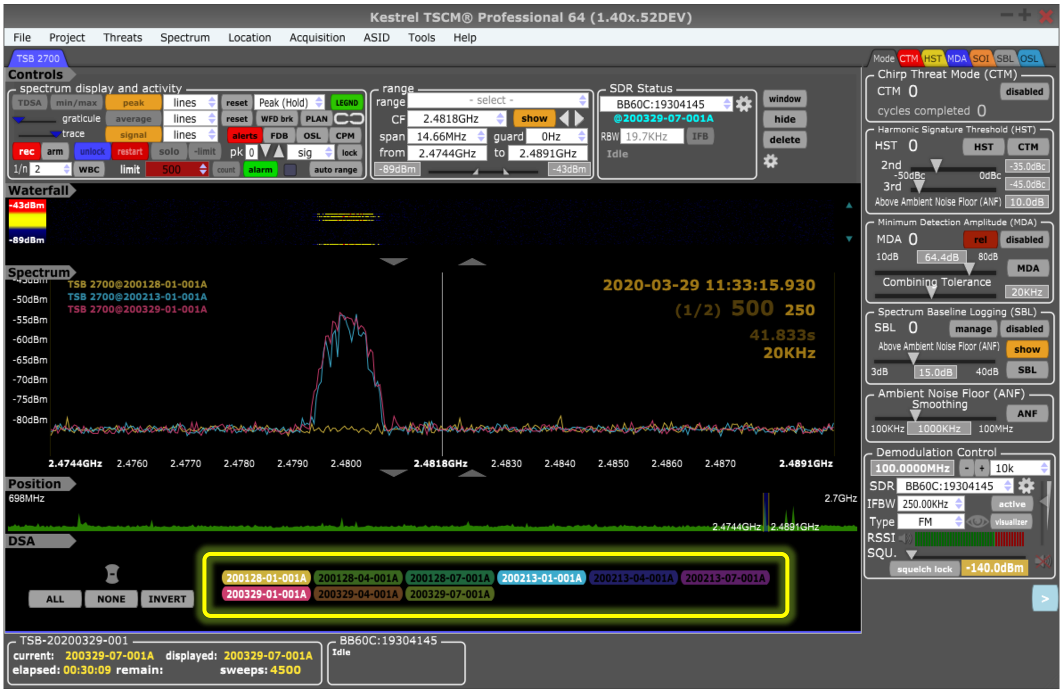
Referring back to the chart above, the technical operator completed a series of collections across three (3) | Operator Defined Target Area (ODTA) ™ | locations, including the boardroom, executive office, and conference room.



Multiple Date | Multiple Locations LDSA ™ | v1.40xx

When the operator presses the | SELECT ALL | button located in the LDSA ™ control group, all LDSA ™ ICONS are highlighted brightly and the text displays as white within the ICON, and all PEC trace data is actively displayed on the Graticule as a powerful comparative overlay, replacing the (current / displayed) location Real-Time Event (RTE) ™ data with the comparative window.

Pressing the | SELECT NONE | clears all LDSA ™ ICONS and removes the highlighted brightness and the text display as black within the ICON, and the display returns to the normal runtime, (current / displayed) Real-Time Event (RTE) ™ data.



Multiple Date | Multiple Locations LDSA ™ | v1.40xx

The operator can independently select any combination of available LDSA ™ ICONS and display specific PEC trace data for direct comparative analysis even if across date and location parameters.

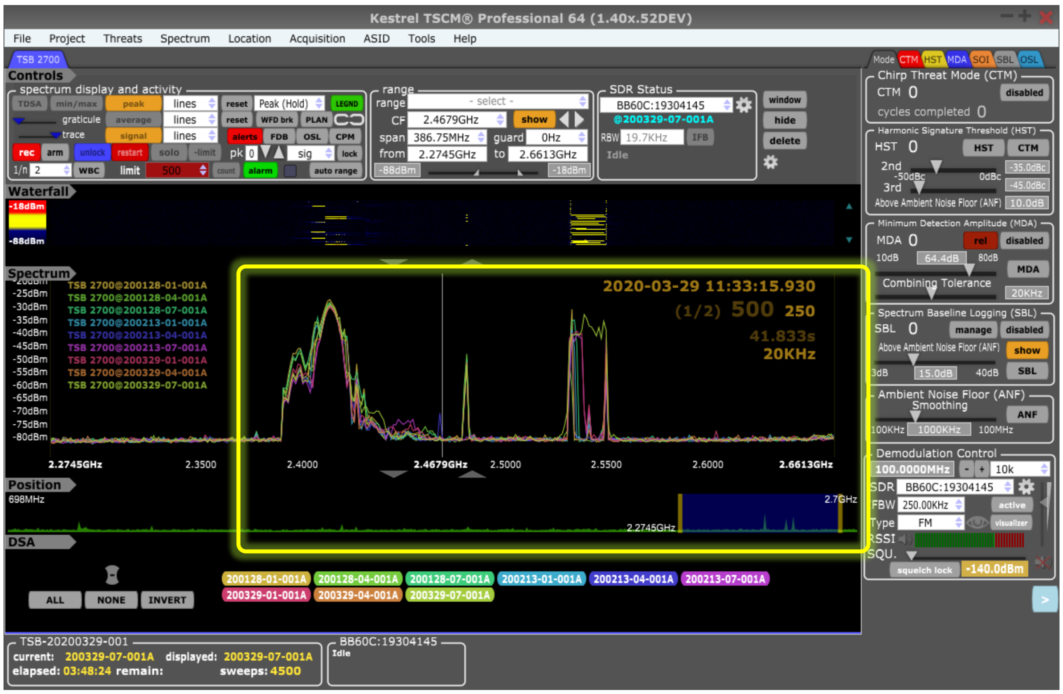
This method is ideal when many trace locations are available and the operator needs to filter the data to display data from different dates, times, floors, or specific rooms.

In the above illustrated example, the technical operator has selected a specific antenna location for the room identified as the Main Boardroom to compare the energy for the Main Boardroom across three (3) separate inspections over a three (3) month period, as follows: '200128-01-001A', '200213-01-001A', and '200329-01-001A'.

The above spectrum illustrates the presence of a BlueTooth advertising channel that was not present during the inspection on '200128-01-001A', but was present during the inspection on '200213-01-001A, and '200329-01-001A'.

The ability to compare any combination of energy existence across location and inspection dates is fully supported.

TIP: When the technical operator is working in LDSA ™ display mode with the | SELECT ALL | active for all current “locations” and adds a new active Antenna Location. By default, the new active Antenna Location is not displayed until manually selected for view by the technical operator. Manually pressing the | SELECT ALL | button or a left mouse click on the actual | LDSA ™ ICON | will add the new active Antenna Location to the LDSA ™ display for comparative analysis.



Multiple Date | Multiple Locations LDSA ™ | v1.40xx

The technical operator can utilize the Positional Zoom Control (PZC) ™ to focus attention on any specific Signal of Interest (SOI) or sub-range as illustrated above.

The technical operator can mouse over any of the LDSA™ ICONS to dim all other active LDSA ™ ICONS and bring focus and highlight brightness to any specific trace of interest against all others.

When in normal spectrum display mode, mouse over of the LDSA ™ ICONS causes the specific location peak trace to display against the current location real-time energy pattern.

TIP: When the LDSA ™ feature is utilized across multiple bands and locations and the technical operator does not run all bands at all locations and then changes to a location where one or more bands were not run, no trace display will appear for those bands. Always confirm the location setting is correct for your analysis purpose to ensure you are not viewing a location where one or more bands were not run.

New Location | Naming Convention

It is an essential recommended practice to set a unique | Antenna Location | name or reference identifier for each new LDSA ™ location.

The Kestrel TSCM ® Professional Software contains a locking mechanism that prevents the technical operator from accidently creating multiple locations utilizing the same name or reference.

This locking mechanism is case sensitive and therefore it is possible to utilize the same character structure, providing the case sensitivity is different.

The LDSA ™ name "OFFICE" and "Office" are permitted and considered unique by the software, however, it is generally accepted that the naming convention remain unique for each location and contain the date and location as a reference.

Should the technical operator wish to import historical trace data into another Kestrel Project File (KPF) ™ in the future, utilizing the following format will provide a clear audit trial as to when and where the trace was collected.

The following example illustrates the recommended LDSA ™ antenna location naming format for three (3) monthly sweeps at the same physical location;

| 200210-03-001A | 200312-03-001A | 200415-03-001A |

Collection Dates | 2020-02-10 | 2020-03-12 | 2020-04-15 |

Facility Level / Floor | 03 |

Location (Area or Room) | 001 |

Room Level (Location within Room) | A |

Import LDSA ™ Comparative

The Kestrel TSCM ® Professional Software fully supports the ability to import any number of historical LDSA ™ | Antenna Locations | including, the associated PEC trace data from multiple historical Kestrel Project Files (KPF) ™, into a currently open project as a direct comparative on the | Location Differential Signal Analysis (LDSA) ™ | spectrum display.

This feature allows the technical operator to import and display historical trace data within the currently open project for analysis and review.

The import of any band even if it is larger, equal to, or smaller than the band importing to is fully supported allowing sub-bands to be displayed for comparative purposes.

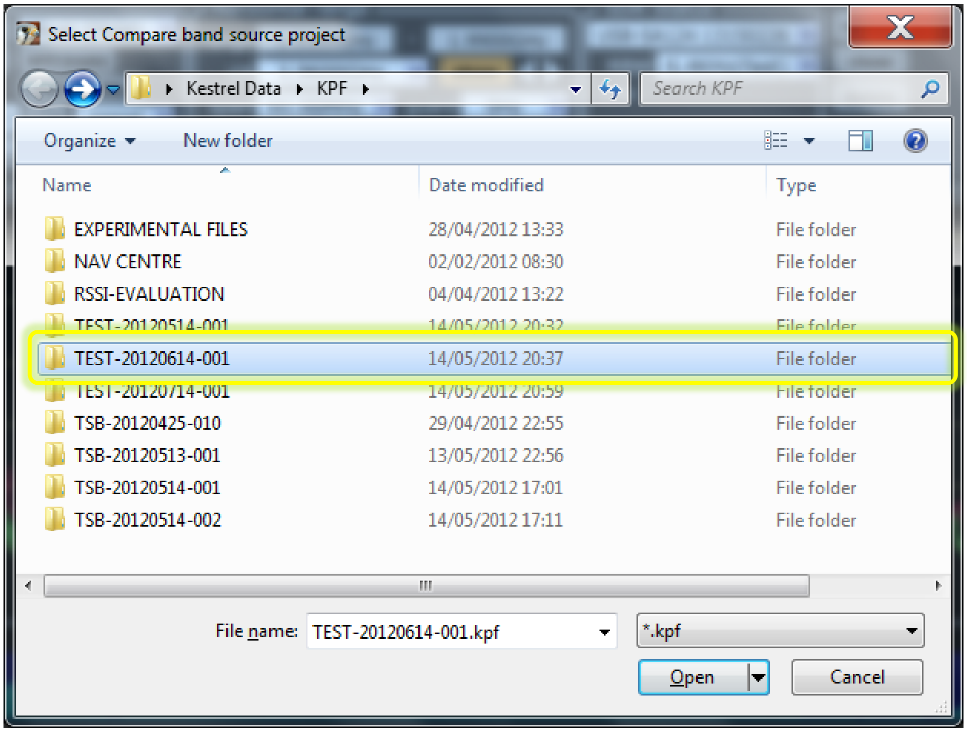
In the event that the band is larger, for example importing TSB 6000 into the 698 MHz to 2700 MHz is now fully supported.

It is possible to import a historical file for example, named ISM 900 or a 902 MHz to 928 MHz as a comparative overlay into a TSB6000 or TSB2000 band for example.

To import an LDSA ™ Antenna Location band from another Kestrel Project File (KPF) ™, the technical operator must access the | PROJECT | LOAD COMPARE BANDS | menu structure to display any available Kestrel Project Files (KPF) ™ residing within any project file directory.

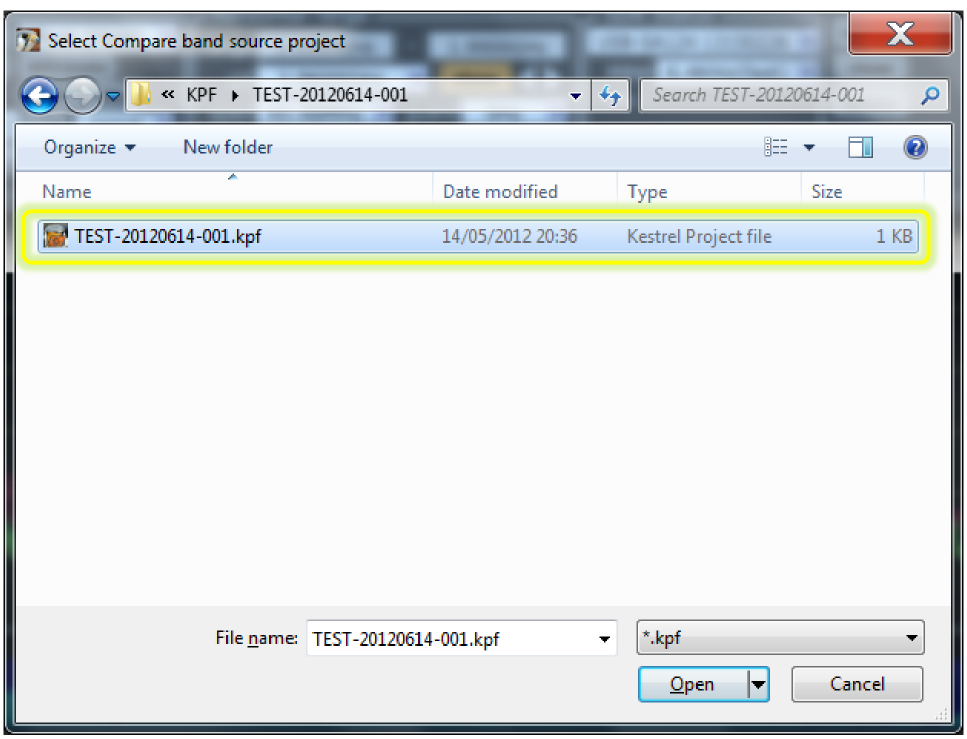
Project Menu | v1.40xx

The technical operator can navigate and select the historical project of interest to display all available LDSA ™ Antenna Location trace data available for import into the current project.



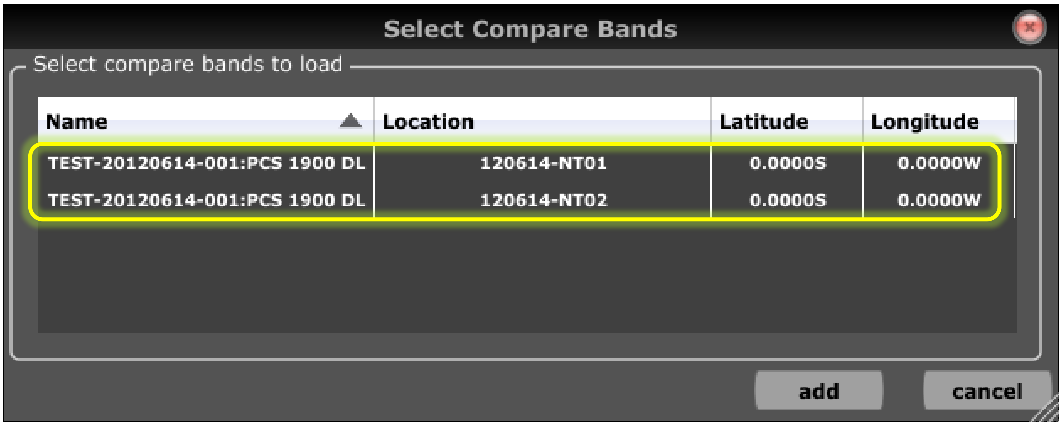
Historical File | v1.35xx

Navigating to the Kestrel Project File (KPF) ™ directory is the first step.



Historical File | v1.35xx

Once the historical project directory is located, selected and opened, the technical operator must select the Kestrel Project File (KPF) ™ as illustrated in the above image.



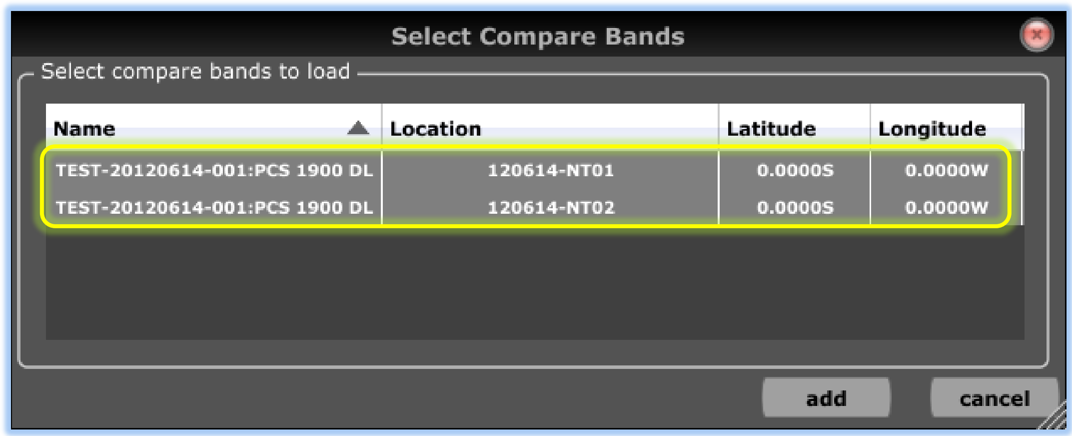
Select Compare Bands | v1.35xx

If any comparative bands are available within the project selected, they will be displayed in the resulting selected compare bands dialog window.

In the event that no comparative bands are available within the project selected, the following warning dialog window will be displayed.

No Bands Found | v1.35xx

The select compare bands image below illustrates the selection of two (2) available LDSA ™ Antenna Location bands available for direct import into the current project by the technical operator.



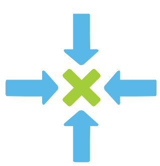
Select Compare Bands | v1.35xx

The | Select Compare Bands | window allows the technical operator to select one (1) or more available bands of interest for direct import into the current project.

Imported compare bands are appended with brackets | [200329-01-001A] | indicating that the LDSA ™ Antenna Location is imported data and not resident within the current Kestrel Project File (KPF).

This process is persistent, meaning the historical trace comparative import from another Kestrel Project File (KPF) ™ will remain in the current project, until manually removed again by the technical operator.

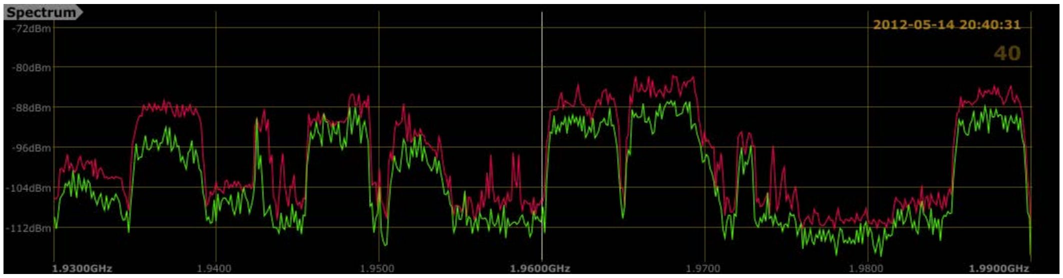
The | Import Compare Bands | process does not alter the file content or structure of the originating import Kestrel Project File (KPF) ™, and simply builds a copy, which is imported seamlessly into the current (designation) project by creating a dynamically generated copy for permanent or temporary inclusion within the currently open project of interest.



TIP: In the event that no bands are found within the project selected; a warning dialog will be displayed. "No bands were found in the selected project; that are compatible with those in this project. No selections are available…"

During the import process the LDSA™ ICON (Antenna Location) will display within the DSA control group, the Peak Envelope Capture (PEC) trace associated with the LDSA™ Antenna Location will be available as a direct comparative on the RF Spectrum Display (RSD) and is available for Trace Math Analysis (TMA), along with each of the LDSA™ Antenna Location ICONS residing within the current project.

The following examples illustrate the LDSA ™ ICON (Antenna Location) import process.



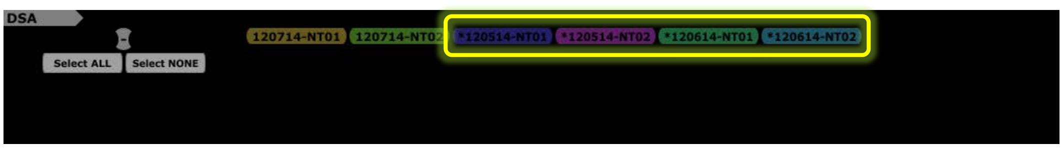
RSD | v1.39xx

The RF Spectrum Display (RSD) above is displaying the Real-Time Event (RTE) ™ trace and the Peak Envelope Capture (PEC) ™ trace resident from the current active Kestrel Project File (KPF) ™.

DSA Control Group | v1.35xx

The above image illustrates the current project LDSA ™ Antenna Location ICONS available for comparative within the current project.

The LDSA ™ ICONS are not currently selected or active.

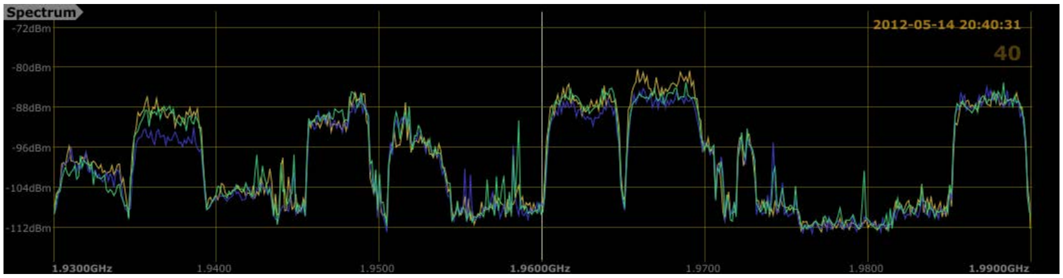


DSA Control Group | v1.35xx

The above image illustrates the LDSA ™ Control Group after the technical operator has imported LDSA ™ Antenna Location bands from two (2) additional separate historical project files for direct LDSA ™ comparative.

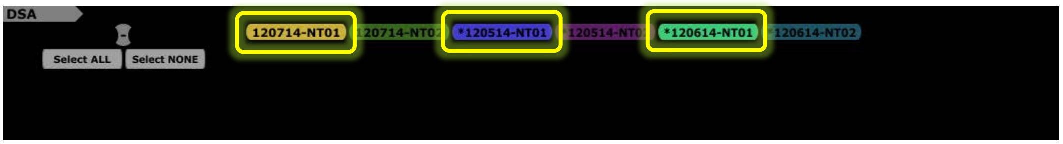
None of the LDSA ™ ICONS are currently selected or active.

The following series of examples illustrate the ability of the technical operator to display any number of the current project LDSA ™ ICONS and / or imported LDSA ™ ICONS for direct comparative.



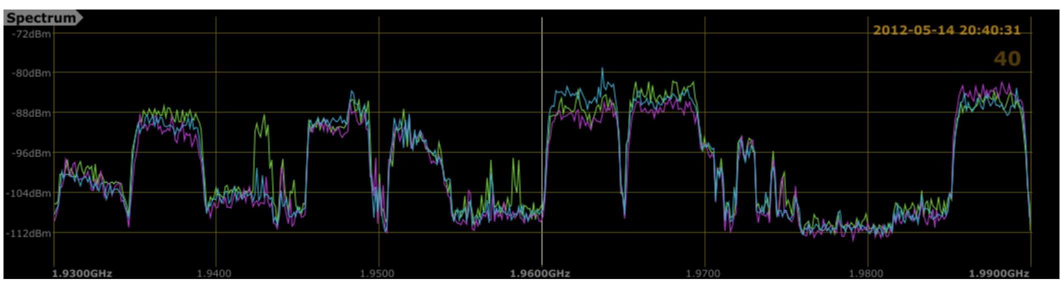
RSD | v1.35xx

The technical operator has selected the current project 120714-NT01; and the imported data represented by the [120514-NT01] and [120614-NT01] displayed LDSA™ ICONS.



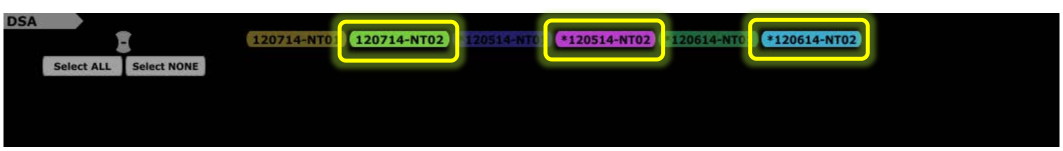
DSA Control Group | v1.35xx

This information represents LDSA ™ Antenna Location data collected for the same location NT01 on three (3) different dates.



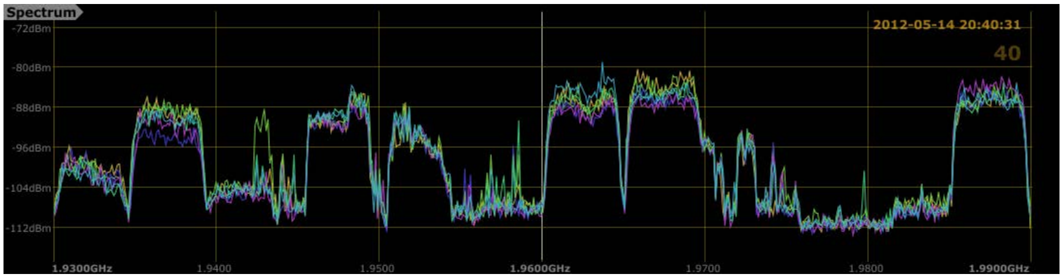
RSD | v1.35xx

The technical operator has selected the current project 120714-NT02 and two (2) imported locations from other dates and the data trace represented by the [120514-NT02] and [120614-NT02] displayed | DSA ICONS |.



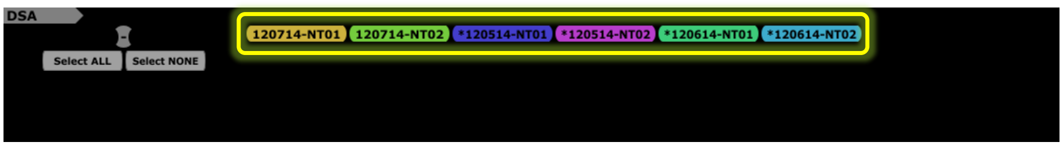
DSA Control Group | v1.35xx

This information represents LDSA™ Antenna Location data collected for the same location NT02 on three (3) different dates.



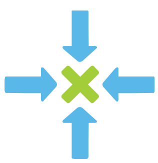
RSD | v1.35xx

The technical operator has selected the current project 120714-NT02, 120714-NT02 and the imported data represented by the [120514-NT02]; [120514-NT02] and [120614-NT02], [120614-NT02] displayed LDSA ™ ICONS.



DSA Control Group | v1.35xx

This information represents LDSA™ Antenna Location data collected for the same locations NT01 and NT02 on three (3) different dates.



TIP: Imported LDSA™ Antenna Location ICONS can be identified by the * that proceeds the Antenna Location Name. On mouse-over; additional details regarding the source project file are dynamically displayed.

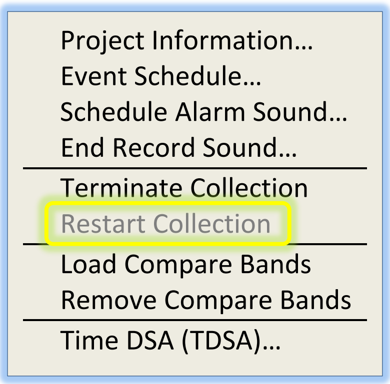
The key operational limitation of the Import Compare Band includes the requirement to only select bands of the same Spectral Profile Name or exact Frequency Band Name.

The technical operator must use the same Spectrum Band Allocation, Range of Interest (ROI) and Resolution bandwidth (RBW).

This is an important element concept to remember if the technical operator plans to utilize the “Import Compare Band” feature.

Restart Collection

Depending on the current state of the project, it may be necessary for the technical operator to | Restart Collection | by selecting | Project | Restart Collection | prior to being able to select the | Load Compare Bands | menu item.



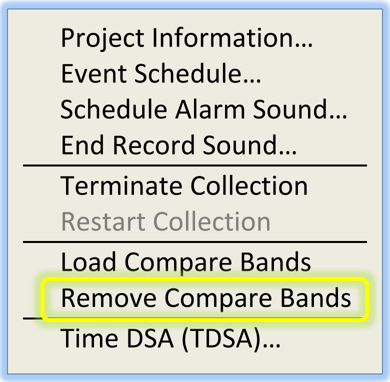
Project Menu | v1.40xx

Selecting | Restart Collection | must be utilized before the technical operator can select for import, any available LDSA ™ | Antenna Locations | from the project of interest, where the project collection was previously terminated on close of the Kestrel Project File (KPF) ™.

TIP: Unlocking a Kestrel Project File (KPF) ™ causes the runtime clock to restart and permits collection on one (1) or all of the historical spectrum bands contained within the project. This may prove problematic from a legal stand-point; if the project file is to be utilized for legal purposes in a court of law. Our recommendation for any project of this nature; would be to generate a copy of the entire original Kestrel Project File (KPF) ™ directory structure and utilize this new file for import purposes.

Remove Compare Bands

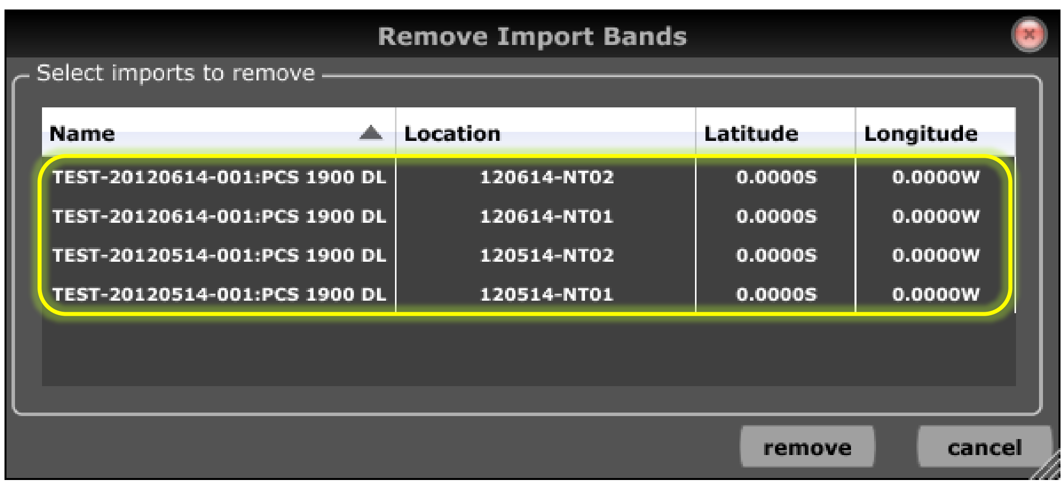
The | Remove Compare Bands | menu option allows the technical operator to remove one (1) or more of the imported LDSA™ ICON (Antenna Locations) from the LDSA™ control group and from the current project file structure.



Project Menu | v1.40xx

Selecting the | Remove Compare Bands | allows the technical operator to select and remove one (1) or more imported LDSA ™ | Antenna Locations | from the current project.

The following example illustrates the four (4) previously imported LDSA ™ | Antenna Location | bands for direct comparative in the current project.



Remove Import Bands | v1.35xx

The technical operator can select one (1) or more of the above listed LDSA ™ | Antenna Locations | for removal from the project.

TIP: Imported LDSA ™ comparative bands are persistent within the current project, once imported and therefore must be manually removed by the operator, if desired. Closing and opening the project will not remove the imported compare bands.

Closing the current active or historical project will not automatically clear and remove imported comparative data from the project.

The ability to use the Image Capture Tool (ICT) ™ to capture a screen shot of the displayed | LDSA ™ | window or utilize the | Session Report Generator (SRG) ™ | to print a PDF report containing LDSA ™ Antenna Location comparative data is fully supported for current project data and any manually imported spectrum trace data, providing that the report is generated prior to closing the current project file, which clears any imported LDSA ™ trace comparative data.

LDSA™ (Location) Display

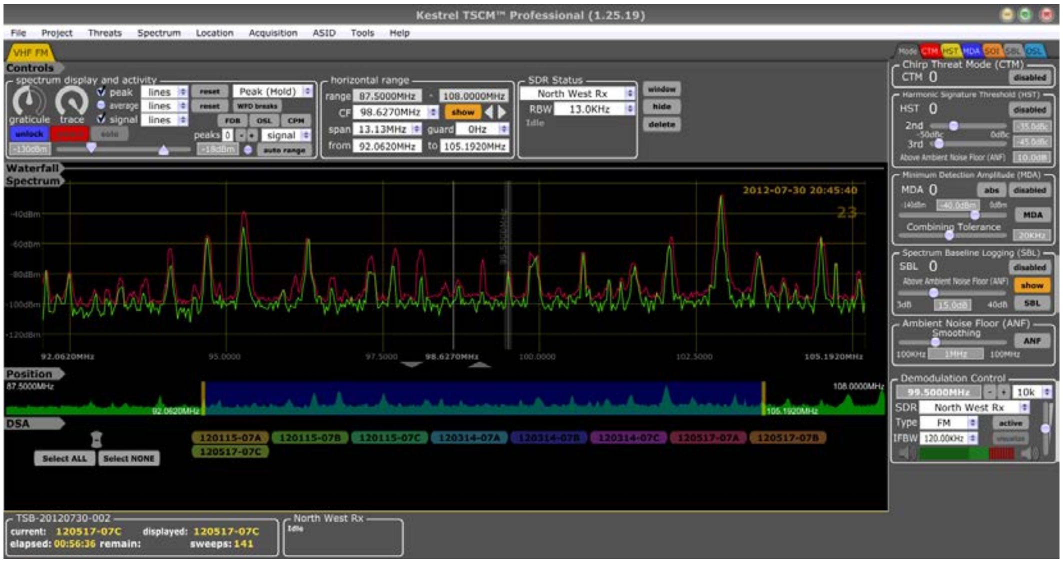
The technical operator may momentarily display any of the previously captured historical data antenna locations as an overlay on the current and active RF Spectral Display (RSD) window as a comparative analysis tool that displays the current (active or static) trace detail.

This is a very powerful feature that allows the technical operator to immediately display any of the LDSA ™ antenna locations for direct comparative analysis by simply placing the mouse cursor on the LDSA ™ antenna location ICON of interest.

The peak LDSA ™ trace from the selected antenna location will appear on the RSD only during active mouse over of the LDSA ™ ICON currently displayed in the LDSA ™ control group window.

During each successive deployment date; the technical operator must establish a new LDSA ™ Antenna Location and then run LDSA ™ collection at each of the same target area locations to generate meaningful comparative traces.

Peak Envelope Capture (PEC) ™ trace data from the same physical Antenna Locations and from different collection dates can be selected by clicking on each of the LDSA ™ ICONS of interest.

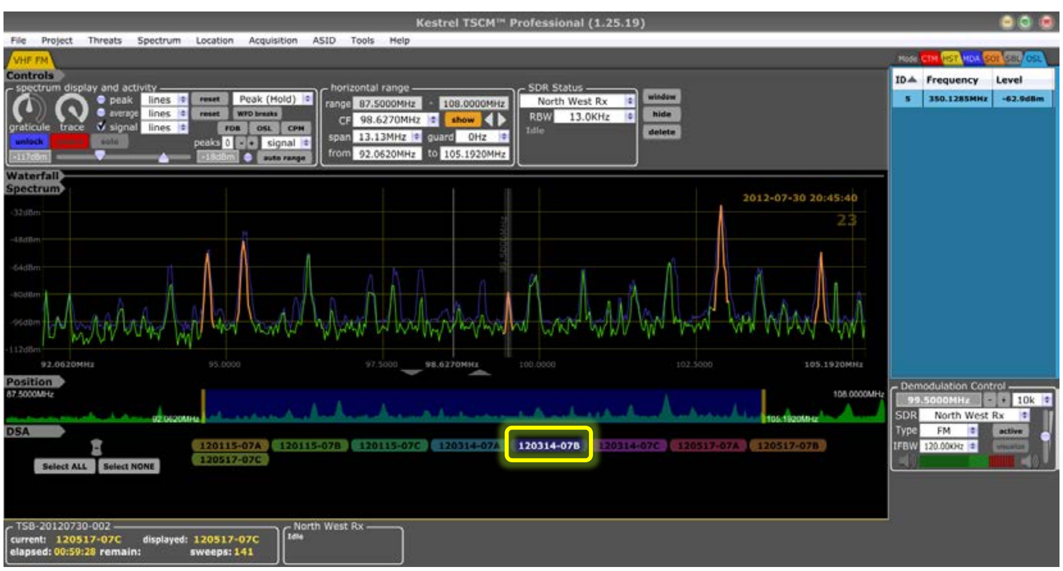


DSA | v1.35xx

The above image represents the current LDSA ™ Antenna Location and displays the Real-Time Event (RTE) ™ trace and Peak Envelope Capture (PEC) ™ trace in the normal display mode.

None of the LDSA ™ Antenna Locations are currently selected.

To compare the current Peak Envelope Capture (PEC) ™, LDSA ™ Antenna Location data from the current active sweep to any past date LDSA ™ trace residing within the project file for the same location is accomplished by mouse over of the any selected LDSA ™ ICON.



DSA | v1.35xx

The technical operator may mouse over on any of the LDSA TM historical antenna locations to immediately display the historical peak trace from another LDSA TM antenna location as a direct comparative to the current PEC trace as displayed.

Clicking on any of the LDSA TM antenna location ICONS causes the LDSA TM trace to replace the Real-time Event Trace (RTE) TM, Spectral Average Trace (SAT) TM and the Peak Envelope Capture Trace (PEC) TM, so that only the selected LDSA TM location peak traces will display on the Graticule.

The mouse-over ability to display any LDSA TM Antenna Location as an overlay on the current Graticule is a very powerful feature for real-time operator assisted signal analysis.

DSA | v1.35xx

The technical operator in the above example has selected the LDSA TM antenna location ICONS, (120314-07A) and (120314-07B) for direct DSA TM comparative analysis.

Time Differential Signal Analysis (TDSA) TM

TDSA TM is a very powerful development milestone and achievement, extending the analytical capability of the technical operator when the software needs to be deployed at a single collection location, for an extended period of time, as is common with Signals Intelligence (SIGINT), and Remote Spectrum Surveillance and Monitoring (RSSM) TM applications.

TDSA™ extends the analytical capability of the standard Location Differential Signal Analysis (LDSA) ™ concept, by adding a powerful analytical date / time block filter capability.

There is a tremendous advantage in the ability to display block date / time, | PEAK | spectrum data for direct comparative analysis, to highlight potentially significant changes and unique signal characteristics, at a single collection location, or even multiple bands and locations, across multiple search receivers and analyzers, over an operator defined fixed block date / time period that can span the | DATE | and | TIME | boundaries of the traditional multiple antenna location LDSA ™ feature, when applied to a historical project file.

The technical operator can dynamically define and select comparative | DATE | and | TIME | blocks, to automatically build a powerful comparative trace display, similar to the Kestrel ®, Location Differential Signal Analysis (LDSA) ™.

To illustrate this advanced analytical capability, the technical operator is able to directly compare defined | Peak Envelope Capture (PEC) | data, generated in real-time, upon activating the | TDSA ™ | feature, from operator defined | DATE | and | TIME | blocks, by selecting a start and stop | DATE | and | TIME | value, and | PERIOD | used to calculate multiple comparative time blocks, as represented by | LDSA™ ICONS | located within the LDSA ™ control group.

For example, if runtime collection was initiated on | 2017-02-18 | at | 1509 H | and terminated on | 2017-02-19 | at | 0037 H |, the technical operator can define the TDSA ™ start time as | 1500 | and select the period as | 1 H |, or another value as required.

This action will result in the automatic generation of time based | TDSA ICONS | within the TDSA ™ control group for the following time blocks, spanning two all date and time periods, and will include TDSA ™ ICONS for the following | DATE | TIME | blocks, including;

20170218-150000	20170218-160000	20170218-170000
20170218-180000	20170218-190000	20170218-200000
20170218-210000	20170218-220000	20170218-230000
20170219-000000	20170219-010000	.

The technical operator will realize a direct comparative, peak spectral trace data set, representing the individual 11, 1-hour time blocks (as illustrated in the above example) from a single collection location, to identify unique and reoccurring signal events across operator defined | DATE | and | TIME | block parameters, with significant clarity.

Alternatively, the technical operator might also want to filter (compare) other time block periods to better refine the initial findings, should Signals of Interest (SOI) present themselves, within the spectra.

The start / stop date and time block definition, tracks the runtime or historical project file statistical details, making it a simple task to define with precision, the required filtering for runtime capture, or historical analysis.

TDSA | DSA Control Group | v1.35xx

This capability provides a very powerful data filter, permitting total operator control over the trace comparative process, by directly comparing unique date and time block data across any number of | DATE | and | TIME | combinations.

Consider the following field deployment collection and analysis of runtime data with a defined start time of 211000 (2110 H) to 215000 (2150 H), resulting in five (5) TDSA ™ ICONS.

The Waterfall Display (WFD), familiar LDSA ™ Comparative Display, and the LDSA ™ Control Group all work in harmony to display powerful analytical data that is filtered by defined time blocks.

A | DATE | and | TIME | stamp overlay marker appears on the Waterfall Display (WFD) based on the TDSA™ | TIME | and | PERIOD | defined by the technical operator.

The | DATE | and | TIME | stamp overlay marker will appear in real-time during runtime deployment of the TDSA ™ feature or will automatically display during post analysis and review.

A | TDSA ICON | is automatically created for each | PERIOD | within the TDSA ™ control group, all peak spectra for that period is automatically calculated and is represented by a single Kestrel Super Trace (KST) ™ utilizing a similar methodology as our write compression technique for runtime data collection.

For example, if the technical operator selects a | PERIOD | of | 1 H |, a representative | TDSA ICON | captures all peak data information for the total accumulated peak spectra data, for that entire period.

The heighted areas of the WFD below represent the Kestrel Super Trace (KST) ™ compression of 1 / n = 25, across 10,000 Real-Time Event (RTE) traces.

The period selected by the technical operator was set as | 10 M | (minutes).

TIP: How does the TDSA ™ feature calculate the comparative time blocks? When the technical operator defines a time block reference, for example 1 hour, all captured trace data for each, 1-hour period is rendered as a single Kestrel Super Trace (KST) ™, where the resulting KST ™ represents all of the peak data for the preceding period. If the technical operator defined file write management as 1/n=1 and defined the runtime parameters on the signal Hound BB60C receiver as TSB 6000 (0 Hz to 6 GHz) @ 20 kHz RBW, each resulting KST ™ representing a 1-hour period, would contain all the peak captured data for 14400 normal traces.

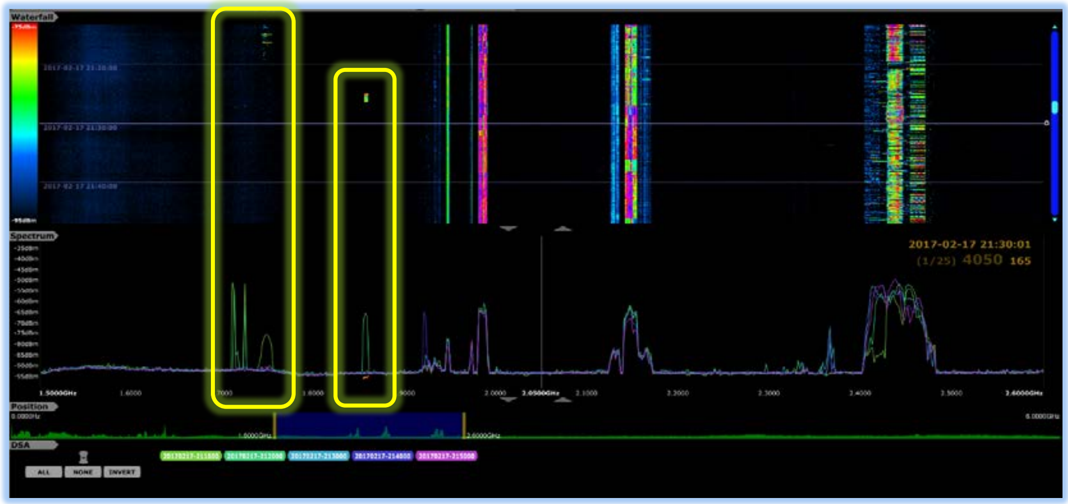
TDSA ™ Button Operation

The | TDSA ™ | button appears under the | Spectrum Display and Activity | control group and permits the technical operator to display a separate real-time reference, peak trace during runtime specifically for the current TDSA ™ period.

When the | TDSA ™ | feature is active during runtime, pressing the | TDSA ™ | button will enable a purple peak trace that responds to the current | TIME BLOCK | trace level activity, separately from the | Peak Envelope Capture (PEC) | trace, which represents all collected data, and not just the current TDSA time block.

Once the | TDSA ™ | period is complete and is rendered as a | TDSA ™ | ICON, the peak reference data for that period is automatically reset and the | TDSA ™ |peak activity for the new, current period is captured and displayed progressively.

The peak spectra for each | TDSA ™ | period is persistent, and can be used as a reference against the | Real-Time Event (RTE) |, or the | Spectrum Average Trace (SAT) | during post analysis and review.



TDSA (Time Block Comparative) Display | v1.35xx

This results in an operator defined overlay | PERIOD | generated for every 10 minutes of actual collection.

The operator's attention is immediately directed to two (2) separate WFD anomalies that appear to have occurred within the protected target area of the facility.

The first highlighted area is an unauthorized 4G / LTE modem brought into facility by an employee.

The second highlighted event is a two (2) minute PCS band mobile signal originating from, or received (and answered) within the protected area, for which a wireless policy prohibits mobile devices.

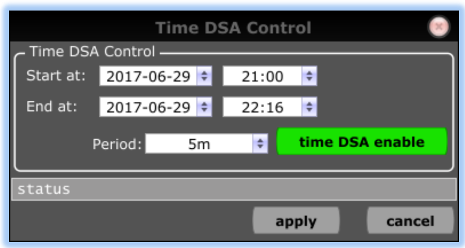
The current TDSA ™ filtering can be dynamically removed by the technical operator and reapplied, utilizing any available | TIME | PERIOD | settings, to further refine the results during runtime, or may be applied during post event review and analysis.

The ability to define TDSA ™ filtering, during runtime collection, or applied during post collection and analysis, is a very powerful analytical tool.

The TDSA ™ feature is accessed from the main | PROJECT | menu | TIME DSA (TDSA) ™ | menu option.

Time DSA Control | Disabled Default | v1.35xx

Time DSA Control | Date + Time + Period | v1.35xx



Time DSA Control | Enabled + 5 MIN | v1.35xx

Time DSA Control | Enabled + 30 MIN | v1.35xx

The | TIME DSA CONTROL | dialog window requires that the technical operator select a | DATE and | REFERENCE TIME |, based on the | TIME STAMP | for the first captured trace.

The operator can use LVA ™ feature to determine this value, when applying TDSA ™ during post analysis and review, or select the current start time for runtime collection when TDSA ™ is applied in a runtime environment.

There are two (2) competing modes of operation, including runtime capture, and post capture filter.

The | START AT | DATE | TIME | values can be selected in any 30-minute interval across a full 24 hours from | 0000 | to | 2330 | hours, or the operator can select any legal | START TIME | value by entering it in the correct format manually.

The | END AT | DATE | TIME | values can be selected in any 30-minute interval across a full 24 hours from | 0000 | to | 2330 | hours, or the operator can select any legal | STOP TIME | value by entering it in the correct format manually.

For example, the collection was started at | 2058 | hours, the operator can select either | 2030 | or | 2100 |.

If the | PERIOD | of | 1 H | is selected the resulting first period | TDSA ICON | rendered will be | 2030 | and include 2 minutes of historical peak data.

The | PERIOD | determines the number of traces rendered to a | PEAK | Kestrel Super Trace (KST) ™ | based on the | PERIOD | selected by the operator, 1 hour in the above illustrated example.

To illustrate this concept further, with the | PERIOD | is defined as | 1 HOUR | and 14400 traces are captured during this period as (reference to the Signal Hound BB60C @ 24 GHz per Sec), all | PEAK | trace data is captured and rendered to a single | Kestrel Super Trace (KST) ™ | for this period.

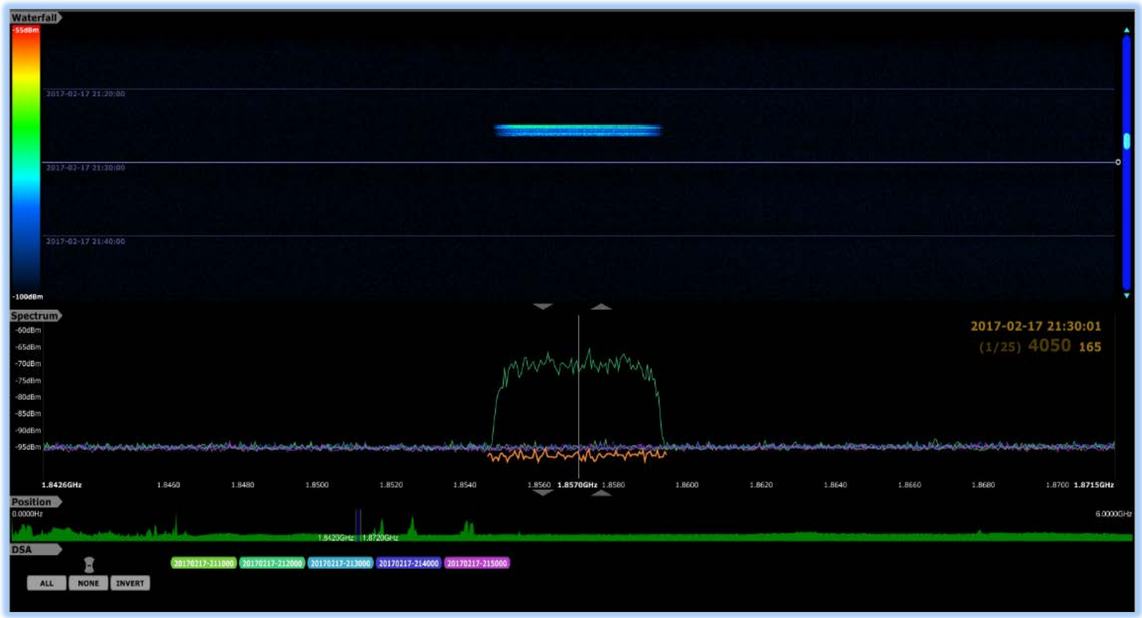
Selecting either | REFERENCE TIME (24H) | results in the generation of a | TDSA ICON | to 2000 to advantage the 2 minutes of collection occurring before the hour.

All standard navigational and display features, including | Live View Analysis (LVA) ™ | are available with the TDSA mode active to maximize the Probability of Detection (POD) of potentially hostile or unauthorized emissions.

Once the technical operator has displayed the | TIME DSA CONTROL | control group window, the | REFERENCE TIME | (directly related to the collection start time) can be selected, along with the desired | PERIOD | (analysis reporting blocks).

Artificial Intelligence (AI) and code level logic will assist the technical operator is defining the optimal values, for example, if the start time is 0858 and the operator defines 0900 hours as the | REFERENCE TIME |, the software will render and display a | TDSA ICON | starting at 0830 hours.

Selecting a | REFERENCE TIME | of 0700 hours, will result in the software rendering and displaying a | TDSA ICON | starting the 0830 hours, as yet another example.



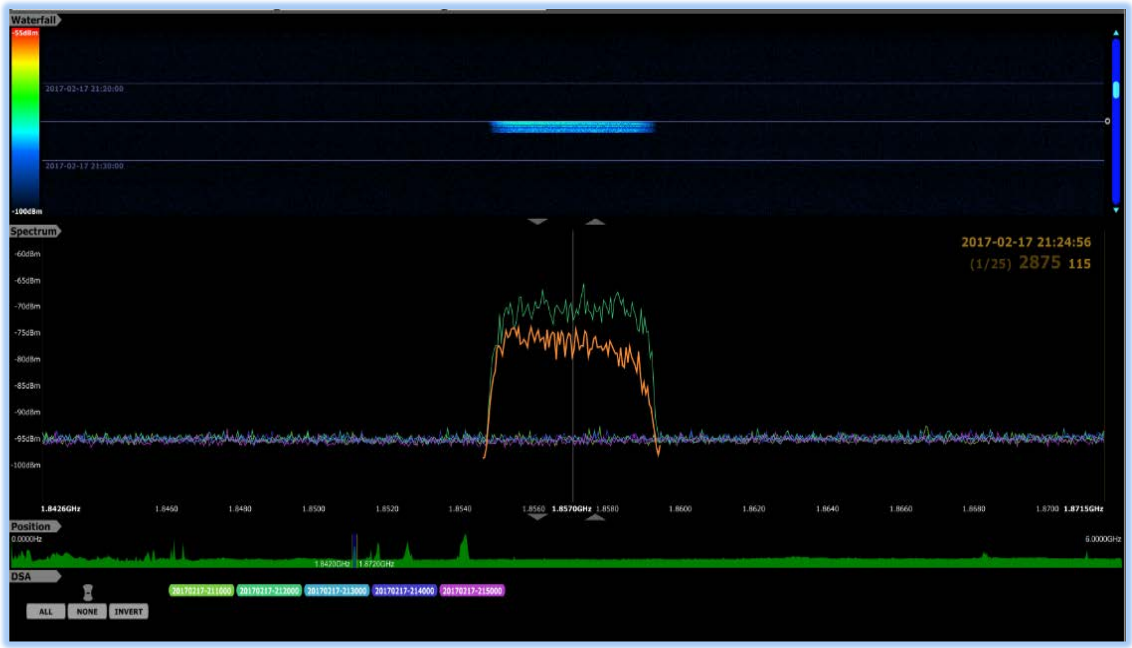
Navigation and Zoom | v1.35xx

Positional Zoom Control (PZC) ™ and Live View Analysis (LVA) ™ are powerful navigation tools that significantly enhance the technical operator's ability to identify, and quickly resolve unknown Signals of Interest (SOI).

The technical operator is advised to utilize these important tools during the analysis and review process during any TDSA ™ session.

Utilizing | Live View Analysis (LVA) ™ | it is possible for the technical operator to determine the precise appearance and termination events for any periodic Signal of Interest (SOI) captured during runtime.

The ability to determine the frequency, bandwidth, amplitude, and periodic nature of the appearance of any Signal of Interest (SOI), is easily accomplished and provides a new way to look at complex extended spectra.



Live View Analysis (LVA) ™ | v1.35xx

LDSA ™ | TDSA ™ | RDSA ™

The primary difference between | Location Differential Signal Analysis (LDSA) ™ |, and | Time Differential Signal Analysis (TDSA) ™ | is multiple antenna locations for comparative, whereby TDSA ™ is based on filtering single location data (from any number of LDSA ™ locations), based on time block filtering, at the project level, or any operator defined portion of the project, back to the start date and time of the project, across LDSA ™ locations.

The RDSA ™ mode, allows the technical operator to display real-time, average, and peak comparative data, to promote runtime and post analytical analysis of managed spectrum and waterfall data, from multiple receiver and / or locations as a definable overlay.

Multiple receiver spectra can be actively compared as a spectrum and waterfall overlay to produce real-time comparative analysis at, operator defined collection locations.

RDSA ™ permits the technical operator to overlay live runtime bands, and sub-bands on a wideband Range of Interest (ROI).

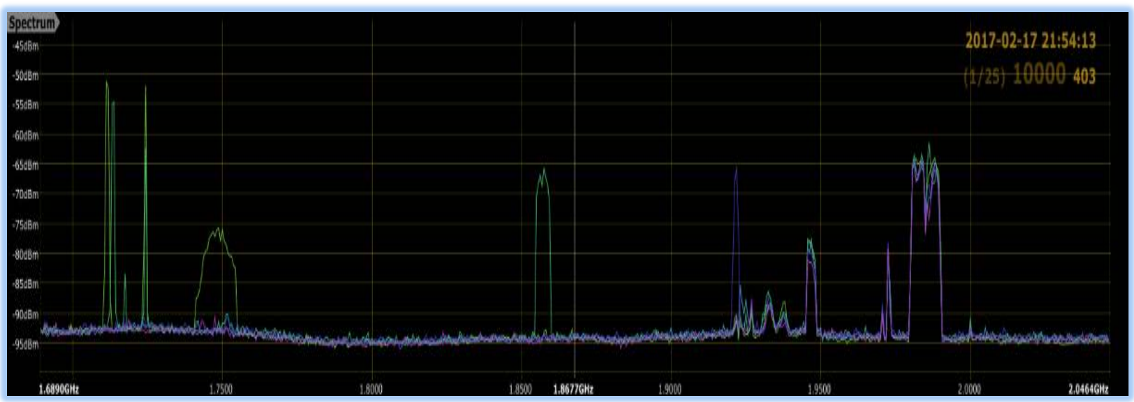
The ability to assign a runtime wideband spectrum of 0 Hz to 6 GHz for example and display a real time VHF and / or UHF comparative band from a second or even third receiver, is a supported.

The combinations are limitless, bringing absolute clarity to complex mission-oriented deployment challenges, within a modern moving target threat model, across locations, receivers, bands, and sub-bands on the same receiver.

For example, the technical operator is able to view the DECT 6.0, ISM 900, ISM 2400 bands running on independent receivers in the main boardroom, executive office, and reception area, on three (3) separate and independent receivers, and overlay the resulting spectra, on another receiver as a real-time, drop-in spectrum overlay.

The advantages are even more pronounced, when TDSA ™ filtering is applied across multiple collection locations.

TDSA™ can be technical operator defined during runtime collection, or during post analytical analysis of historical Kestrel Project Files (KPF) ™.



TDSA ™ | v1.35xx

The above TDSA ™ plot represents differences across specific operator defined time blocks that narrow the emission, or event window for any Signal of Interest (SOI), and permits unique patterns associated with periodic signals to be quickly identified.

Receiver Differential Signal Analysis (RDSA) ™

Receiver Differential Signal Analysis (RDSA) ™, is a powerful Kestrel ® capability that allows the technical operator to deploy multiple local, or remote SDR hardware, and overlay the spectrum and waterfall data from each receiver, as a live, direct comparative across multiple search receivers, or spectrum analyzers.

RDSA ™ is a significant development milestone that enhances TSCM, SIGINT, and Remote Spectrum Surveillance and Monitoring (RSSM) ™ applications, in combination with TDSA ™ analytical filtering.

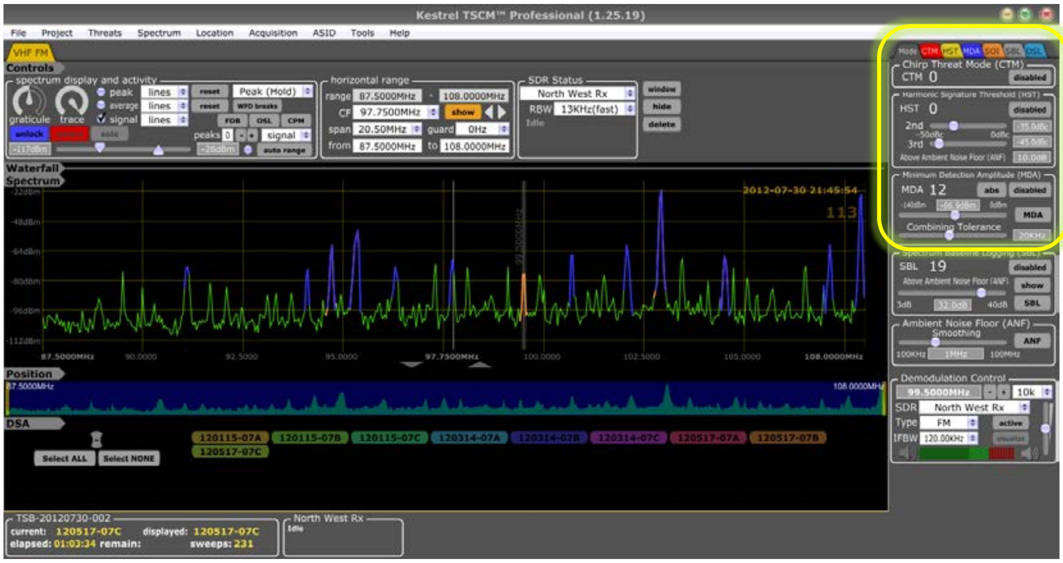
The Kestrel TSCM ® Professional Software, Receiver Differential Signal Analysis (RDSA) ™ feature includes, a first in its class, powerful multi-layer waterfall display that compliments the Real-Time Spectrum Display (RSD) ™ overlay capability.

LDSA + Threat Detection Algorithm (TDA)

A key feature of the Differential Signal Analysis (DSA) ™ module is the unique ability to operate the Threat Detection Algorithm (TDA) at each technical operator defined DSA Antenna Location during active deployment.

The ability to run the MDA + CTM + HST provides active threat detection of analog based audio transmitters that may be unique to a specific Antenna Location.

The Threat Detection Algorithm (TDA) may be set for the initial Antenna Location and will remain active for each new Antenna Location as the DSA ™ feature is actively deployed.



DSA Threat Detection | v1.35xx

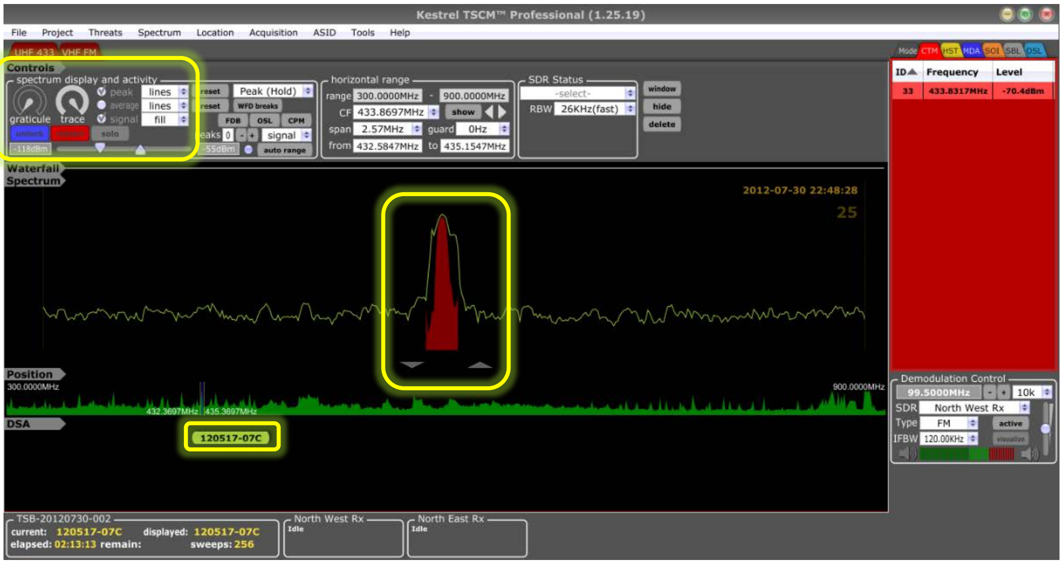
The Kestrel TSCM ® Professional Software fully supports both passive (so-called) "Non-Alerting" and Active (CTM) "Alerting" threat detection modes during deployment.

The Minimum Detection Amplitude (MDA) ™ level determines the amplitude that any given signal event must meet or exceed before being flagged as and MDA signal event.

Only signal events that meet or exceed the MDA level (dBm) will be analyzed when the Chirp Threat Mode (CTM) is active.

DSA Threat Detection | v1.35xx

The above example illustrates a CTM hit at the current | Antenna Location |, alerting the technical operator to the presence on an analog based audio surveillance transmitter.



DSA Threat Detection | v1.35xx

The technical operator can adjust the spectrum display and activity control group to better focus attention of the CTM hit and the current Peak Envelope Capture (PEC) trace.

The technical operator can establish a New Project and set at least the initial Antenna Location from the Setup Wizard and add additional Antenna Locations before exiting the Setup Wizard in advance of active deployment, or “on-the-fly” from the | LOCATION | NEW LOCATION | menu, or the | LOCATION | PROJECT LOCATIONS | menu, or the | LOCATION | FLOOR PLAN | menu during runtime.

Graphical Mapping

Our | Differential Signal Analysis (DSA) ™ | functionality is significantly enhanced by the implementation of the graphical mapping capability.

The ability to import horizontal floor plans, multi-level vertical riser plan, site plan, geographical area maps, aviation and marine charts, aerial photographs, satellite images and photo-realistic virtual reality images, supports the direct import of target area or facility photographs in (PNG) (JPG) (GIF) formats.

It is an easy task to convert a (PDF) file to one of the above supported file formats, utilizing third-party software.

Floor Plan (Import) DSA ™

Our progressive floor plan import capability is utilized by the technical operator in combination with the Kestrel TSCM ® Professional Software, Differential Signal Analysis (DSA) ™ functionality to provide a significant new TSCM specific capability.

Our TAB based graphical mapping feature fully supports the import of one, or more graphic images providing DSA ™ support for multiple target areas, zoned zoom areas of the same facility and the ability to display different floor plates or vertical risers of different areas of the client's facility.

Graphical Mapping Control Group

The graphical mapping control group allows the technical operator to work almost entirely within the | LOCATION | FLOOR PLAN | window to control and monitor the deployment of the Differential Signal Analysis (DSA) ™ feature.

The technical operator is able to import as many graphic images as required to represent the target area or facility, with each image set within its own window TAB for display purposes.

The first step is to import an image utilizing the | IMAGE | button.

In the event, that more than one (1) image is required, the technical operator can utilize the | NEW FLOOR PLAN | button to create additional TABS and then press the | IMAGE | button to import another image as may be required.

The ability to change the imported floor plan image name permits consistency and clarity for the Kestrel Project File (KPF) ™ structure and for the purpose of technical operator situational awareness.

This is accomplished by right mouse clicking on the imported image, a menu selection dialog will display providing the option to Change Floor Plan Name or Delete Floor Plan from the current window.

Selecting the Change Floor Plan Name displays a text input dialog window showing the current name to be edited.

Floor Plan | v1.35xx

An image calibration grid is also available as a reference overlay and further refines the Antenna Placement Distance (APD) ™ for the purpose of advanced TSB 2000 (Technical) Standard ™ based threat level detection protocol.

The calibration grid overlay is activated by pressing the | GRID ON | button.

Once active the technical operator can select the calibration grid size in Feet, Meters, Miles and Kilometers as required.

The calibration grid overlay is not global in nature and can be configured independently for each window TAB separately.

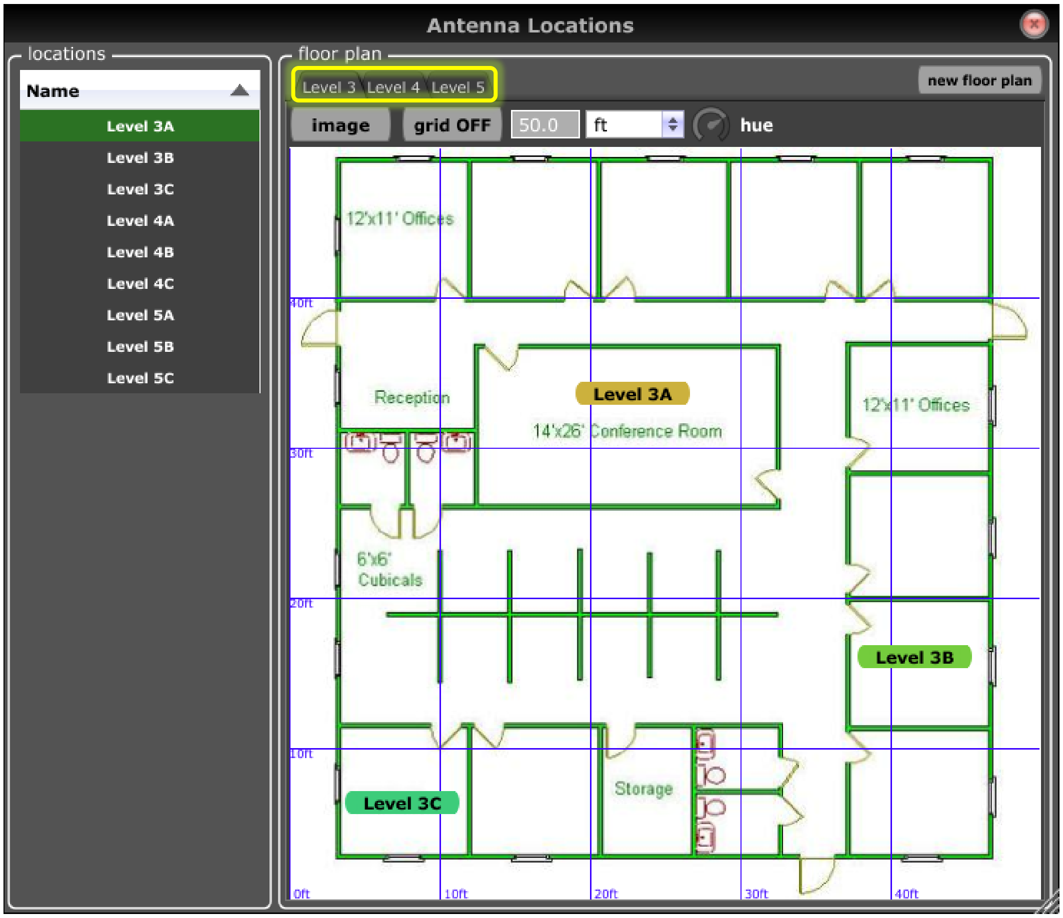
As an example, the technical operator can toggle the calibration grid overlay on to display the calibration grid over the floor plan image.

The next step is to select the desired calibration units consistent with the approximate measurements of the imported floor plan, mouse over any calibration grid overlay intersecting lines and drag the grid to the lower left corner of the image to set a reference point and confirm the calibration is appropriate for the target area or adjust as required.

The default grid colour is RED and may not be the best contrasting colour for the imported image.

There is a | HUE | control that allows the technical operator to continuously adjust the calibration grid overlay colour to provide the best overall contrast.

The hue control is not global in nature and can be configured independently for each window TSB separately.



DSA Floor Plan | v1.35xx

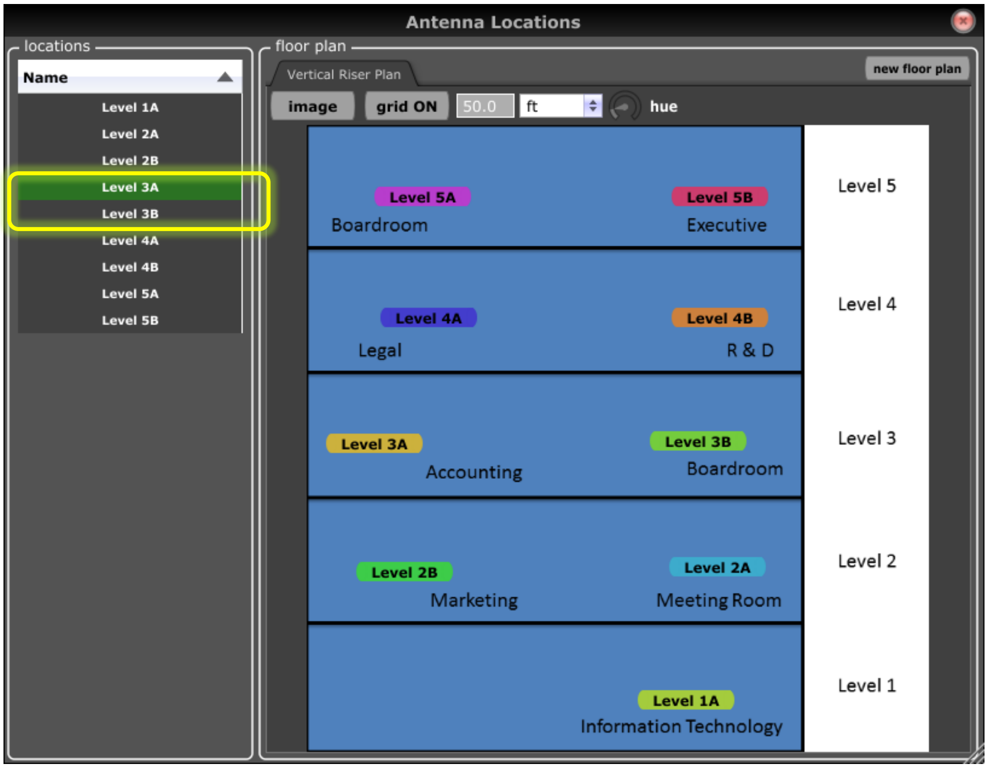
The example above demonstrates the ability of the technical operator to import a base level horizontal floor plan directly into the Kestrel TSCM ® Professional Software and overlay operator defined DSA antenna locations.

This enhanced capability to import a target area or facility horizontal floor plan; multi-level vertical riser plan, site plan, geographical area map, aviation or marine chart, aerial photograph, satellite image, or a photo-realistic virtual reality image, is fully supported in the Kestrel TSCM ® Professional Software.

A list of current, "drag-and-drop" operator defined Antenna Locations are displayed on the locations list.

The technical operator can add new locations, edit current locations and set any displayed location as the currently active location for collection purposes.

It is also possible to select and display GPS based Latitude and Longitude information when a generic GPS receiver module is connected to the host computer and is actively receiving data.



DSA Vertical Riser Plan | v1.35xx

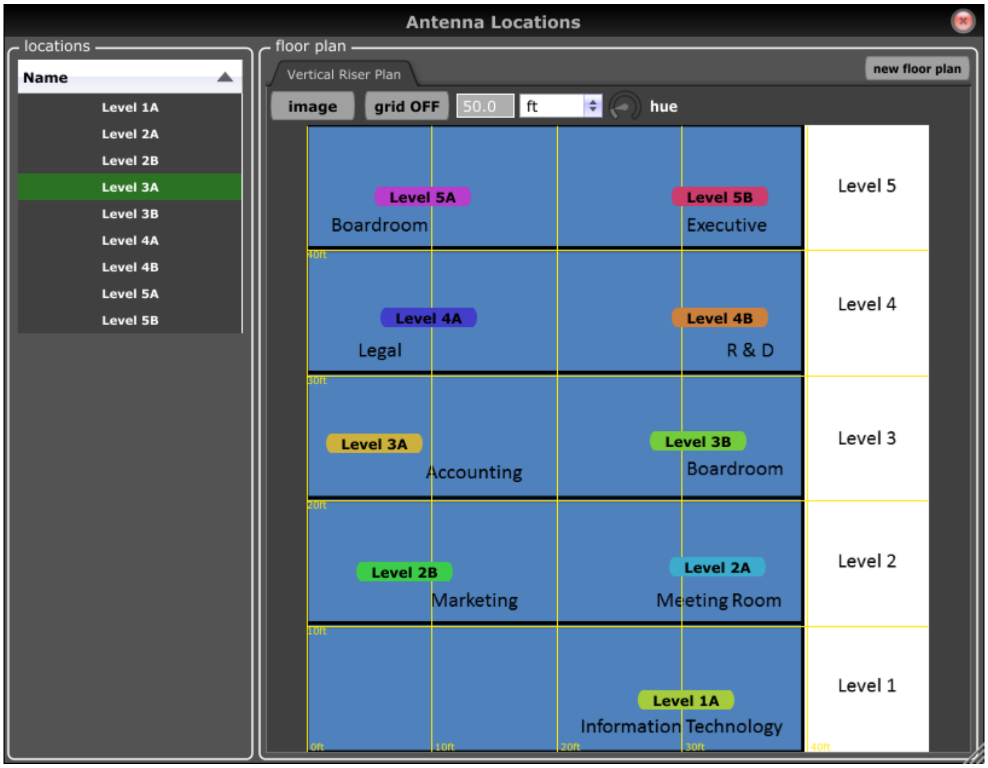
The above example illustrates the current deployment of the Kestrel TSCM ® Professional Software in a multi-level facility utilizing a simple operator defined vertical riser image that was created by the technical operator with Microsoft Office or another third-party graphics program.

The current DSA ™ antenna location is Level 3A (Accounting Department) as indicated on the DSA ™ antenna location list.

It is also possible to define an Antenna Location located on the roof of the target facility, as a DSA ™ collection point as is typically the case for physical review during the inspection.

Field applications include standard DSA ™ deployment, Intentional and Unintentional Radiators, Electro-Magnetic Interference (EMI) source localization, Radio Direction Finding (RDF), multi-point (fixed and mobile) triangulation and electronically assisted Search and Rescue (SAR) applications.

The following example illustrates the calibration grid reference overlay ability, providing approximate vertical and / or horizontal grid reference.



DSA Vertical Riser Plan | v1.35xx

TIP: Professional Development TSCM Group Inc., provides advanced electronic Search and Rescue (SAR) mission deployment training in Radio Direction Finding (RDF) and Triangulation principles with our more than thirty (30) years of direct field experience. Our instructor is one of only a few civilian pilots to have completed the Department of National Defence (DND) Search Master Program – Canada.

The Kestrel TSCM ® Professional Software fully supports the direct file import of (PNG), (JPG), and (GIF) graphics-based image file formats and photographs, providing the technical operator with the ability to easily deploy full graphical DSA ™ capability utilizing standard supported file formats.

It is also possible to create simple block floor plans and multi-level vertical riser plans utilizing third-party productivity software as demonstrated above.

Geographical Area Map (Import) DSA

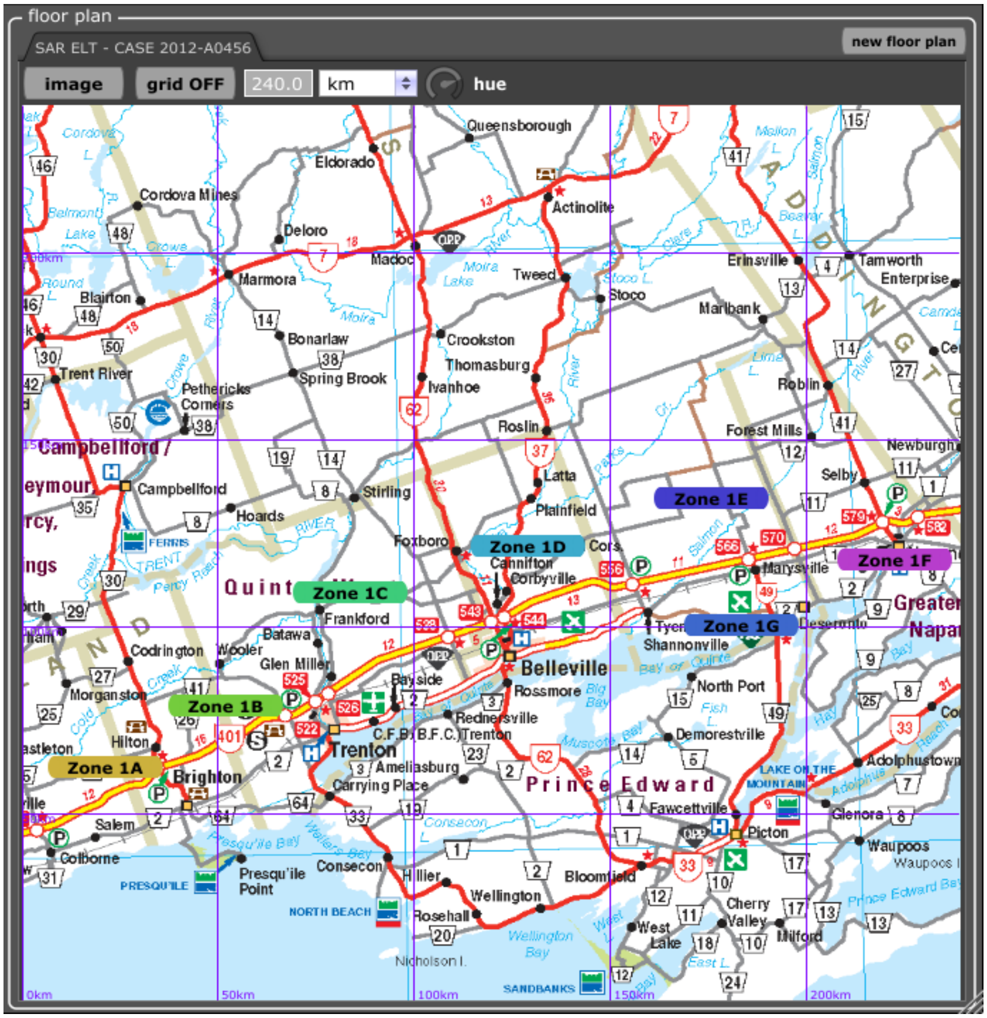
The example below demonstrates the ability of the technical operator to import a base level geographical area map directly into the Kestrel TSCM ® Professional Software and overlay operator defined DSA ™ antenna locations.

Electronic Geographical Site Surveys (GSS), Spectrum Surveillance and Monitoring (SSM), Search and Rescue (SAR), Radio Direction Finding (RDF), and Electro-Magnetic Interference (EMI) tracking and location are all possible field applications utilizing either single or multiple, fixed or mobile deployments. Any supported graphics-based file format may be directly imported into the Kestrel TSCM ® Professional Software.

Our TAB based graphical mapping feature fully supports the import of one (1) or more images providing area hand-off, multiple mobile support integration and the ability to display an overview map and separate zoom areas containing more or less detail.

DSA Geographical Area Map | v1.35xx

The above example illustrates the technical operator’s ability to capture and document the unique signal parameters at various geographical locations or GPS coordinates, the image window may be resized for greater image detail.



DSA Geographical Area Map | v1.35xx

The calibration grid reference overlay provides the approximate scale in feet, meters, miles and kilometers.

This functionality is ideal for Search and Rescue (SAR) deployment in support of the location of Emergency Locator Transmitters (ELT), Emergency Position Indicating Radio Beacons (EPIRB) and Personal Locator Beacons (PLB) with either a 121.5 MHz or 243 MHz continuous carrier tracking signal.

Photo Realistic | Virtual Reality (Import) DSA

The ability to import photo realistic; virtual reality images of the target area, facility; interior or exterior visuals, site photographs, aerial photographs or even satellite images into the Kestrel TSCM ® Professional Software is fully supported.

This ground-breaking functionality provides significant analysis and intelligence rich content directly related to the capture of the RF ambient spectrum environment, physical layout and structural elements of the target area, facility or site.

This ability significantly enhances the technical operator experience during post analysis review and report generation, often providing additional clues as to signal propagation factors, multipath, reflections and a variety of potential physical security vulnerabilities.

Utilizing dynamic, content rich photographic based imagery provides the technical operator with the unprecedented ability of to easily document the entire inspection process with our intuitive and fully integrated approach to data collection, documentation and reporting.

The technical operator has total command and control of the post analysis review phase of the inspection when utilizing our advanced best practices methodology and a balanced deployment approach.

TIP: The Kestrel TSCM ® Professional Software is well positioned and founded on the basis of total work-flow integration of all collected RF spectral data; best deployment practices; a balanced approach to the application of physical and electronic search parameters; and when combined with a dedicated; experienced and knowledgeable TSB ™ certified Technical Security Specialist (TSS) ™ can significantly enhance the Probability of Detection (POD).

The following three (3) examples clearly illustrate the powerful advanced capability that our photo-realistic, virtual reality image import, Location Differential Signal Analysis (LDSA) ™ provides during complex deployment scenarios.

Photographs can be taken on-site and immediately loaded onto the host computer where they may be directly imported into the graphical mapping feature.

It is also possible to accomplish editing or post image processing utilizing third party image editing software before importing any image into the graphical mapping feature.

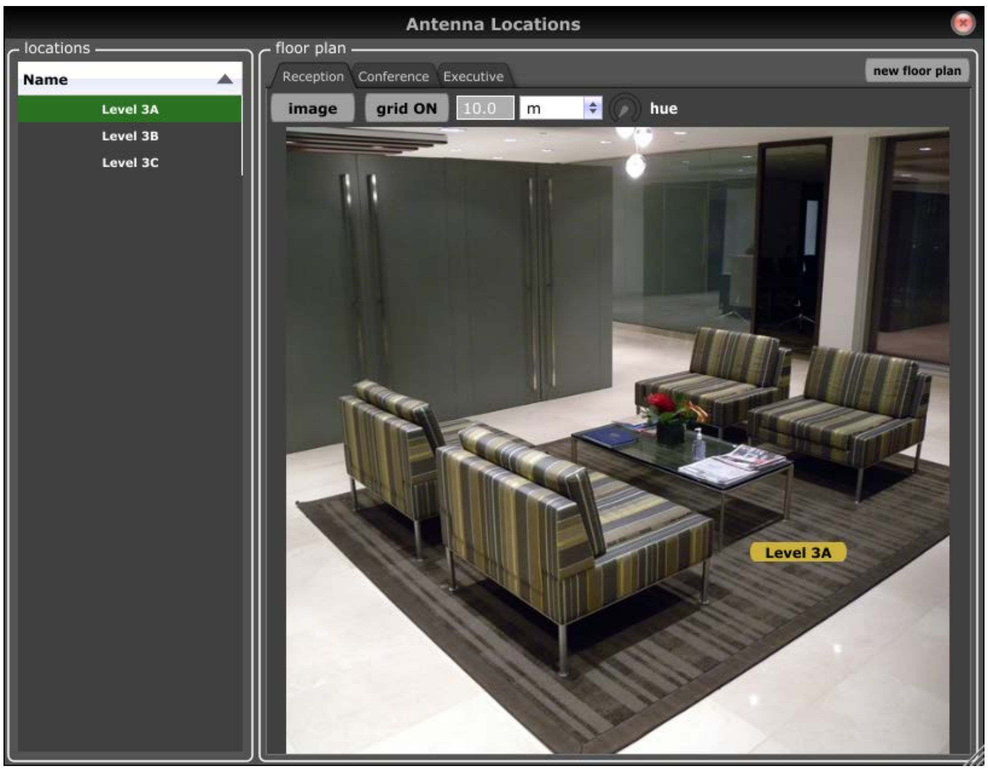
Pressing the | IMAGE | button located on the floor plan window, displays the standard windows file directory and permits the technical operator to navigate and select images residing on either the local drive or external media drives.

The ability to add any number of additional floor plan TABS is accomplished by pressing the | NEW FLOOR PLAN | button and importing a new image (or utilizing the blank workspace without any image) for inclusion of additional LDSA ™ antenna locations or as a simple reference image.

LDSA ™ antenna locations may only be added once to the graphical mapping feature.

It is possible to relocate LDSA ™ antenna locations from one floor plan to another during active deployment, however each LDSA ™ antenna location may only be utilized once.

Moving a LDSA ™ antenna location to another floor plan, removes the LDSA ™ antenna location from the currently placed position.

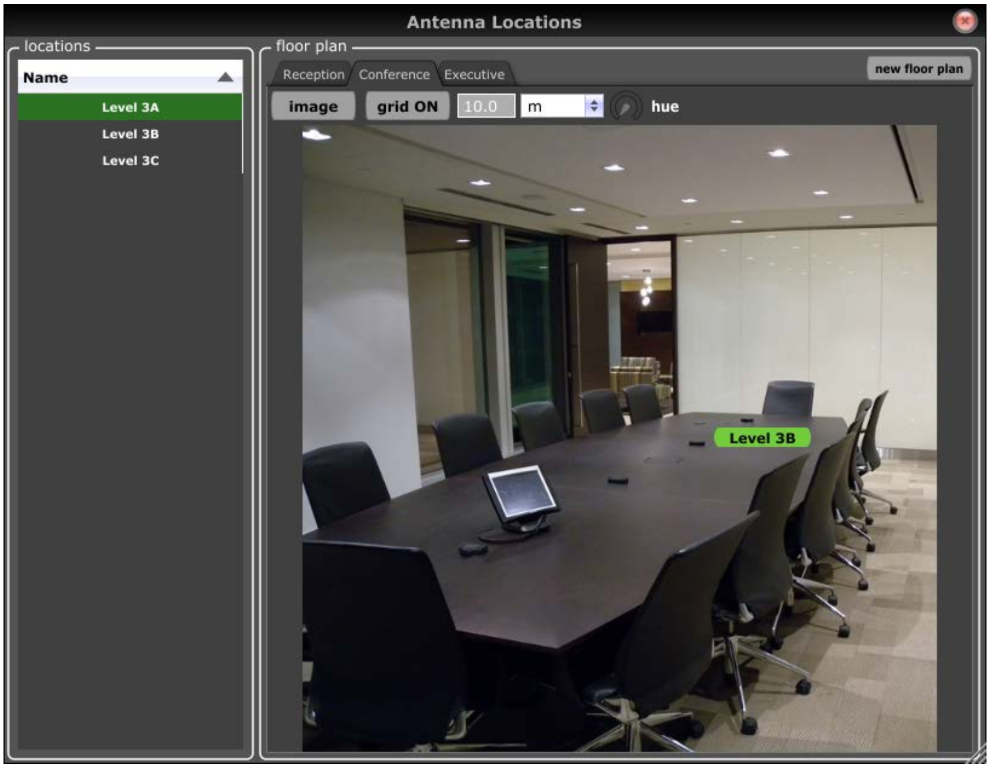


DSA Photo Realistic | v1.35xx

The above example of the Reception Area, displays one (1) LDSA ™ antenna location collection points on the 3rd Floor of the facility, identified by the technical operator and displayed as Level 3A.

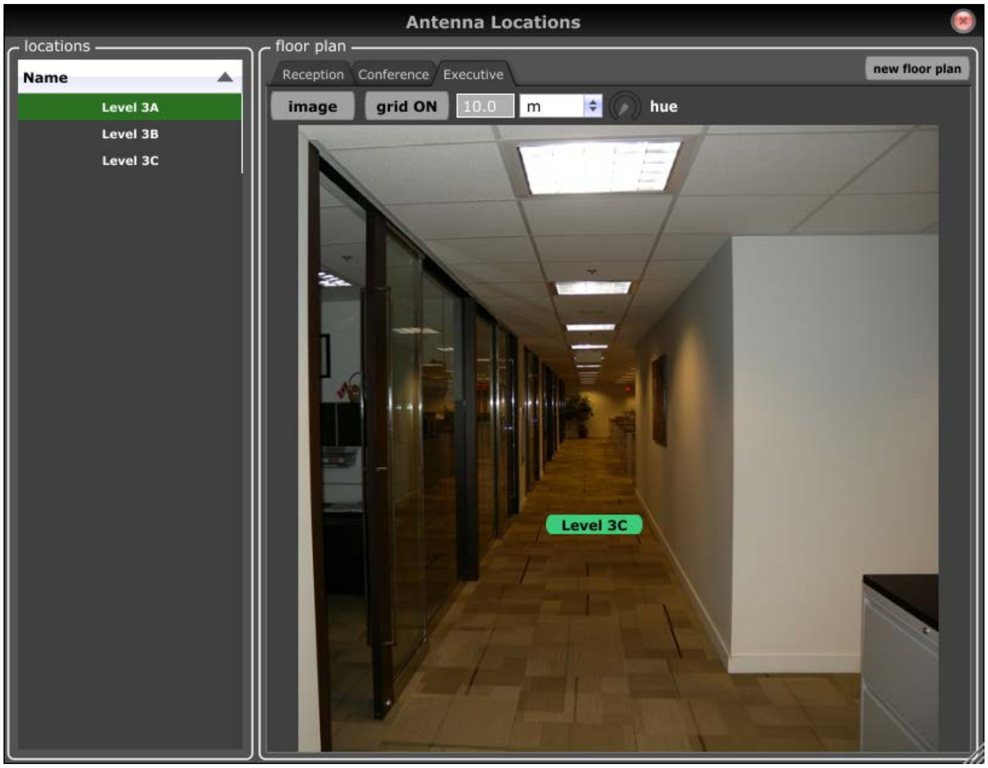
The actual photograph of the target area provides the technical operator or other reviewer (as well as the client) with excellent visual content that is designed to provide a better understanding of the structural and occupancy effects on signal propagation, multipath, reflections and to better visually identify any physical security vulnerabilities during post analysis review.

The ability to mix LDSA ™ graphically based content such as floor plans, geographical area maps, multi-level vertical riser plans and photo realistic, virtual reality content is fully supported in the Kestrel TSCM ® Professional Software.



DSA Photo Realistic | v1.35xx

The above example of the Operations Meeting Room clearly displays the LDSA ™ collection reference point as Level 3B and provides excellent insight as to the room layout, furnishings and other occupancy-based factors.



DSA Photo Realistic | v1.35xx

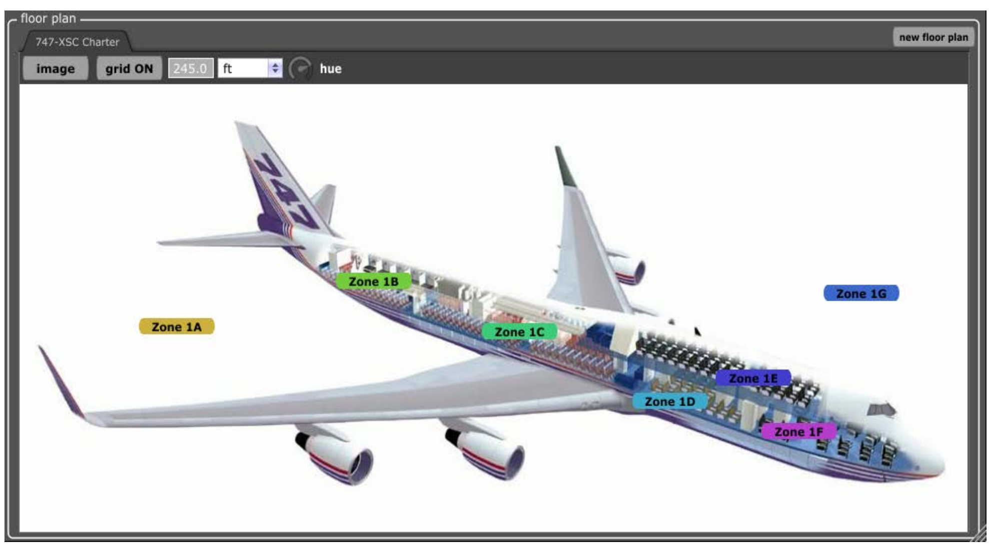
The above example of the client's Executive Area displays the LDSA ™ antenna collection point described as Level 3C and provides excellent insight into the layout and occupancy-based furnishing.

The following examples highlight the many practical applications associated with the Kestrel TSCM ® Professional Software, graphical mapping feature and functionality.

DSA Floor Plan | v1.35xx

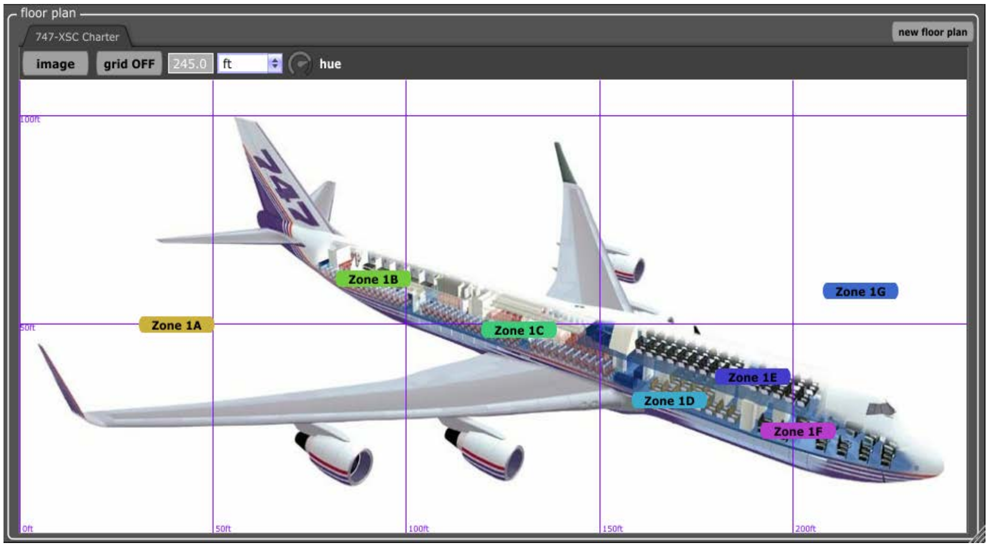
The above example illustrates the technical operator's significantly enhanced visual situational awareness for both real-time and post event analysis when LDSA ™ Antenna Locations are display on a target area floor plan.

The following image clearly demonstrates the power of the graphical mapping when unusual or more complex target areas must be analyzed by the technical operator.



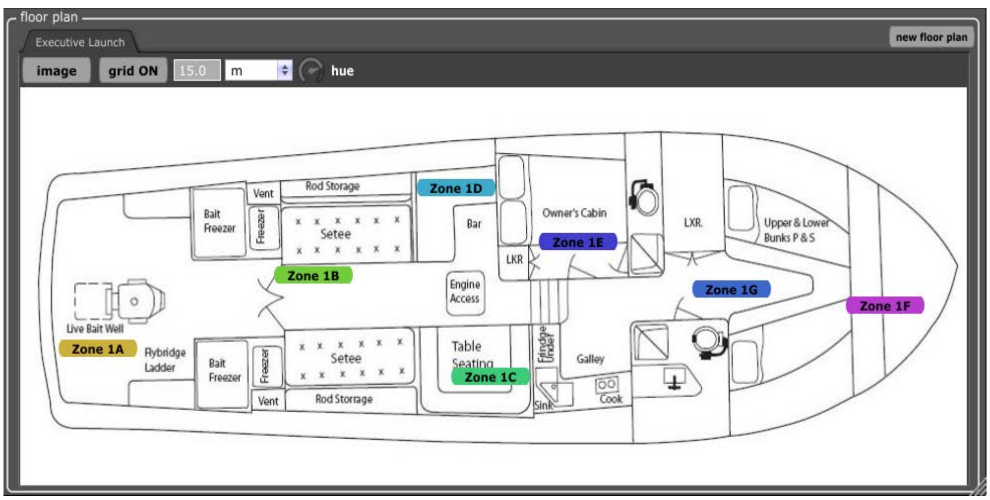
DSA Aircraft | v1.35xx

The following plot illustrates the calibration grid overlay actively displayed and providing both scale and zoning.



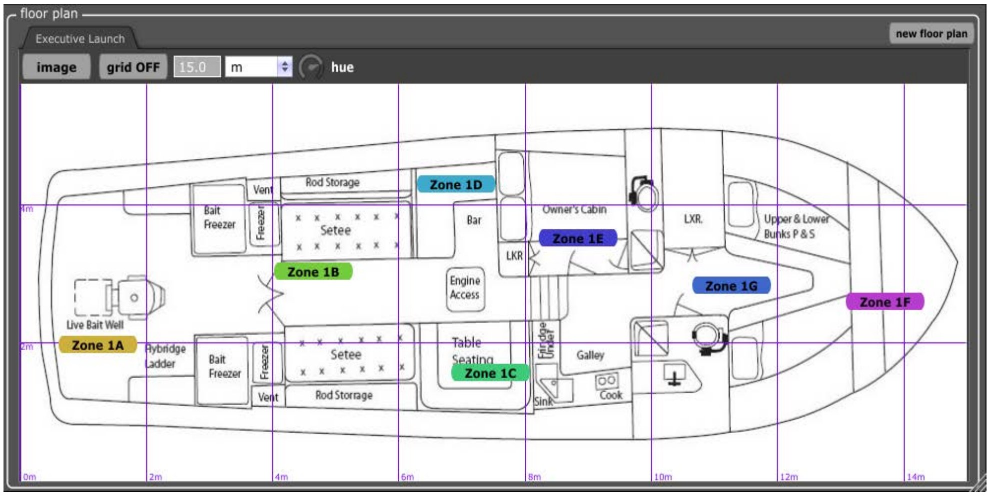
DSA Aircraft | v1.35xx

The ability of the technical operator to import graphical representations of aircraft, marine vessels, recreational vehicles, mobile command posts, campaign buses, provides incredible functionality for professional technical operators in the private sector, government, law enforcement and military applications.



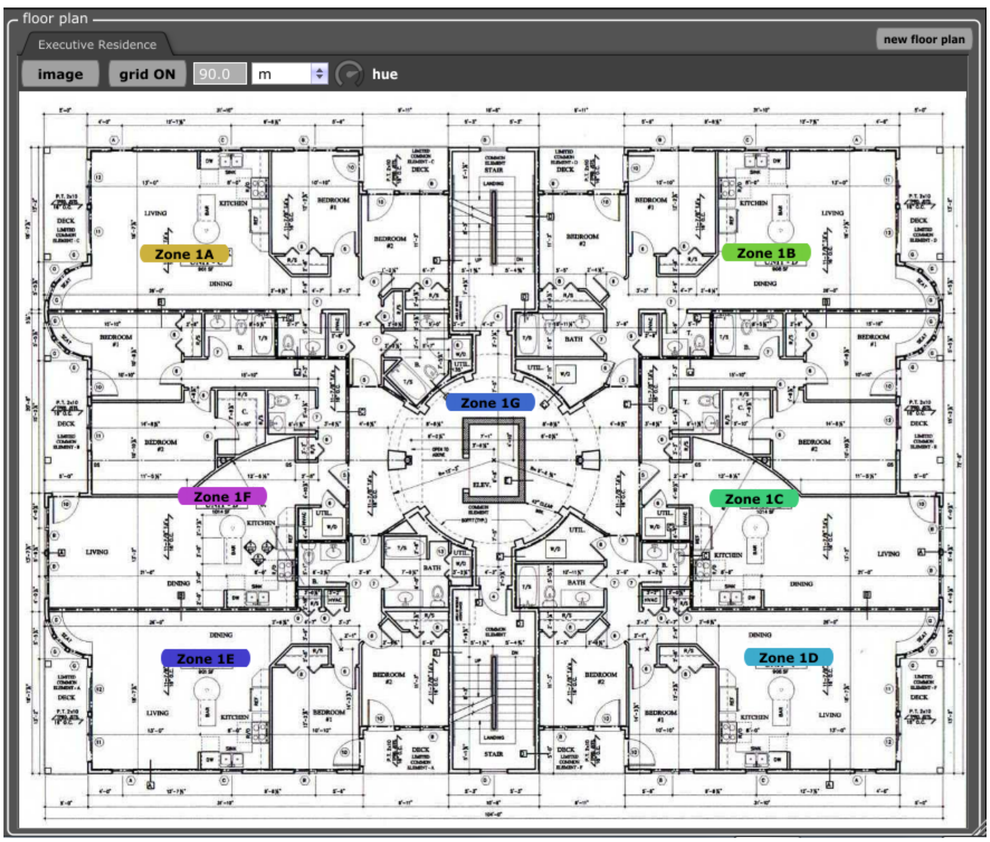
DSA Marine Vessel | v1.35xx

The following plot shows the calibration grid overlay active.



DSA Marine Vessel | v1.35xx

No matter how simple or complex the assignment, the graphical mapping feature will significantly enhance the Probability of Detection (POD) during active deployment.



DSA Executive Residence | v1.35xx

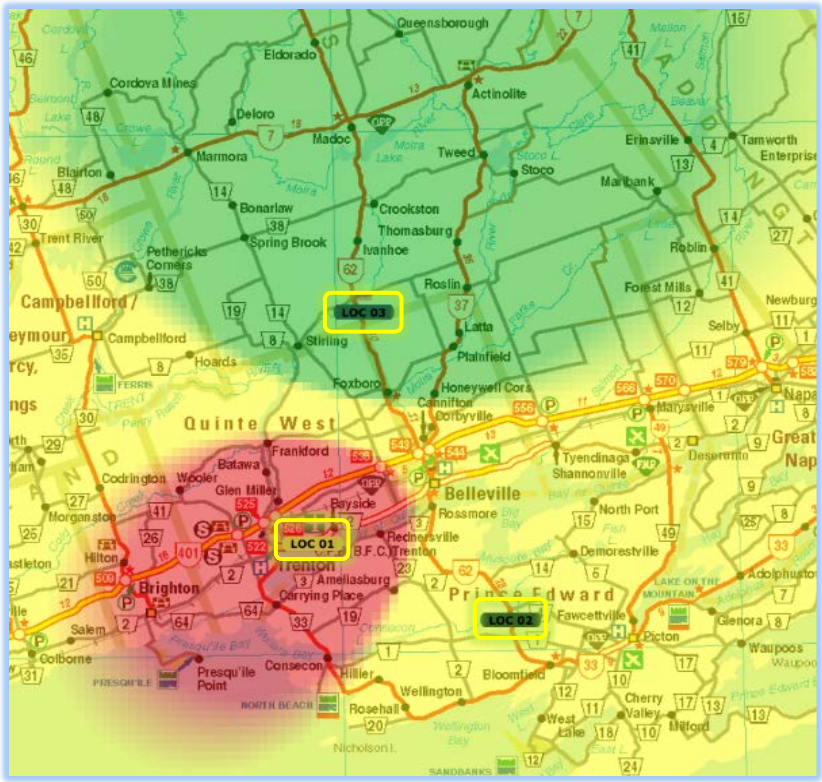
Geo-Location Heat Mapping

Our geo-location heat mapping capability permits multiple SDR radios to be placed at independent, operator defined, antenna collection locations to facilitate geo-location heat mapping, on any image as an overlay which can be distance calibrated using the build in calibration grid.

The geo-location heat mapping feature is directly associated with the | Receiver Differential Signal Analysis (RDSA) ™ | resource and is a standard feature within the software.

Heat Mapping | Facility Level | v1.40xx

Dynamically, defined Signals of Interest (SOI) can be geo-painted, "on-the-fly", based on three (3) powerful | Gaussian Weight |, | Inverse Square Weight | and | Differential Free Space Power Level (FSPL) | algorithms, to provide a measure of geo-localization, with reference to other radios in real-time, or against a historical comparative trace.



Heat Mapping | Geographical Area | v1.40xx

Dual Receiver Operation (DRO) ™ and Multiple Receiver Operation (MRO) ™ are fully supported for geo-location heat mapping.

Kestrel ® has a habit of doing the seemingly impossible, when it comes to intelligent design standards, and therefore, even in a single receiver LDSA ™ mode, a Real-Time Event (RTE) ™ can be live heat mapped against a static LDSA ™ location to highlight significant RSSI changes within a controlled, or specified target area.

Dynamic heat mapping is possible with just two (2) receivers, however, a minimum of three (3) or more receivers provides significantly more accuracy and localized results.

Whether operating within a typical facility level sweep environment, defined internal and external collection points, or across a large geographical region, heat mapping can provide a high-standard of situational awareness for the technical operator.

Heat Mapping | Complex | v1.40xx

The geo-location heat mapping display capability advantages the | Receiver Differential Signal Analysis (RDSA) ™ | capability, to independently resolve unique receiver locations, and provide the necessary spectra intelligence, which is utilized to calculate complex algorithmic relationships, and provide the required output rendering.

The simplicity of the operator controls, completely masks the complexity of the underlying code level calculations, making the geo-location heat mapping display feature extremely user friendly and easy to use in virtually all deployment scenarios.

The geo-location heat mapping display mode is first defined by the technical operator, utilizing | PEAK | AVERAGE |, or | REAL-TIME | trace values.

The geo-location heat mapping display overlay control group includes a | CENTER FREQUENCY | input box, supported by our "Drag-and-Drop" technology, and a frequency slider bar, to adjust the center-frequency across the primary input band, which dynamically populates across the various receiver, bands, and sub-bands, without operator intervention.

This capability makes it easy to assess possible fundamental harmonic relationships, simply by navigating to logical harmonic values.

The | BANDWIDTH | control provides flexibility based on the | CENTER FREQUENCY | selected by the technical operator, for narrow and wide band signal types.

There are two (2) functional algorithms, with additional algorithms currently under development, to provide new feature and functionality.

The | GAUSSIAN | mode is based on the premise that each receiver is at the center of a Gaussian from an RSSI perspective.

The radius of the Gaussian is some multiple of the closest distance between to antennas, and we compute and add all Gaussians, then range the result, and apply an operator defined heat map colouring scheme.

The | FOCUS | control tweaks the parameters of the algorithm for the Gaussian mode.

The | INVERSE SQUARE | model provides a powerful, well defined visual display, when the technical operator has deployed three (3) geo-localized receivers, however both of the algorithms support Dual Receiver Operation (DRO) ™.

The geo-location heat mapping display colour palette can be operator defined, on-the-fly by selecting, or editing, any existing colour palette, or a new custom colour palette can be created.

Tap Capture Plot (TCP) ™ | OPT TCP

The TCP ™ module is an advanced optional component and requires aa additional separate | Activation Security Key (ASK) ™ | to enable a powerful feature on the target system.

For new licenses where OPT TCP ™ is purchased, this process is seamless and the option will be enabled as part of the initial licensing process.

The TCP ™ option can be added at any time for an already licensed system by purchasing OPT TCP ™ and requesting a renewal | Activation Security Key (ASK) ™ | for the target system.

Assuming that the | Tap Capture Plot (TCP) ™ | module is licensed on the target system; the following information provides information and guidance as to the initial setup and runtime operation of the | RF Visualizer (RFV) ™ | Tap Capture Plot (TCP) ™ | geo-location heat mapping resource.

The TCP ™ process can be run on a Laptop and roving equipment cart to accomplish the process; however, it is recommended that the technical operator transition to a suitable tablet, such as the | Tactical Geo-Location Workstation (TGW) ™ | computer when the assignment requires extensive facility RF propagation mapping and / or signal localization as part of the TSCM or other mission specific process.

The Signal Hound BB60C Spectrum Analyzer and RF Recorder is the ideal (strongly recommended) hardware-based Software Defined Radio (SDR) for TCP ™ deployment across a 9 kHz to 6 GHz ROI.

The first step is to initialize the software and the connected radio by selecting the desktop ICON and confirm any settings relative to the hardware within the | ANALYZER CONTROL | group.

Next the technical operator selects the | NEW PROJECT | NO TEMPLATE | option to invoke the | SETUP WIZARD | dialog window.

TCP Setup | v1.40xx

The operator need only complete the required | PROJECT DESCRIPTION | inputs for | Project Name |, | Technical Operator | and ensure that the | TCP Operation | Checkbox is selected.

If required, the technical operator can use the | ACTIVITY SCHEDULE | dialog to set the correct working time zone, if required.

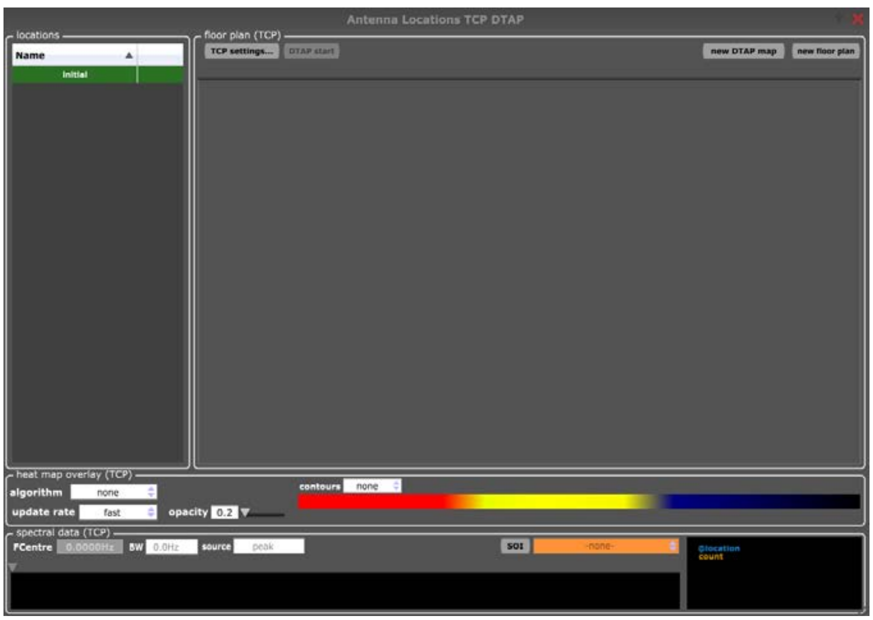
There is no requirement to setup a location in the | ANTENNA LOCATIONS | dialog or spectrum band within the | Spectral Range Control (SRC) ™ | at this time and the | SPECTRUM BANDS | dialog can simply be left empty.

The | SETUP WIZARD | above, illustrates the required information needed to invoke the RF Visualizer (RFV) ™ Tap Capture Plot (TCP) ™ process.

Once the required information is appended to the | SETUP WIZARD | the technical operator selects the | CREATE NEW PROJECT | button to complete the setup process.

Once the | CREATE NEW PROJECT | button is pressed the | SETUP WIZARD | will close and the operator can move to the next step.

Select the | LOCATION | TCP FLOOR PLAN | option from the menu to invoke the | ANTENNA LOCATIONS (TCP) | window.



Antenna Locations TCP | v1.40xx

The | ANTENNA LOCATIONS (TCP) | window provides access to the | LOCATIONS | list, | FLOOR PLAN (TCP) |, | HEAT MAP OVERLAY (TCP) | and the | SPECTRAL DATA (TCP) | control groups.

There are a number of essential programming steps to consider in getting the software ready for the Tap Capture Plot (TCP) ™ process.

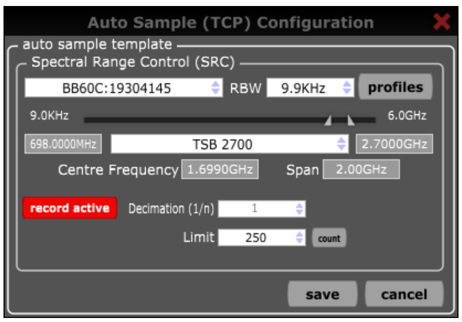
The image above illustrates the < default > view based on the setup parameters thus far.

The | LOCATIONS | section will display the < default > project location as defined by the software automatically called < initial >.

This default location is not used within the TCP TM process and is only created as a necessity to access the TCP Floor Plan from the | LOCATIONS | menu.

The technical operator can import any image such as a floor plan, 3D rendering, photograph, 3D graphical representation, geo-graphical area map, site plot, facility riser, or any other suitable working image.

Press the | TCP SETTINGS | button, to open the | Auto Sample (TCP) Configuration | window and complete the configuration settings to define the mission.



TCP Auto Sample Configuration | v1.40xx

Press the | SAVE | button.

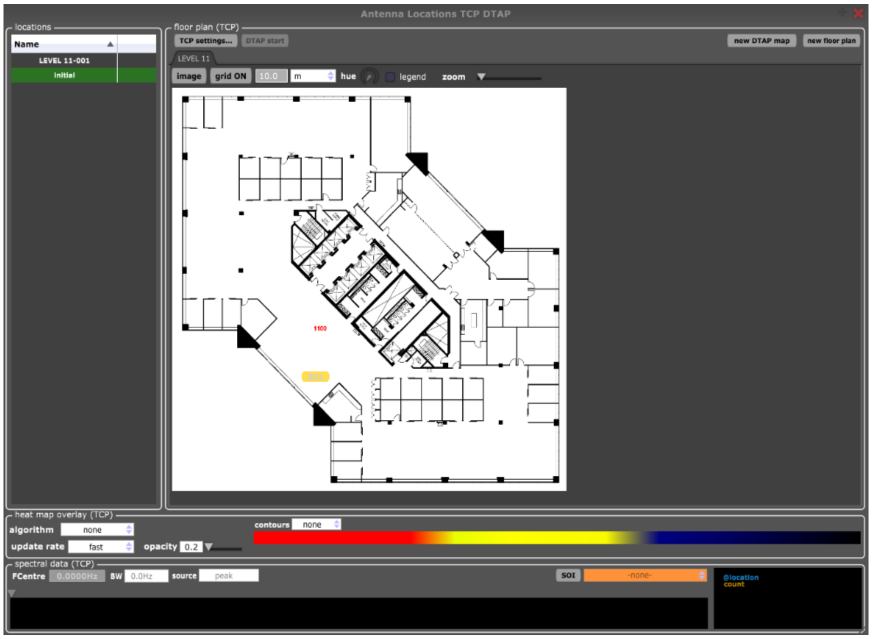
Next, a left mouse click at the first intended TCP TM collection point allows the first location to be set and displayed on the floor plan by the technical operator.

Next, press the | NEW FLOOR PLAN | button and append a name for the floor plan and press ok, next press the | IMAGE | button and navigate to the desired floor plan image.

The next step is to left mouse click on the desired starting position of the floor plan and select | PLACE AUTO LOCATION LEVEL 11-001 |.

The pop-up menu will indicate | PLACE AUTO LOCATION LEVEL-11-001 | and once displayed, the auto location ICON position can be adjusted, if required.

Use a right mouse click on the | 001 AUTO LOCATION | and select the | AUTO SAMPLE | menu option to begin capturing data.



TCP Heat Map Overlay | v1.40xx

The initial | AUTO SAMPLE CONFIGURATION | step is only required for the first | AUTO LOCATION | and will then be used for all additional capture locations within the project unless updated by the technical operator during deployment.

The image above displays the setup progress so far with the first TCP ™ | AUTO LOCATION | position set.

The | HEAT MAP OVERLAY (TCP) ™ | can be configured next.

The | ALGORITHM | can be selected by the technical operator.

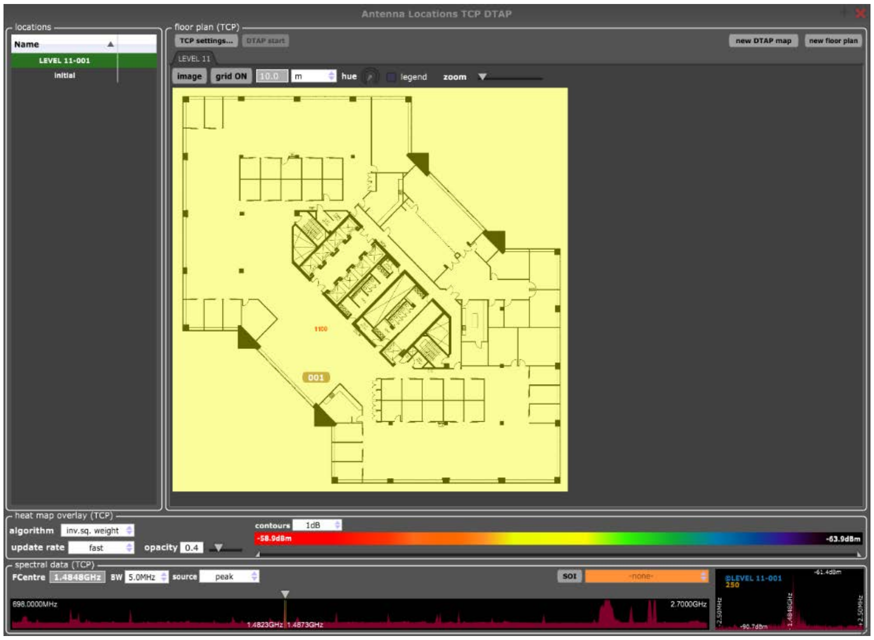
It is recommended that the | INVERSE SQUARE WEIGHTING | be selected for most TSCM signal localization requirements.

There are additional algorithms available including | GAUSSIAN WEIGHT | and our wide area | DIFFERENTIAL FREE SPACE POWER LOSS | for mission specific deployment requirements.

The | UPDATE | can be selected as slow, medium, or fast.

It is recommended that | FAST | or | MEDIUM | be selected for most TSCM signal localization requirements.

The heat map will not propagate until after the second location is run.



TCP Heat Map Overlay | v1.40xx

The overlay | OPACITY | control is set at 0.2 as a < default > and it is recommended that the technical operator set the opacity to 0.4 or 0.5 to provide a better visual rendering of the geo-location heat mapping overlay.

The | RF Visualizer (RFV) ™ | is invoked by selecting a | CONTOURS | value in dB allowing propagation modelling lines to be visualized on the geo-location heat map.

By default, | NONE | is selected and the technical operator can select values of 0.1 dB, 0.5 dB, 1 dB, 3 dB, 10 dB to provide a powerful RF propagation model.

The ability to display the contour lines on the heat map provides the technical operator with the ability to visualize active propagation.

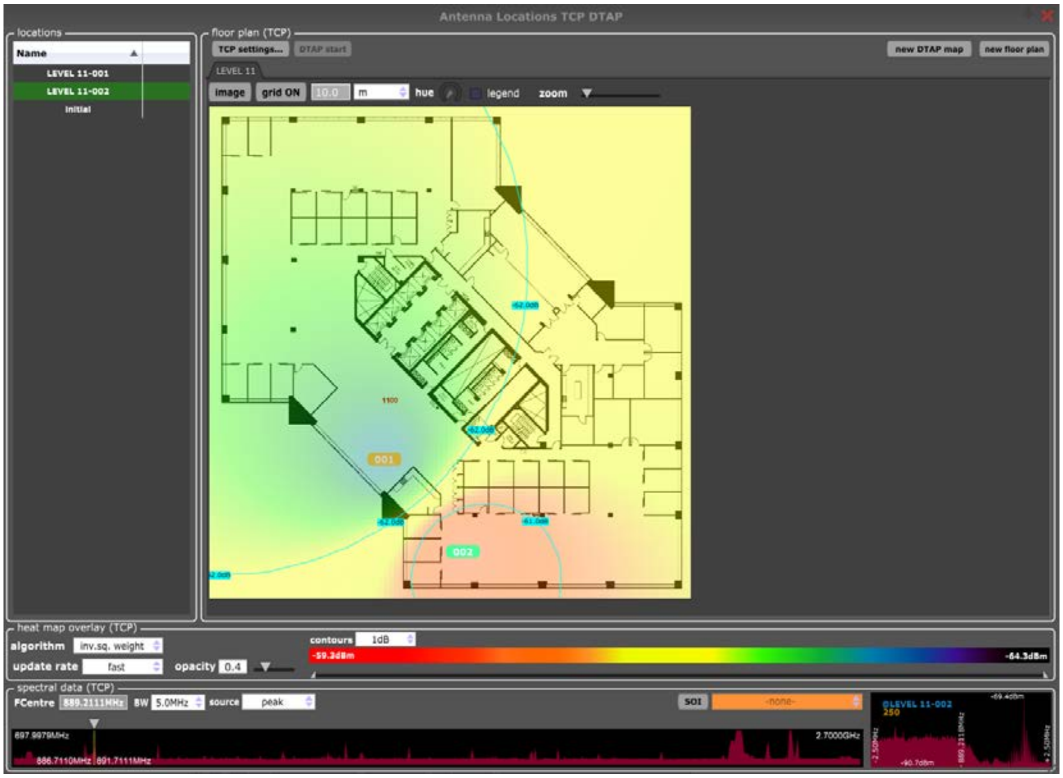
For the purpose of illustration, 1 dB has been selected.

The geo-location heat map colour range is a very important element to be considered and can be changed from the default colour map to any existing profile or any operator custom profile.

It is recommended that at least five (5) well blended colours be utilized to represent the RF propagation model given the nature of in-door propagation factors within a TSCM role.

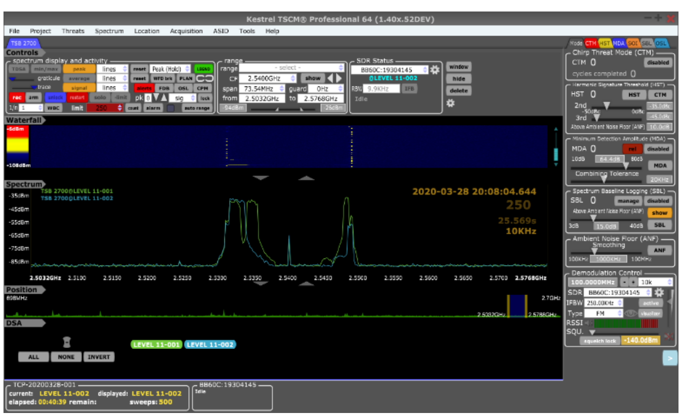
A custom | COLOUR MAP | profile has been selected for the above illustrated example.

The | SPECTRAL DATA (TCP) | cannot not be configured until after the first | AUTO LOCATION | has entered runtime as there is no spectrum data available to display until the first runtime capture.



TCP Heat Map Overlay | v1.40xx

The software will intuitively create a Location Differential Signal Analysis (LDSA) ™ runtime environment and automatically begin the capture process based on the operator defined parameters and will automatically stop the capture process based on either | TRACE | or optionally | TIME |, as programmed.



LDSA ROI | v1.40xx

The technical operator can use the LDSA ™ spectrum display to identify and select any energy event present, or simply directly enter a known Signal of Interest (SOI) in the | CENTER FREQUENCY | text input box located on the heat map overlay control group.

If any signal is flagged as a Signal of Interest (SOI), drag and drop is supported and there is an SOI capture tool and SOI selection menu on the | Spectral Data (TCP) | control group.

Once the 2^{nd} | AUTO LOCATION | capture completes, the | SPECTRAL DATA (TCP) | window will populate, and can be set to render the heat map RF propagation model visualization based on an operator defined | CENTER FREQUENCY | and | BANDWIDTH | for the | PEAK | AVERAGE | or | REAL-TIME | traces.

The technical operator has set the | CENTER FREQUENCY | to 889.2111 MHz and the | BANDWIDTH | window to 5 MHz and has selected the | SPECTRUM | to | PEAK |.

Next step is to repeat the | AUTO LOCATION | positioning and move to the new location to initiate the | PLACE AUTO LOCATION LEVEL-11-002 | capture at | 002 |.

Selecting the | AUTO SAMPLE | menu option invokes the LDSA ™ rendering to automatically enter runtime for the | 002 | location, populating the 2^{nd} LDSA ™ location.

Depending on the signal level differential between | 001 | and | 002 | the technical operator may see the heat mapping colour display populate.

Next step is to repeat the | AUTO LOCATION | positioning and move to the new location to initiate the | PLACE AUTO LOCATION LEVEL-11-003 | capture at | 003 |.

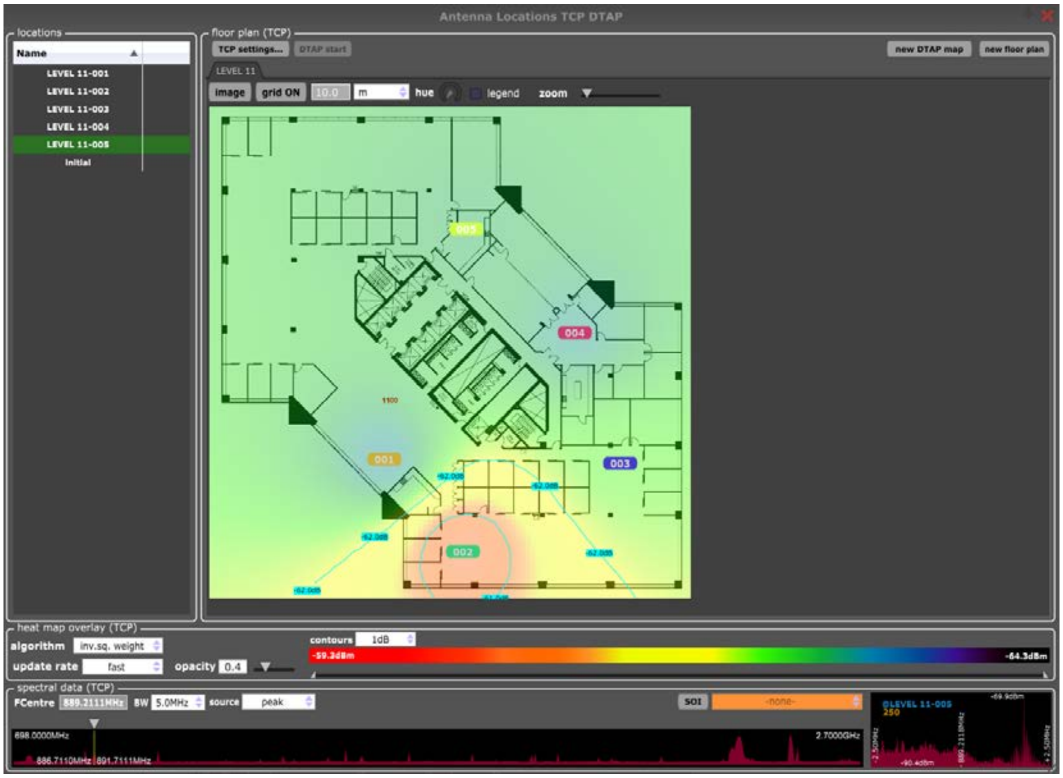
Selecting the | AUTO SAMPLE | menu option invokes the LDSA ™ rendering to automatically enter runtime for the | 003 | location, populating the 3^{rd} LDSA ™ location.

Next step is to repeat the | AUTO LOCATION | positioning and move to the new location to initiate the | PLACE AUTO LOCATION LEVEL-11-004 | capture at | 004 |.

Selecting the | AUTO SAMPLE | menu option invokes the LDSA™ rendering to automatically enter runtime for the | 004 | location, populating the 4^{th} LDSA ™ location.

Next step is to repeat the | AUTO LOCATION | positioning and move to the new location to initiate the | PLACE AUTO LOCATION LEVEL-11-005 | capture at | 005 |.

Selecting the | AUTO SAMPLE | menu option invokes the LDSA ™ rendering to automatically enter runtime for the | 005 | location, populating the 5^{th} LDSA ™ location.



TCP Heat Map Overlay | v1.40xx

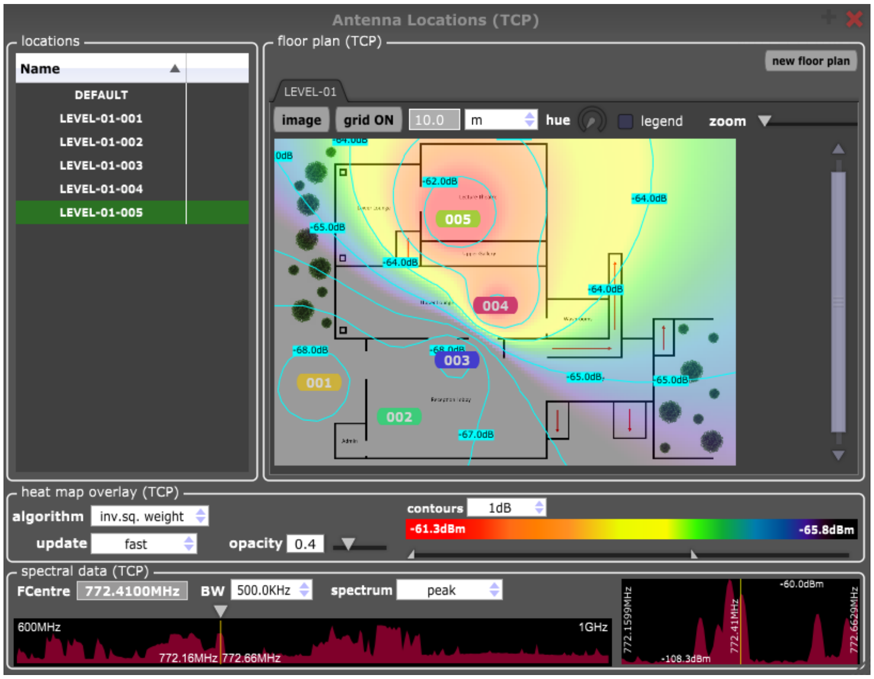
Any number of locations can be captured as part of the process, more capture points are always better and too few in order to populate a uniform result across the geo-location heat mapping display.

Once the technical operator has initiated and completed the Tap Capture Plot (TCP) ™ walk-through process, the RF propagation model heat map will render and can be adjusted manually using our | REFERENCE LEVEL OFF-SET | feature to adjust the propagation model for the intended purpose, and localize the source of a Signal of Interest (SOI) or identify propagation voids in signal coverage more precisely when the signal differential is relatively small across the target area.

The image below renders the propagation modelling across 1 dB contour reference lines representing very little attenuation across the target area

The narrow reference level range is -61.3 dBm to -65.8 dBm, a difference of only 4.5 dBm across the sampled target area.

Adjusting the lower (dBm) value (strongest signal level) reference value accentuates the higher RSSI values across the heat map.



Reference Level Off-Set | v1.40xx

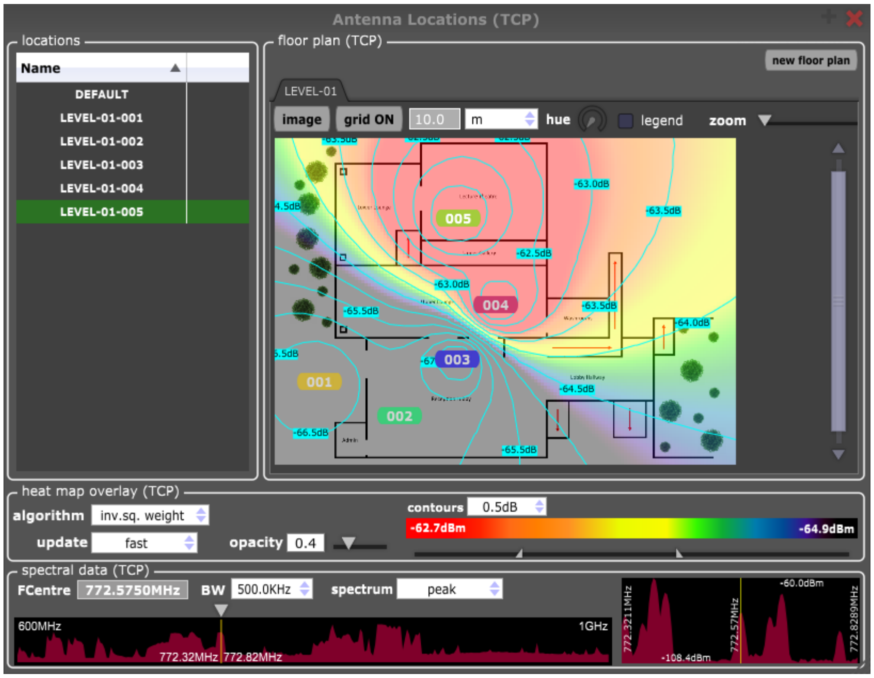
Adjusting the higher dBm value (lower signal level) reference value accentuates the lower RSSI values across the heat map.

This information is also a useful indicator in determining areas of the facility where the Energy of Interest (EOI) might be too low to escape the facility and would perhaps not be recovered externally by the attacker.

This information can be used to potentially identify the most likely listening post locations external to the facility based on the heat map visualization behaviour of the hostile Technical Surveillance Device (TSD) propagation factors.

It is this level of advanced capability that is reflected in our moving target threat model methodology.

Visualizing the RF propagation modelling brings a powerful new weapon to combat espionage on every level involving an RF based threat.



Reference Level Off-Set | v1.40xx

The technical operator can select alternate algorithms, overlay opacity, contour settings, colour mapping, and any reference level off-set to build the best possible propagation modelling from a visual display perspective.

The technical operator can change the | **CENTER FREQUENCY** | to automatically render a new propagation model based on the adjusted center frequency or channelized Signal of Interest (SOI).

To illustrate this concept, the technical operator has adjusted the | **CENTER FREQUENCY** | to 772.5750 MHz to render a new RF propagation model using the | **REFERENCE LEVEL OFF-SET** | feature.

The TCP ™ feature supports unlimited | AUTO LOCATION | capture locations across the defined target area.

Drag and drop technology is supported for the | **CENTER FREQUENCY** | and any custom value can be entered for the displayed | **BANDWIDTH** |.

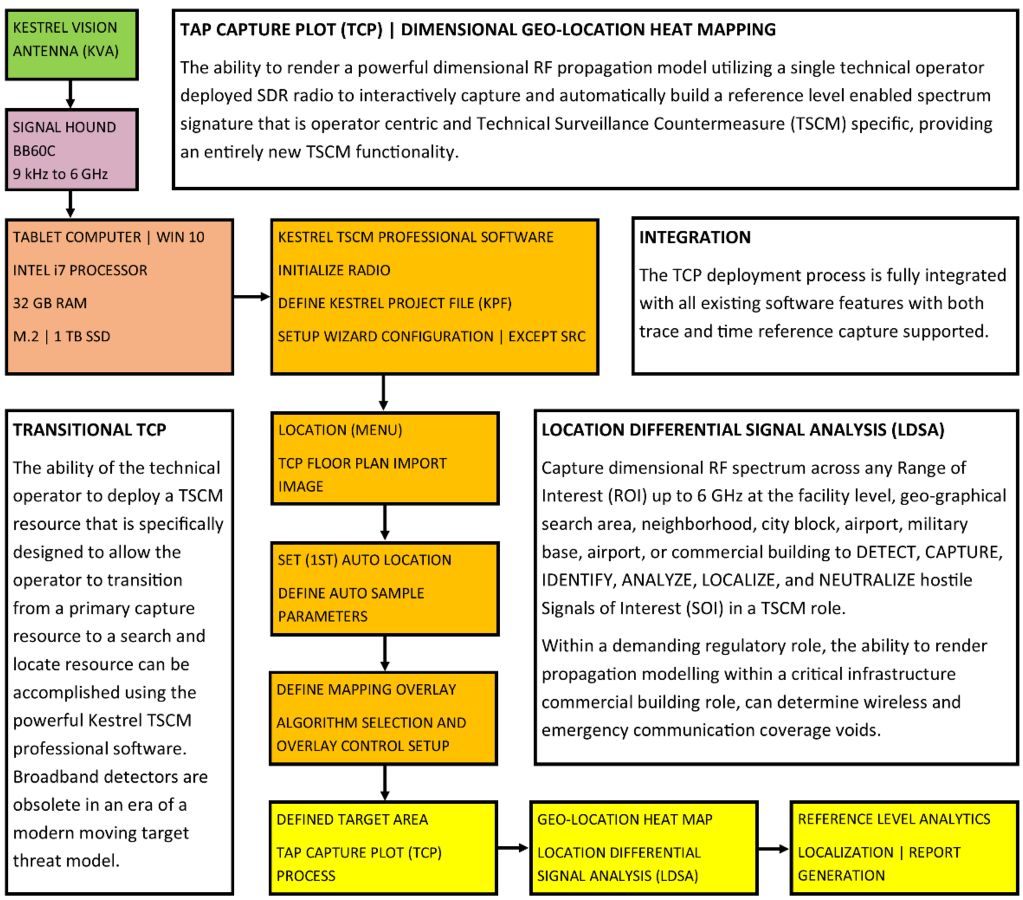
Tap Capture Plot (TCP) ™ | Work Flow Chart

The capability of the | RF Visualizer (RFV) ™ | is a significant technological achievement and integrates across several mission specific deployment requirements.

The ability to render a powerful virtual reality driven RF propagation model for any technical operator defined Signal of Interest (SOI) using the Kestrel TSCM ® Professional Software | Location Differential Signal Analysis (LDSA) ™ | functionality is supported.

The technical operator can build a powerful interactive geo-location heat mapping overlay to visualize the propagation modelling across any desired frequency within the captured LDSA ™ ROI, utilizing the Kestrel TSCM ® Professional Software concept of Single Receiver Operation (SRO) ™.

Now imagine an innovative RF visualization resource that has the awesome ability to capture and plot both horizontal floor plate and vertical riser plots, while instantly producing a corresponding 3D vector heat map output, based on positional RF capture, and therefore automatically takes into account many structural and occupancy-based propagation factors.



This latest innovative milestone culminates considerable advanced scientific research and development along with exceptional expert software engineering to produce an entirely new RF visualization technology with enhanced virtual propagation modeling that literally allows the technical operator to visualize RF propagation dimensionally with (horizontal and vertical) rendering, across multiple imported virtual reality images.

For example, picture a modern new tablet-PC based RF resource that can capture, say < x = n > 250 traces in just 3.65 seconds across a targeted spectrum band or any Range of Interest (ROI) such as, 250 MHz, or the ability to capture the full hardware ROI during the process!

Now picture yourself using the latest industry disruptive Tap Capture Plot (TCP) ™ feature equipped with a virtual reality RF Visualizer (RFV)™ display to not only record a visualization of an operator defined spectrum representing any channelized Signal of Interest (SOI) across a target area or Range of Interest (ROI), rendering powerful propagation modeling across an entire residence, business facility, commercial building, warehouse, campus, airport, military base, theater of operation, residential or commercial neighbourhood, or even a city.

Now picture the same propagation modelling as a virtual reality enhanced RF Visualizer (RFV) ™ resource, capable of mapping any SOI or channelized RF energy across a complex spectrum modelling requirement from an airborne asset, satellite, or spacecraft.

This capability is uniquely available within the kestrel TSCM ® professional software bringing life an entirely new generation of dynamic RF analytics.

Picture capturing those 250 operator defined traces across any number of Tap Capture Plot (TCP) ™ < auto location > data collection coordinates in just minutes; or roughly the time it takes you to complete a casual walk-though of the target area of interest, and capture 250 traces (or any number of traces consistent with the intended mission) at each of (let's say) 100 collection locations both within and external, to the operator defined critical infrastructure, at the facility level.

The aforementioned 3.65 second capture for each operator invoked < auto location > collection point is now a reality within the Kestrel TSCM ® Professional Software, as described above, and that is just the half of it, as the technical operator can define any number of traces for capture of continuous signals at each TCP ™ positional < auto location > or the operator can invoke a time-based collection for periodic signals.

The TCP ™ feature can be utilized on continuous signal events for shorter capture times, and for bursting, intermittent or otherwise periodic signal event capture, the time can be adjusted higher to ensure that the peak (periodic) spectrum data is properly captured at each operator defined collection capture points.

This advanced capability provides additional assurance that periodic SOI events are captured across all defined positional < auto locations > providing meaningful reference data for the geo-location heat mapping display.

In the event that the Signal of Interest (SOI) did not appear at one (1) or more < auto location > capture points, this will be reflected within the LDSA ™ comparative display during runtime or post collection and review.

Any < auto location > points that do not contain any relevant signal level data can be removed from the geo-location heat mapping overlay image and the propagation modelling algorithm will recalculate the heat map.

Tap Capture Plot (TCP) ™ positional < auto locations > that do not contain SOI peak spectrum data can be removed from the virtual reality propagation model heat map to ensure that that the RF Visualizer (RFV) ™ modelling is automatically recalculated to represent only those < auto locations > containing relevant SOI spectrum metrics.

The following runtime capture charts represent and illustrate the deployment modes for | TRACE | priority and | TIME | priority.

The chart example below illustrates a 250 MHz ROI LDSA ™ capture, consisting of 250 traces, requiring approximately 3.65 Seconds at each < auto location > capture point.

<table>
<tr><th colspan="4">ROI vs Traces (Priority) | 20 kHz RBW</th></tr>
<tr><th>LDSA ™ Capture | ROI</th><th>Search Speed | BB60C</th><th>Capture Time Realized</th><th>Traces</th></tr>
<tr><td>50 MHz</td><td>10 mSec | 104.7 FPS</td><td>2.56 Sec</td><td>250</td></tr>
<tr><td>150 MHz</td><td>11 mSec | 97.6 FPS</td><td>2.80 Sec</td><td>250</td></tr>
<tr><td>250 MHz</td><td>14 mSec | 71.6 FPS</td><td>3.65 Sec</td><td>250</td></tr>
<tr><td>500 MHz</td><td>25 mSec | 40.1 FPS</td><td>6.40 Sec</td><td>250</td></tr>
<tr><td>1000 MHz</td><td>48 mSec | 20.9 FPS</td><td>12.28 Sec</td><td>250</td></tr>
<tr><td>1500 MHz</td><td>60 mSec | 16.7 FPS</td><td>15.17 Sec</td><td>250</td></tr>
</table>

ROI vs Traces | v1.40xx

The chart example below illustrates a 250 MHz ROI LDSA ™ capture, consisting of 500 traces, requiring approximately 7.18 Seconds at each < auto location > capture point.

ROI vs Traces (Priority) | 20 kHz RBW			
LDSA ™ Capture | ROI	**Search Speed | BB60C**	**Capture Time Realized**	**Traces**
50 MHz	9 mSec | 107 FPS	4.90 Sec	500
150 MHz	11 mSec | 94.7 FPS	5.48 Sec	500
250 MHz	**14 mSec | 71.6 FPS**	**7.18 Sec**	**500**
500 MHz	25 mSec | 40.1 FPS	12.7 Sec	500
1000 MHz	48 mSec | 29.9 FPS	24.3 Sec	500
1500 MHz	60 mSec | 16.7 FPS	30.1 Sec	500

ROI vs Traces | v1.40xx

The chart example below illustrates a 250 MHz ROI LDSA ™ capture, consisting of a defined capture time of 30 Seconds, with approximately 2138 traces realized at each < auto location > capture point.

ROI vs Defined Capture Time (Priority) | 20 kHz RBW			
LDSA ™ Capture | ROI	**Search Speed | BB60C**	**Capture Time**	**Traces Realized**
250 MHz	**14 mSec | 71.6 FPS**	**30 Sec**	**2138**
500 MHz	25 mSec | 40 FPS	30 Sec	1201
1500 MHz	60 mSec | 16.7 FPS	30 Sec	498
3000 MHz	118 mSec | 8.5 FPS	30 Sec	255
4500 MHz	175 mSec | 5.7 FPS	30 Sec	172
6000 MHz	221 mSec | 4.5 FPS	30 Sec	136

ROI vs Defined Capture Time | v1.40xx

The chart example below illustrates a 250 MHz ROI LDSA ™ capture, consisting of a defined capture time of 60 Seconds, with approximately 4285 traces realized at each < auto location > capture point.

ROI vs Defined Capture Time (Priority) | 20 kHz RBW			
LDSA ™ Capture | ROI	**Search Speed | BB60C**	**Capture Time**	**Traces Realized**
250 MHz	**14 mSec | 71.6 FPS**	**60 Sec**	**4285 Traces**
500 MHz	25 mSec | 40.1 FPS	60 Sec	2398 Traces
1500 MHz	60 mSec | 16.7 FPS	60 Sec	1000 Traces
3000 MHz	117 mSec | 8.5 FPS	60 Sec	512 Traces
4500 MHz	174 mSec | 5.8 FPS	60 Sec	345 Traces
6000 MHz	220 mSec | 4.5 FPS	60 Sec	273 Traces

ROI vs Defined Capture Time | v1.40xx

The actual capture time at each < auto location > can be a few seconds, minutes, hours or even days, depending on mission specific requirements and the type of signals being captured or anticipated in the hunt for problematic interferers.

The decision of the technical operator to base the TCP ™ capture on TRACE COUNT or CAPTURE TIME will depend on the characterization of the SOI as either a continuous or periodic signal event.

Our TCP ™ positional < auto location > capability is an extremely powerful and highly integrated feature within the Kestrel TSCM ® Professional Software application bringing a new and very powerful virtual reality RF Visualizer (RFV) ™ technology, designed to tackle complex RF energy mapping, interference analysis, and regulatory compliance requirements relating to public safety radio inter-operability.

The introduction of the TCP ™ feature provides additional opportunities to build new professional service revenue streams through the introduction of new capabilities within the telecom, regulatory and wireless service provider sectors in an era of ever evolving spectrum challenges.

This capability is an innovative feature that is fully integrated with our existing Location Differential Signal Analysis (LDSA) ™ deployment model and supports all runtime and post analytical functionality across the application in support of the RF Visualizer (RFV) ™ propagation model contour reference visualization overlay within the Tap Capture Plot (TCP) ™ feature.

Our RF Visualizer (RFV) ™ geo-location heat mapping capability permits the real-time display of the resulting propagation modeling, to be manipulated through a simplified operator-controlled reference level range control off-set technology.

This capability permits the technical operator to view the resulting geo-location heat mapping process across a wide reference level range, providing exceptional visual clarity as to propagation voids in radio coverage and / or promotes Signal of Interest (SOI) localization within a TSCM role.

When an < auto location > is enabled by the technical operator, a spectrum band or any custom operator defined capture ROI enters a familiar runtime capture and recording mode in the background for the defined Range of Interest (ROI), providing the technical operator with considerably more than just a specific CF RSSI plot found in traditional heat mapping resources.

In the background the LDSA ™ feature automatically invokes the necessary file structure and enters runtime and captures the operator defined Range of Interest (ROI) while the RF Visualizer (RFV) ™ geo-location heat mapping resource focuses on the operator defined, targeted SOI or specified channel of interest.

Signals of Interest (SOI) can be captured directly from the RF Spectrum Display (RSD) ™ as a random or channelized SOI event to produce a powerful ad hoc heat map visualization.

Our drag-and-drop technology can be utilized to populate the RF Visualizer (RFV) ™ Center-Frequency (CF) control, supporting the ability of selecting any captured center frequency and bandwidth to invoke a recalculated peak reference geo-location heat map.

The technical operator can define any Signal of Interest (SOI) within the geo-location heat mapping setup for Tap Capture Plot (TCP) ™ rendering and easily change the CF or channel anywhere within the defined capture ROI across any number and type of imported virtual reality images, such as floor plans, site plans, photographs, geographical area maps, air and marine charts, riser plots, 3D renderings, satellite images, or any other custom graphical representation.

The Kestrel TSCM ® Professional Software captures powerful LDSA ™, location-based data across the operator defined spectrum band or ROI and records all data to the assigned storage drive for post capture playback, or for post capture analytical review of the entire TCP ™ geo-location heat mapping process.

Once the capture session is configured, the technical operator can simply use the TCP ™ capability to map the RSSI and build an algorithmic propagation model based on any number of < auto location > points across the imported floor plan using our RF Visualizer (RFV) ™ geo-location heat mapping overlay.

The technical operator can select the | Gaussian Weight |, | Inverse Square (recommended) |, or | Free Space Power Loss (FSPL) | algorithms and adjust various control settings.

The TCP ™ feature is just one of the innovative new capabilities added to the Kestrel TSCM ® Professional Software providing the technical operator with the ability to map and navigate real-time RSSI values across a single or multiple horizontal and / or vertical riser plot.

The importance of emergency services regulatory communication interoperability validation testing within large commercial and residential buildings can be quickly accomplished with our operator assisted, TCP ™ technology, to identify potential communication voids with live real-world RF propagation patterns, is fully realized for compliance purposes.

Other possible use cases include WIFI signal strength profiling, energy mapping and coverage plotting; cellular repeater coverage, hostile signal geo-location heat mapping, wireless microphone ranging and propagation pattern verification and analysis with support for many other types of transmitter energy modeling, to determine the RF propagation characteristics and other factors.

Whether the requirement is related to Technical Surveillance Countermeasures (TSCM) or a complex geo-location heat mapping application, our integrated TCP ™ feature supports many professional mission specific deployment options, all across a single radio running on a hand-held walk-and-plot tablet computer, or a mobile platform such as our Mobile Monitoring and Analysis Platform (MMAP) ™ tactical intercept vehicle.

Reporting Capability

The ability to render a professional report output, utilizing our recently released Advanced Report Generator (ARG) ™ is fully realized as all runtime session data associated with the Location Differential Signal Analysis (LDSA) ™ feature is recorded in real-time to storage and easily appended to the ARG ™ rendering powerful mission-based compliance reports.

Building professional in session and post collection reports is an absolute must have feature and has been for years! If you cannot correlate captured technical reference data automatically, and render documentation that is court admissible, the second-generation Advanced Report Generator (ARG) ™ is essential.

It takes more than a screen shot to impress the courts!

Tap Capture Plot (TCP) ™ Runtime Project

The TCP ™ process is ideally deployed on a hand-held tablet computer, but can also be deployed on facility level security robotics and even airborne UAV technology to build powerful heat-mapping capability within a designated facility or across a wide geographical area, for fully automated RF Visualizer (RFV) ™ geo-location heat mapping.

The Signal Hound (BB60C) is an ideal (recommended) SDR radio for use with the TCP ™ feature given the exceptional specifications, size and USB power requirements.

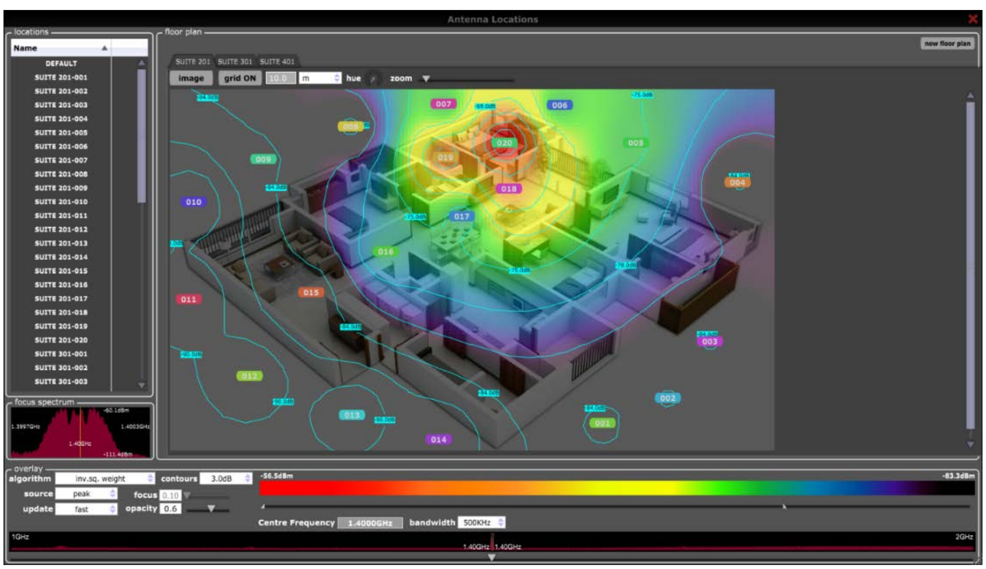
The following process remains under development and is subject to change in both the setup process and operational deployment as the feature is formalized.

The first step is to connect a radio suitable for portable deployment on a mobile device such as a tablet computer.

The next step is to select and initialize the Kestrel ® application.

The technical operator must enter the new project information within the setup wizard as with any new project, with the exception of the spectrum details.

The Spectrum Range Control (SRC) ™ can be left unpopulated, as this information can be added within the TCP ™ positional < auto location > menu.



Reference Level Off-Set (Internal Threat) | v1.40xx

The technical operator must assign an antenna location to populate the application with a default project location, in order to render the required Kestrel Project File (KPF) ™ structure.

It is recommended that this location be named DEFAULT to differentiate it from the < auto locations >.

Operationally, the | DEFAULT | location will not be utilized directly for the TCP ™ positional < auto location > capture point and is the initial | DEFAULT | naming convention will better differentiate this project level location from the < auto locations > rendered during the TCP ™ capture process, which will have a separate File naming Convention (FNC) based on the floorplan name.

By default, the 1st floor plan name will display as the Kestrel Project File (KPF) ™ name and can be changed when the first-floor plan image is imported.

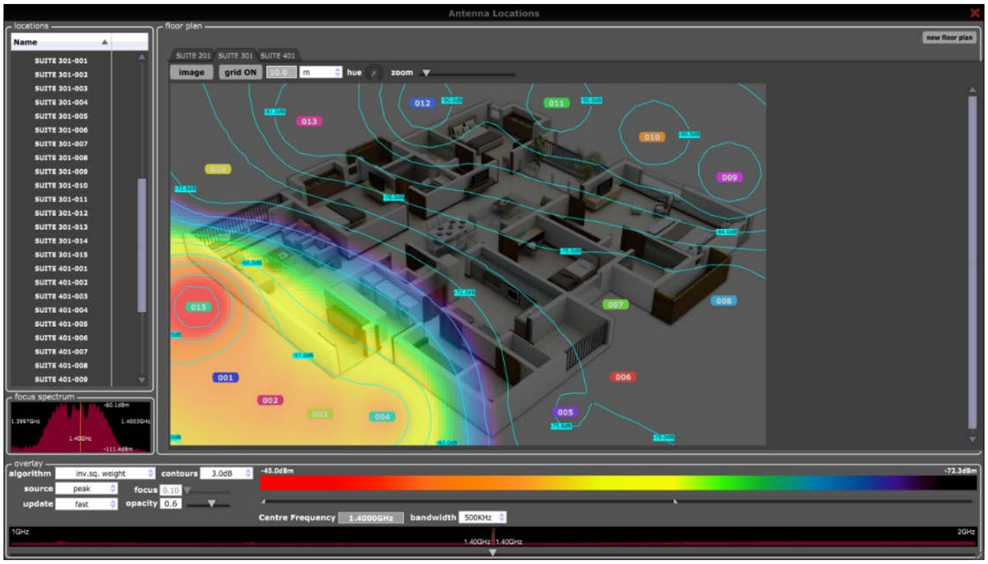
Once the setup wizard is populated, and the project started, the main user-interface will be visible, notably without a runtime project, as is the normal process when a runtime session is initiated, due to the absence of a defined spectrum profile, as the Spectrum Range Control (SRC) ™ was not populated within the setup wizard.

All other setup and runtime controls are available within the | LOCATION | menu structure and the | FLOOR PLAN | RF Visualizer (RFV) ™ geo-location heat mapping window for the purpose of deploying the feature.

The technical operator can select the | LOCATION | menu structure and then select the | FLOOR PLAN | option, to open the | FLOOR PLAN ANTENNA LOCATIONS | control window that contains the RF Visualizer (RFV) ™ geo-location heat mapping control group.

The next immediate action step is to import one (1) or more floor plan or vertical riser images and define a meaningful reference name for each floor plan or riser plot, such as LEVEL 01, LEVEL 02, LEVEL 03, etc.

This is an essential step as the Tap Capture Plot (TCP) ™ renders a series of ICONS appended with the abbreviated corresponding FLOOR PLAN name defined by the technical operator within the | ANTENNA LOCATION | list, along with -001, -002, -003, etc., as the operator captures multiple location specific data and it is essential to character limit the floor plan name.



Reference Level Off-Set (External Threat) | v1.40xx

Please note that the auto location ICONS will only display 001, 002, 003, etc., to provide smaller, space saving < auto locations > for better overall clarity of the heat map.

When the technical operator is physically positioned at the first desired Tap Capture Plot (TCP) ™ physical location consistent with the floor plan overlay location, a left mouse click at the desired first location on the floor plan will render a menu and the technical operator can select the “place auto location < NAME-001 >, which will place an ICON to flag the auto location as < 001 > for the first location, and for example, where the floor plan is named < NT09 > the | ANTENNA LOCATION LIST | will display < NT09-001 > appended as the first < auto location > reference.

Since this is the first location position and no spectrum range has yet been defined, it will be necessary to mouse click on the first < auto location > ICON and select “set auto sample parameters”, which invokes the “Auto Sample Configuration” dialog window.

This dialog window is the same format as the Spectrum Range Control (SRC) ™ dialog window normally defined within the setup wizard, purpose built within the TCP ™ model to allow the technical operator to define the | RECEIVER | RBW | START | and | STOP FREQUENCY RANGE |, or used to select any existing | SPECTRUM BAND | profile along with the WRITE COMPRESSION (if desired) and the TCP ™ | TRACE LIMIT | or | TIME LIMIT | options for the runtime routine.

It is important to note that write compression is not generally required or recommended for the TAP CAPTURE PLOT (TCP) ™ as the intent is to quickly SNAP-SHOT the signal propagation characteristics at each desired location across the facility or wider geographical area with sufficient spectra for qualified analytical purposes.

Reference Level Off-Set (Energy Distribution) | v1.40xx

For sustained signal events, 250 or 500 traces is all that is needed and will provide excellent metrics, with more traces or time required for | RANDOM |, | PERIODIC | or the | INTERMITTENT | appearance of signal events.

When write compression is utilized, only limited trace level information will be appended to the storage drive and will not be available for post collection analysis.

In the event of intermittent, periodic and burst oriented signals, it may be necessary to capture more trace level data at each auto location for a longer period of time in order to ensure the capture of meaningful metrics, in which case write compression would be advisable and perhaps recommended.

The Signal Hound BB60C Spectrum Analyzer and RF Recorder is an ideal Software Defined Radio (SDR) receiver for portable and mobile use and can be set to capture 250 or 500 real-time traces in a matter of seconds, when capturing a narrow ROI, signal and / or channel level spectra, which is more than enough to provide added value analytics to the TCP ™ process.

For example, it is entirely possible to use the Signal Hound BB60C Spectrum Analyzer and RF Recorder running at 24 GHz per second (4 FPS x 6 GHz / Sec), to capture LDSA ™ modeling of the entire spectrum hardware range available (maximum effort), or the technical operator can limit the LDSA ™ modeling to the band or channel level for smaller file sizes, etc., and still focus on a specific CF and BW at the signal or channel level within the RF Visualizer (RFV) ™ geo-location heat mapping tool.

Most RF walk and plot tools on the market simply do not offer this advanced TSCM specific capability beyond RSSI geo-location heat mapping.

The ability to set the radio at the band level means that the operator can conduct multiple channel analytics within the same runtime session across multiple floor plans by importing multiple copies of the same floor plan and naming them for example | 806MHz | and | 807MHz | and simply doing the auto plot process once for each channel by changing the CF at the start of each walk through of the same target area.

Five (5) channels, five (5) floor plans, one (1) session, with channel level modeling rendered and reviewed for signal integrity and regulatory compliance.

However, where the TCP ™ capture includes an ROI that encompasses all of the desired channel level metrics, the technical operator can observe, select and display any legal range value during post capture and append the signal to the RF Visualizer (RFV) ™ geo-location heat mapping overlay as a peak value reference.

Most TSCM and many T&M resources simply are not well suited to the capture of periodic and pulsed signal events as a moment in time snap-shot of the Signal of Interest (SOI).

Advanced TSCM specific resources that provide variable capture time and infinite ROI is a key requirement, for which the Kestrel TSCM ® Professional Software was specifically developed as more than simply another spectrum analyzer with limited real-world functionality.

Depending on the operator’s pre-existing knowledge of a periodic SOI, the runtime recording of the LDSA ™ feature can be adjusted to significantly improve the capture of available metrics for analytical purposes as part of the Location Differential Signal Analysis (LDSA) ™ capability.

The extended runtime, by design, allows for improved POI in that more than a single burst is captured as part of the extended collection processing by trace count or time.

If the purpose of the deployment is to map known signal RF propagation coverage voids for perhaps a UHF channel frequency of 452.5000 MHz, the operator might define the ROI as 400 MHz to 500 MHz, within the LDSA ™ module by setting the CF as 450 MHz | 100 MHz SPAN at perhaps 4.9 kHz RBW without any defined write compression (1/n = 1) (Real-Time – No Compression), and define a trace limit of 250 or 500 traces at each auto location.

It is essential to understand that unless the signal is of a continuous nature, no energy pattern may be registered for any given location where the signal did not appear in the ambient RF spectrum environment; potentially requiring additional time on target for such locations to ensure the SOI peak is properly captured as an accurate result.

By setting the required parameters, the software will initiate a runtime session at the first defined auto location as soon as the technical operator selects the | AUTO SAMPLE | menu option.

The software will automatically generate a new LDSA ™ location and enter a runtime condition, and then terminate collection automatically upon reaching the defined trace count or time limit.

There is no operational restriction on running the TCP ™ process manually capturing any number of traces at each auto location by simply not defining a trace limit during the initial setup.

It is entirely possible that one location might have 253 traces, another 760 traces, and another 1275 traces, where the operator at the first location observed a signal appearance early in the capture and manually terminated the collection, and the second and third location, did not see the signal appearance until later in the process, for example.

As note previously, it is essential for the technical operator to consider applying write compression if the requirement calls for an inherently extended runtime capture process or the software is deployed in a managed Remote Spectrum Surveillance and Monitoring (RSSM) ™ role, for an extended TCP ™ capture period.

250 or 500 traces (as might be defined by the technical operator) will be captured for the center frequency defined within the 400 MHz to 500 MHz ROI based on the example described above, and all spectrum data will be automatically recorded and appended to the DSA control group for differential comparative analysis.

Aside from the Tap Capture Plot (TCP) ™ data, the technical operator will also have a DSA capture of the 100 MHz ROI band plot (as defined above) to assist in the identification of other band related or adjacent channels of interest within the defined ROI.

A trace level reference of the presence of any incidental Electro Magnetic interference (EMI) and other spectrum artifacts such as out of band harmonics that may be responsible for the degradation of the of existing communication network will also be available for post analytical review.

The DSA ™ control group can be simply ignored if the mission is to capture a defined number of auto capture samples across the floor plan, as this level of automation is defined during the setup process and results in a powerful RF Visualizer (RFV) ™ geo-location heat mapping display.

The DSA ™ control group is a post analytical resource within the deployment process used to provide additional differential information as part of the normal operation of the Kestrel TSCM ® Professional Software.

Map Import | Control Group

The operator can import any appropriate image for use as a TCP ™ overlay making the Kestrel TSCM ® Professional Software one of the most versatile applications available.

There are a number of essential technical operator defined control functions to be considered that bring powerful new capability that is in every way mission specific and operator defined.

By default, the initial | **FLOOR PLAN (TAB)** | is generated automatically, and during import image process, the floor plan name must be defined by the technical operator as part of the workflow process.

The | **IMAGE** | button allows the operator to import a suitable (PNG, JPG, GIF) image stored on the host computer or other removable storage, to be used for the TCP ™ overlay on the selected floorplan tab.

PDF files are not supported and need to be converted to a supported image format prior to importing.

NEW FLOOR PLAN | The new floor plan button can be used to add additional floorplan tabs and the same process as described above can be used to import any number of overlay images to represent multiple locations, multiple floors, or even multiple geo-graphical locations.

A right mouse click and hold allow the technical operator to reposition the imported image when zoom is invoked.

The vertical and horizontal slider bars can also be utilized to reposition the focus on the overlay image.

The | **GRID** | overlay provides calibration for the RDSA ™ functionality.

Although the grid can be utilized as the reference within the TCP ™ feature, it is not required and does not provide any calibration functionality within the TCP ™ feature.

GRID CALIBRATION | Grid calibration is not required for the TCP ™ feature and is only utilized within the RDSA ™ functionality.

This allows calibration of the imported image based on the RDSA ™ antenna locations based on the physical dimensions of the facility, site or wider geo-graphical area in | METERS | FEET | KILOMETERS | MILES | depending the nature of the mission.

HUE | Depending the imported image colour, style, and contrast, the HUE colour can change the displayed colour of the overlay | GRID | and | CONTOUR | overlay for better visibility.

ZOOM | The zoom control is used to adjust the TCP ™ image size and is particularly useful when working with a small scale imported image where any number of auto locations are required in close proximity. The zoom factor can provide better visibility. During the importing process High Resolution images will automatically be compressed consistent with the < zoom > scaling control.

Heat Mapping Overlay | Geo-Location Control

For the RF Visualizer (RFV) ™ geo-location heat mapping specific deployment requirement, the technical operator will need to setup the | OVERLAY | control options at the bottom of the | FLOOR PLAN | window.

The technical operator can select the following parameters;

ALGORITHM | NONE | GAUSSIAN WEIGHT | INVERSE SQUARE WEIGHT | DIFFERENTIAL FREE SPACE POWER LOSS (DFSPL is not recommended for use with the TAP and PLOT feature for facility level rendering).

UPDATE | NONE | SLOW | MEDIUM | FAST |

VARIANCE | 0.100 to 1.000 | can be adjusted for the | GAUSSIAN WEIGHT | overlay algorithm.

OPACITY | 0.2 to 0.9 | can be adjusted to enhance the transparency level of the geo-location heat mapping overlay.

N LAMBA | 1.00 to 16.00 | can be adjusted for the | DIFFERENTIAL FREE SPACE POWER LOSS (DFSPL) | algorithm.

The inverse of wavelength is referenced as the spatial frequency and wavelength is typically designated by the symbol lambda.

This powerful | **CONTOURS** | overlay option provides a virtual propagation reference contouring, based on the Relative Signal Strength Indication (RSSI), across the target area.

Options include a | 10dB | 3dB | 1dB | 0.5dB | and | 0.1dB | contouring references.

The ability to view the RF propagation across the target area is supported.

HEAT MAP COLOUR PALETTE | Can be set to display any defined Waterfall Display (WFD) colour palette selected from the database or a custom defined colour palette.

It is recommended that custom defined options utilize at least five (5) blended colour options.

REFERENCE LEVEL SLIDER BAR | The reference level can be manually adjusted during runtime or post analysis to tweak the RF Visualizer (RFV) ™ geo-location heat mapping display overlay for the best visual experience by altering the displayed reference level range.

To change the lower value (higher signal level) move the REF LVL slider bar from the left default position to the right to accentuate the energy visualization hot range.

To change the higher value (lower signal level) move the REF LVL slider bar from the right default position to the left to accentuate the energy cold range.

A mouse click on the REF LVL slider bar invokes a quick upper or lower reference jump based on the position of the mouse click.

A double mouse click on the REF LVL sider bar will reset both the upper ad lower values back to the default capture range.

Spectrum data | Control and Display Group

The spectrum data control group allows the technical operator to quickly select and identify the Signal of Interest (SOI), adjust the heat mapping algorithm BW and select the spectrum mode (Peak, Average, or Real-Time) for the display.

SPECTRUM FOCUS DISPLAY | This window provides the operator with a runtime and / or historical display for the Signal of Interest (SOI) currently set within the CF input box based on the bandwidth (BW) and the spectrum mode selected by the technical operator.

The start and stop frequency are displayed based on the selected bandwidth control value as is the Center-Frequency (CF) based on the selected CF value.

The ability to click and drag fine tuning for the CF is supported.

The noise floor reference value and the power (amplitude dBm) of the signal level is also displayed within the spectrum focus window.

The mouse wheel can be used to adjust the bandwidth manually, which is immediately reflected on the geo-location heat map

Right click to set the current CF as an operator defined Signal of Interest (SOI). This is extremely useful when additional signals of interest or energy patterns are identified during runtime, the signals cap be appended to the SOI threat list for further investigation.

CENTER FREQUENCY | Manually entering or drag and dropping any frequency within the ROI as defined by the technical operator, or via the frequency slider bar can be used to focus the center frequency.

This is an extremely powerful feature as any CF within the captured DSA ™ range can be viewed as a geo-location heat map by simply selecting the frequency, channel, or range visually or by direct entry, even if the initial walk-though was related to another CF from a project perspective.

Drag and Drop technology is supported from any signal list source, directly to the floorplan CF spectrum focus control input box.

BANDWIDTH | 10 kHz | 20 kHz | 50 kHz | 100 kHz | 200 kHz | 500 kHz | 1 MHz | 2 MHz | 5 MHz | 10 MHz |.

The technical operator can manually select any desired BW within the defined capture Range of Interest (ROI) to best represent or filter the energy for display across the geo-location heat mapping display.

SPECTRUM | PEAK | AVERAGE | and | REAL-TIME |

This control allows the technical operator to plot the energy based on the peak, average or real-time values.

Depending on the trace selected, the colour of the spectrum overview range and the focus window with update accordingly.

POSITIONAL ZOOM CONTROL | The PZC ™ is similar to the familiar PZC ™ on the main spectrum display in that it displays the ROI and representative energy levels across the defined ROI.

The ability to drag from the left and right drag bars, double click on the PZC ™ to focus the display at any operator selected position, drag the zoom region across the defined spectrum, mouse wheel to zoom further on the Signal of Interest (SOI) and select the a zoom factor from a right click menu are all supported.

Interference Analysis | Resolution

During the past decade we have witnessed very large financial investments for the purchase of spectrum by wireless providers. Interference has become as complex to resolve as the emerging wireless technologies have likewise continued to advance in sophistication.

The Kestrel TSCM ® Professional Software has continued to progress by breaking new technological ground to meet the complex challenges of a moving target threat model as defined by the TSB 2000 (Technical) Standard ™, while recognizing the need to encompass significant new threat technology.

Visualization of Interference vs Time

The need for new technology that is specifically designed to graphically visualize radio-frequency propagation is now a reality within the Kestrel TSCM ® Professional Software.

The RF Visualizer (RFV) ™ geo-location heat mapping technology was developed to localize hostile emitters within a TSCM role, identify potential propagation voids for regulatory and compliance purposes, assist wireless communication providers in detecting, identifying and resolving harmful interference that can have a dramatic effect on critical business infrastructure without the usual moment in time snap-shot style practices that frankly have been obsolete for two (2) decades.

The focus on snap-shot style techniques has a relatively low Probability of Detection (POD) of time periodic interference and often is difficult to resolve due to a much higher intended signal for which the interference is often interacting in a negative and sometimes random way.

The need for a clean ambient RF spectrum environment is a core business requirement in protecting the spectrum investment.

Spectrum Profiling

The Kestrel TSCM ® Professional Software is well positioned hunt in a complex signal environment for in the moment operator assisted TSCM oriented spectrum mapping and is equally up to the task for extended unattended deployment within a managed Remote Spectrum Surveillance and Monitoring (RSSM) ™ role.

The ability to detect, capture, analyze, trigger, hand-off, alert, display and render professional reports all fall under the umbrella of advanced spectrum fingerprinting; more commonly referred to as Kestrel Signal Analytics (KSA) ™.

There is nothing better than the mighty Kestrel ® when national technical security is an absolute requirement.

Antenna Placement Distance (APD) ™

Our proprietary | Antenna Placement Distance (APD) ™ | algorithm, specifically developed and described in the TSCM Operational Standard – Policy and Procedure Guideline (OS-PPG) ™ and the TSB 2000 (Technical) Standard ™ is fully integrated within the Kestrel TSCM ® Professional Software to provide a set of automatic threat level calculations that are based on technical operator defined deployment factors, including the known, perceived, or anticipated, risk factors, and threat level characterization.

The Kestrel ® APD ™ algorithm references significant NIST scientific research and findings relating to structural and materials-based attenuation factors and leverages this information in the form of Artificial Intelligence (AI) integration, at the code level.

Our APD ™ reference calculations take into account years of field experience in determining realistic attenuation factors, and scientific research and experiments relating to indoor propagation characteristics, plotted against a powerful threat matrix that is fully integrated deep within the Kestrel TSCM ® Professional Software.

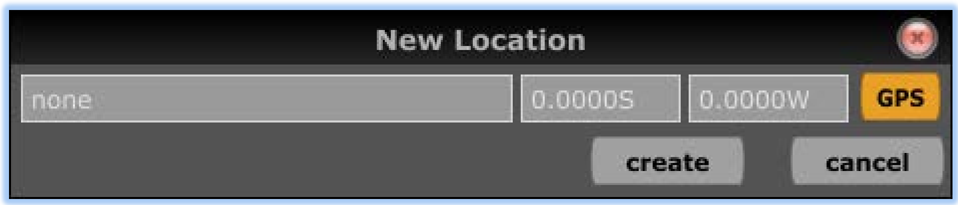
Currently implemented APD ™ functionality includes the ability to define the target area distance in | METERS | FEET | KILOMETERS | MILES |.

The | GRID ON | button displays a grid overlay, which can be dragged to better line up with the graphical representation of the target facility or area.

Antenna Locations

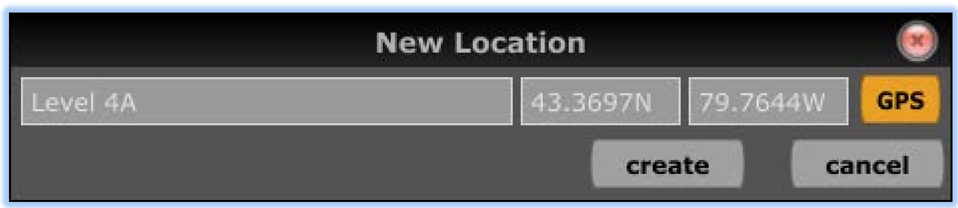
The antenna location menu is accessed from the main tool bar | LOCATION | and provides three (3) menu options including | NEW LOCATION | LOCATIONS LIST | FLOOR PLAN | options.

Pressing the | NEW LOCATION | menu option displays a default dialog window as illustrated below.



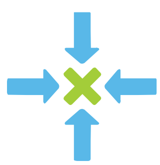
New Location | v1.35xx

The technical operator has defined the new location as Level 4A and has pressed the GPS button to capture and display the current GPS coordinates.



New Location | v1.35xx

Selecting the | LOCATION | PROJECT LOCATIONS | menu option from the main menu results in the display of the | PROJECT LOCATIONS | dialog window.



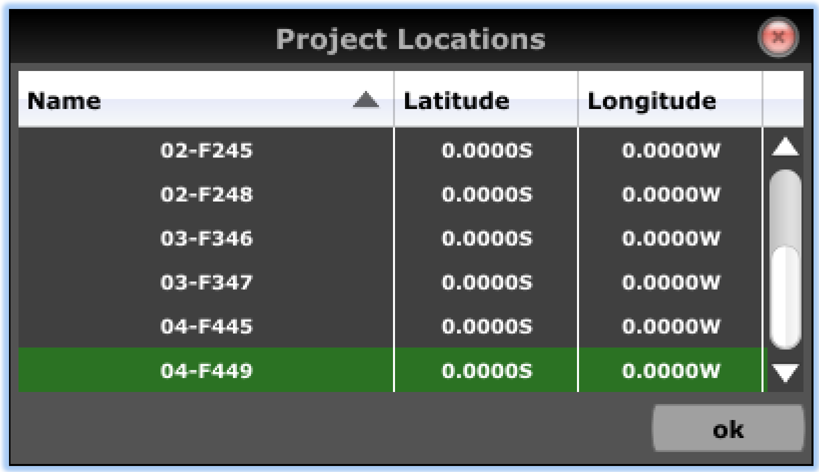
TIP: A supported generic USB GPS receiver module must be connected to the host computer and actively acquiring GPS data before the technical operator can capture GPS coordinates, unless the receiver or analyzer contain a built in GPS receiver, and this is ported through the hardware API and advantaged by the software.

This window displays a list of all DSA antenna locations and allows the technical operator to select any of the DSA antenna locations as the current and active collection location.

The currently active DSA antenna location is highlighted and displayed in green as is illustrated in the image below as 04-F449 by the technical operator.

A right mouse click on any listed DSA antenna location, will result in the display of a | SET AS CURRENT | menu option, which causes the actively sweeping DSA antenna location to complete the current operation and lock.

The software will set the system on pause pending operator restart at the new DSA location.



New Location | v1.35xx

The | LOCATION | FLOOR PLAN | and results in the display of the DSA Floor Plan control group and workspace.

The left side of the window provides a list of dynamically linked LDSA ™ locations that currently exist within the Kestrel Project File (KPF) ™ structure and allows the technical operator to add new locations and select any existing location as active; as displayed in green highlight.

Our “on-the-fly” advanced “drag-and-drop” technology is fully supported allowing the technical operator to dynamically place and relocate any of the available DSA Antenna Locations, directly on the graphical LDSA ™ workspace or graphic image.

LDSA ™ | Band Level

The DSA features supports the ability to run any number of spectrum bands or ROI at each independent DSA Location, however, any spectrum bands not run at all locations, and selected for comparative analysis will not be available.

Changing the | DISPLAYED | location, to a LDSA ™ Location where the spectrum band or ROI was run, will reveal the LDSA ™ ICON for that specific location only.

It is strongly recommended that the technical operator not run multiple sub-bands at some locations, but not others to avoid possible confusion during the analysis process.

Running multiple DSA sub-bands is not generally required when working with high speed receivers and the ability of the Kestrel TSCM ® Professional Software to support Positional Zoom Control (PZC) ™ and navigational stepping control during runtime and when working with historical Kestrel Project Files (KPF) ™.

LDSA ™ | GPS Assisted

The ability to utilize the Kestrel TSCM ® Professional Software | Location Differential Signal Analysis (DSA) ™ | and built in | Global Positioning System (GPS) | functionality allows the technical operator to take advantage of yet another advanced software capability, including | Geographical Area Reviews (GAR) ™ | comparatives, or active searches for known and unknown, potentially hostile emitters, Electro-Magnetic Interference (EMI) resolution, and in support of electronically assisted | Search and Rescue (SAR) | mission deployment.

LDSA ™ | Room Level

The DSA feature all but eliminates the requirement for a broadband detector, when the RSSI Tone Locator (RTL) feature is deployed within 25 feet of the host computer, utilizing the Signal Hound USB-SA44B search receiver and a suitable 25-foot High Speed USB 2.0 cable.

Understanding | Kestrel ® LDSA ™ Capability

The technical operator is able to directly compare current or historical spectral data with DSA trace information and select which additional background traces are displayed on the Graticule.

LDSA ™ is a powerful tool for comparing the ambient RF signal environment at various points within the target area or other operator selected areas in the vicinity or outside of the influence of the target area, such as a Far-Field capture away from the target area or facility, referred to as a | Geographical Area Review (GAR) ™ | [2].

[2] Geographical Area Review (GAR) refers to the technical operator's ability to conduct reference collection sweeps at various strategic locations 360 degrees around the perimeter of the target facility as defined in the TSB 2000 (Technical) Standard ™, and the TSCM Operational Standard - Policy and Procedure Guideline (OS-PPG) ™

This advanced principle has been deployed on a larger scale during Search and Rescue (SAR) mission deployment and emergency response based Geo-Location and Radio Direction Finding (RDF) assignments for many years allowing our Software Development Group (SDG) to define and refine the early deployed and time-tested concepts, into advanced methods and techniques for inclusion within the Kestrel TSCM ® Professional Software.

Far-Field geographical area LDSA ™ data can be utilized for direct comparison to the target area Near-Field data when the LDSA ™ functionality is deployed within the target area or facility.

LDSA ™ allows the operator to select any two (2) captured LDSA ™ traces and display the related trace math on a differential Graticule display plot when the LDSA ™ feature is selected for view.

This principle is well founded in the early evolution and development of analog and digital spectrum analyzers that included trace math and maximum hold capability.

Such techniques are utilized for regulatory spectrum management, search and rescue, law enforcement and military applications.

The default position of the DSA ™ control group window is directly below the Positional Zoom Control (PZC).

The DSA ™ data can be displayed during active collection or for post analysis review.

DSA ™ allows the technical operator to directly compare captured spectral data information at various points within or around the target area in near real-time too quickly and easily to compare a specific spectrum band allocation, Range of Interest (ROI), or discrete Signal of Interest (SOI).

The technical operator may run as many LDSA ™ traces as desired for each target facility or mobile deployment, based on the actual sweep time available to ensure that periodic and intermittent signals are captured over time.

The result is immediate when the hostile signal event is of a continuous nature, and only a small number of sweeps would be required at each LDSA ™ collection location.

The more “time-on-task” available, the better the resulting comparative will be in resolving intermittent and periodic signal events.

TIP: This method is referred to as Trace Math by spectrum analyzer manufacturers and dates back many years. We have employed this technique manually since the late 1970's utilizing very large and heavy spectrum analyzers utilizing the A / B / MAX Hold and AVG features. The DSA technique is new technology that has been refined and perfected over many years. We have included an advanced version of the DSA ™ tool with the Kestrel TSCM ® Professional Software. This method has also been deployed during electronic searches within a Search and Rescue (SAR) role for the past 40 years.

To establish a working baseline of the ambient signal environment for several rooms or target areas for a specific SOI quickly, it is recommended that the technical operator allow the software to complete at least 3000 sweeps and upward of 5000 sweep events prior to moving to another LDSA ™ antenna location when utilizing a high-speed search receiver.

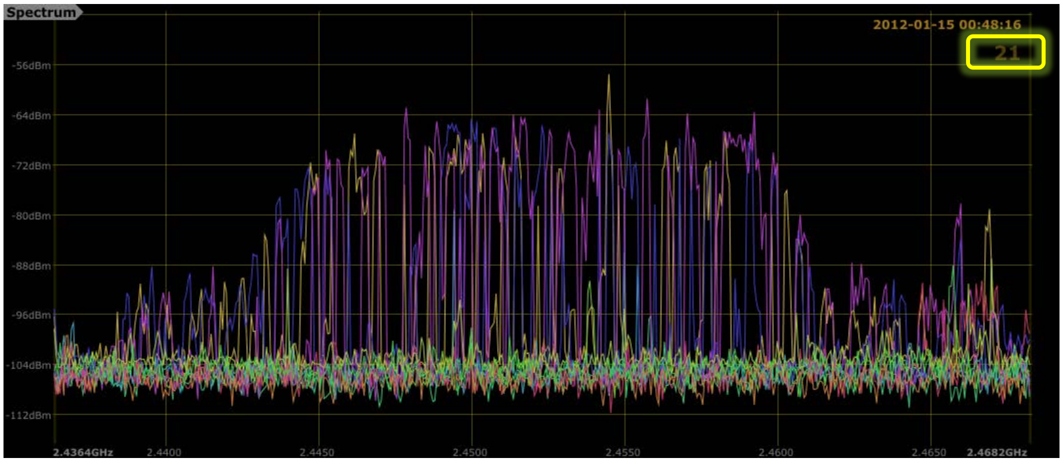
TIP: Utilizing a 25-foot, High-Speed USB 2.0 cable with the Signal Hound (USB-SA44B) search receiver as a walk about RF Probe, the operator can quickly move to an adjacent area or various points within the same room to determine the area of strongest RF within the target area.

Each individual captured trace can be displayed or hidden on the Graticule in a different automatically assigned colour.

You can collect LDSA ™ data continuously for any period of time before returning to the DSA ™ control group to lock the current location in preparation for moving to the next DSA collection location.

When the technical operator is satisfied that enough LDSA ™ Peak Data for any given location has been collected, pressing the | LOCK | button causes the last sweep to complete and pauses the data collection process.

The technical operator may press the | LOCK | button at any time or when the RSD sweep status annotation displays the desired number of LDSA ™ sweeps.

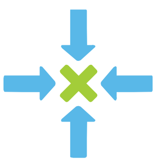


DSA Mode | v1.35xx

In the above example of a WI-FI signal event, the sweep status annotation indicates that the current sweep count is 21 as displayed.

When the technical operator presses the LOCK button at any time during the current sweep process, the software will complete the current operation and stop sweeping.

The technical operator, may also press the UNLOCK button and RESTART button to continue collection at the current location, if desired.



TIP: It is recommended that the operator allow between 25 and 100 sweeps (Recommended) to complete prior to locking a DSA trace into memory. This will take varying amounts of time based on the Range of Interest (ROI) established. The more DSA sweeps completed in each individual target area, the better the comparative will be. It is recommended that the number of traces completed be consistent with the perceived or identified “threat level” and “time-on-task” considerations.

Real-Time DSA (ECHO Mode)

Real-Time Differential Signal Analysis (DSA) provides the unique ability to display trace data from multiple historical locations and compare as many, or has few traces as desired, directly to the currently active DSA Location, trace level data.

Real-Time DSA ECHO Mode | v1.35xx

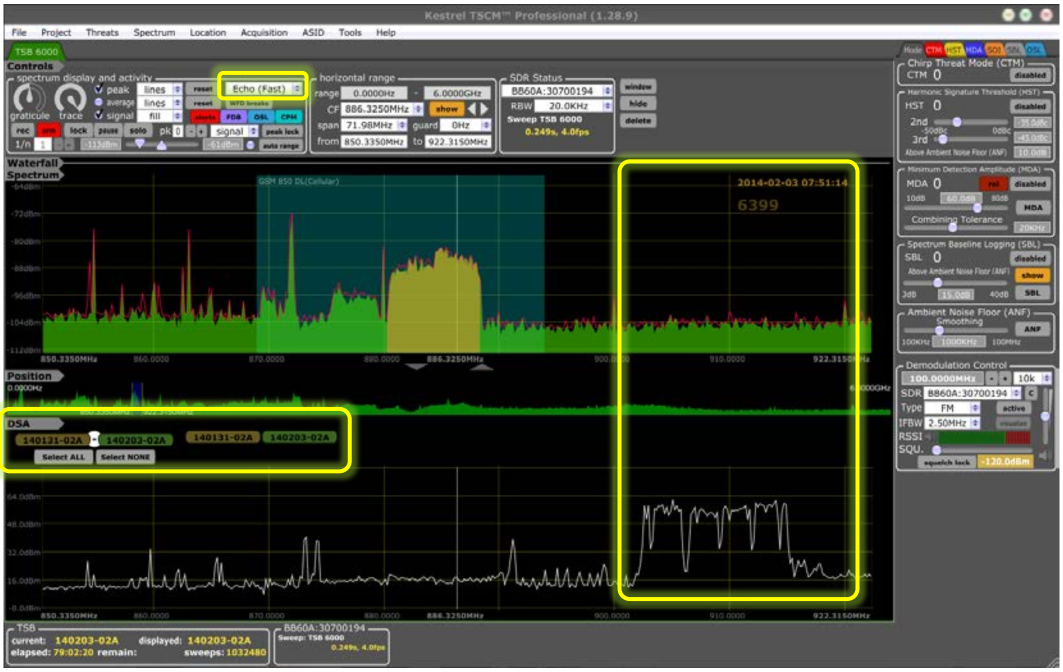
When the trace math display (A-B / B-A) is selected for the current and historical DSA ™ Location, along with any number of available DSA Locations of interest displayed, including the currently active DSA location, the result is a direct MAX Peak Hold trace comparative and differential trace display.

The MAX Peak Hold trace comparative permits any number of historical DSA ™ locations from the current Kestrel Project File (KPF) ™ or imported trace data from other KPF projects, including the currently active DSA ™ Location, all of which will display as static peak comparative traces.

The technical operator can quickly identify and evaluate differences in the ambient RF spectrum environment and investigate any number of potentially hostile activity.

However, when ECHO mode is selected, the technical operator will now be able to observe real-time updating for the current location against any number of selected historical DSA Locations.

This mode of operation provides the technical operator with real-time analytical capability and provides a clear visualization of the not only historical DSA ™ data during the deployment, but also what is occurring in real-time.



Real-Time DSA ECHO Mode | v1.35xx

Real-Time DSA ECHO Mode is available even when no DSA Location ICONS are selected active.

When this mode is selected, the technical operator will see the real-time RF Spectrum Display (RSD) as well as the Real-Time DSA ECHO Mode data for the ROI or region of the spectrum selected.

The technical operator may mouse over any DSA ICON to display historical trace data as an overlay on the RSD or select any number of available DSA Location ICONS to immediately enter the DSA comparative display mode.

All normal visual display parameters, including Channel Profile Masks (CPM), spectrum marker flags, navigational stepping control, and Positional Zoom Control (PZC) are all fully supported when operating in the DSA or DSA ECHO mode.

Geographical Area Review (GAR)

Conducting a sector based 360-degree Geographical Area Review (GAR) ™ assumes you are either outside of any Near-Field influence or hoping to take advantage of Far-Field spectrum activity that may suggest the presence of a sophisticated repeater-based interception system, or the possibility of low power and highly directional interception methods being deployed and emitted from the target area or facility.

The method of capturing only a single external reference trace is considered obsolete in a moving target threat model and fails to meet minimum due-diligence considerations.

A 360-degree, sector-based GAR ™ must be considered as an essential best practice to properly document the ambient RF spectrum environment.

For example, an attacker might deploy a very low power Technical Surveillance Device (TSD), with a highly directional antenna on the roof, or an exterior wall of the target area or facility, that might not be detectable from any particular single external collection location, or from within the target area, or facility.

Working a sector based 360-degree Graphical Area Review (GAR) ™ as defined by the TSB 2000 (Technical) Standard ™, may be the only way to detect directional SHF (and above) transmissions that are generally low power, use complex modulation schemes, and are highly directional in nature.

The placement of highly directional, hostile signals operating within the SHF region of the spectrum, by design, utilize low power levels to invade active detection.

In-fact, such devices may only transmit enough power to reach a nearby repeater that is capable of transmitting on an entirely difference frequency, or even modulation type with store and forward, or burst on demand, technology.

It is essential that an external reference trace include all exterior line-of-sight facility walls at a distance sufficient to ensure that the collection location is capable to “seeing” any directional emissions from the target facility.

Precise external reference collection positions need to be determined by the technical operator, with consideration for the perceived threat level and other mission specific factors.

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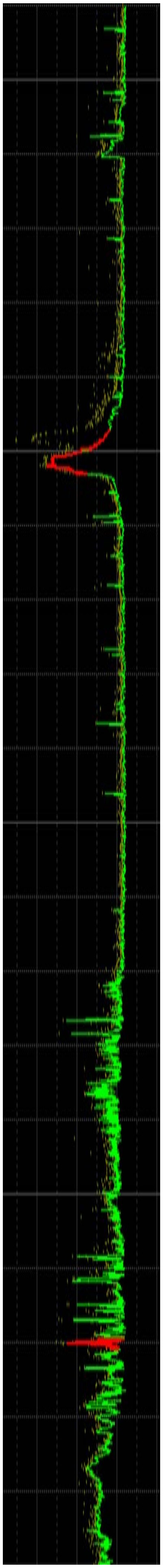
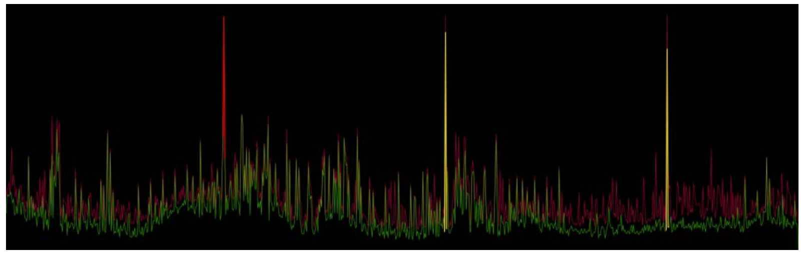


Chapter 13



Audio | Video Demodulation and Analysis

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Audio | Video Demodulation and Analysis

There are several advanced demodulation modes of operation that provide the technical operator with unsurpassed deployment functionality, including the ability to sweep the desired spectrum and demodulate on the same search receiver or analyzer, or sweep on the primary search receiver or analyzer and demodulate Signals of Interest (SOI) on a secondary search receiver or analyzer and dynamically "hand-off" the demodulation process to any supported and connected search receiver or analyzer.

Communication Receiver Mode (CRM)

The Kestrel TSCM ® Professional Software can be operated in a standalone Communication Receiver Mode (CRM) to demodulate audio Signals of Interest (SOI) on any supported, connected and initialized search receiver or analyzer without the need to establish a runtime Kestrel Project File (KPF).

This feature allows the technical operator to open the application, select any available receiver in the demodulation control group dialog window, enter the Center Frequency (CF), select the demodulator mode (AM, FM, USB, USB) and set the appropriate IF Bandwidth (IFBW).

Pressing the | ACTIVE | button completes the operation and starts the demodulation process for the Signal of Interest (SOI) based on the Center Frequency (CF), Mode (AM, FM, SSB), and the IFBW selected.

The Kestrel ® FFT Demodulation Visualizer is also available when operating in the CRM capacity, providing the technical operator with unsurpassed signal analysis, audio record and playback capability.

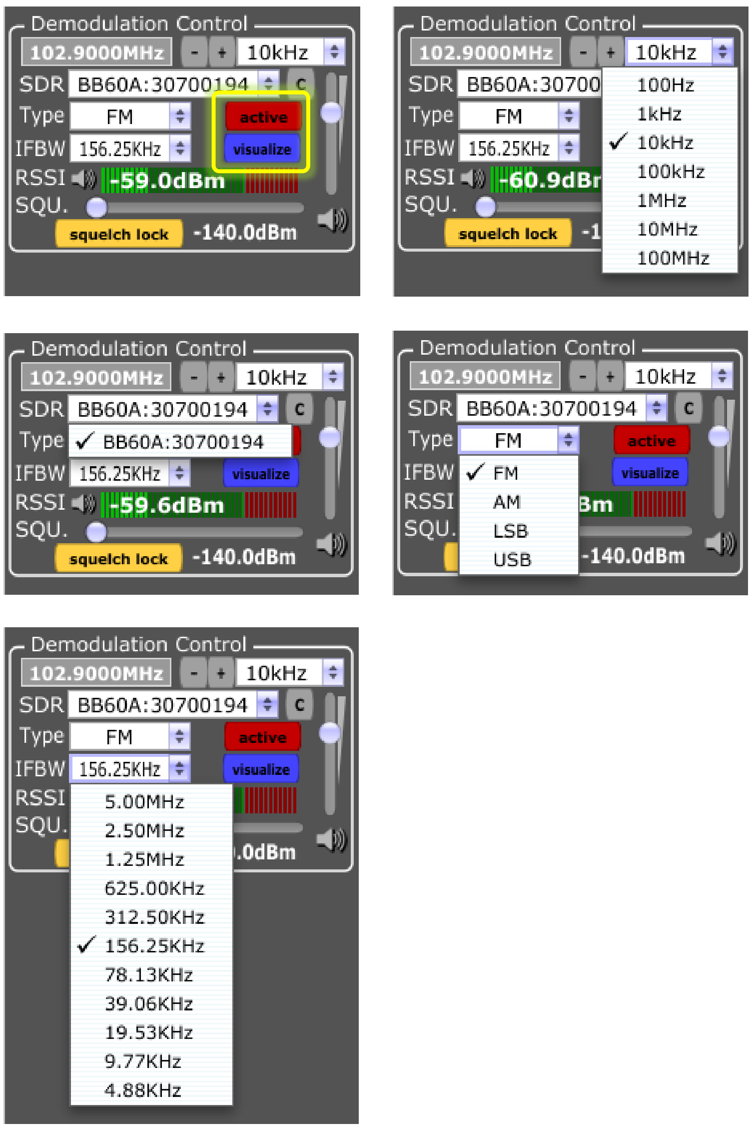
Kestrel ® includes a powerful IQ | RECORD | and | PLAYBACK | feature with the ability to | LOOP | playback of recorded IQ samples to aid in signal analysis.

Operators have the option to save IQ files in our proprietary | KIQ | file format or a standard | CSV | IQ file.

Demodulation and Analysis Control Group

The | Audio Demodulation Control Group | is located on the user-interface sidebar structure for direct operator access to all essential demodulation related controls, easy access to the FFT Demodulation Visualizer control group.

The | Kestrel Wave Recorder (KWR) | record and playback controls are only found within the | Demodulation Visualizer | control group.

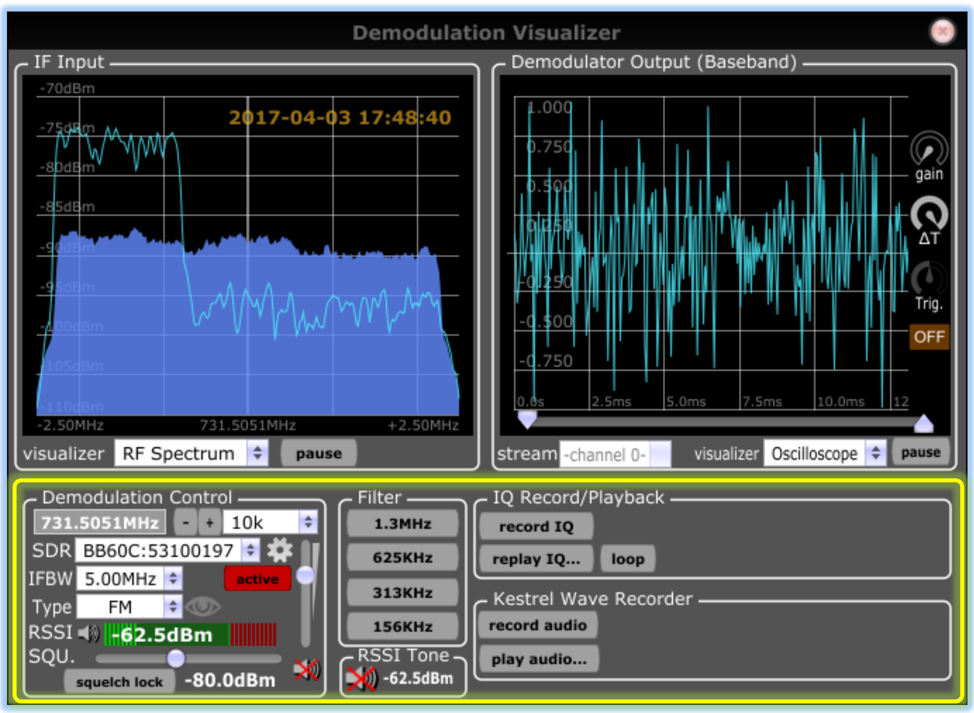


Demodulator Control Group | v1.35xx

A duplicate set of the | Demodulation Control Group | is conveniently located within the FFT Demodulation Visualizer and includes additional features that include dynamically generated | Audio Filters | the | Kestrel Wave Recorder (KWR) |and the | IQ Record and playback | controls.

The ability to capture and playback demodulated audio file samples in a standard | WAV | file format for direct inclusion within the Kestrel Project File (KPF) structure is fully supported.

The ability to record analog or digital modulation audio sample and create an operator reference database is supported utilizing the Kestrel Wave Recorder (KWR) as a capture tool.



Demodulation Control Group | v1.35xx

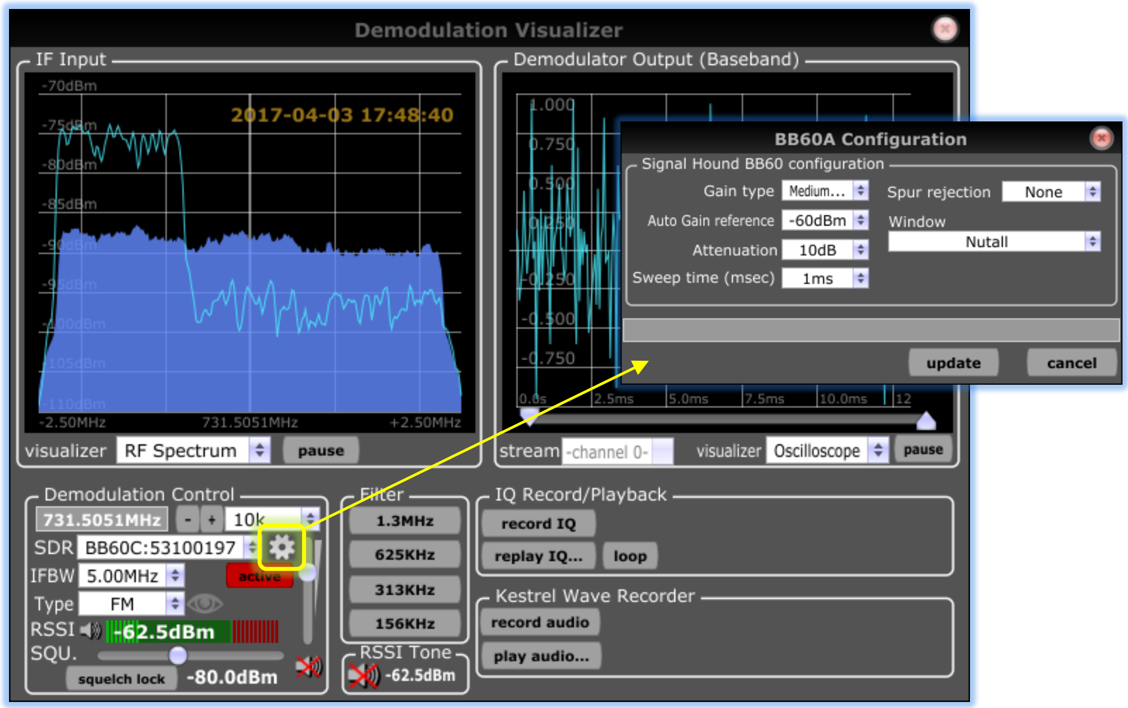
The Demodulation Control, Dynamic Filters, RSSI Tone Locator (RTL) ™, IQ Record, Playback, and Kestrel Wave Recorder (KWR) ™, are all co-located within the Demodulation Visualizer.

The ability to program, or fine tune the center frequency, IFBW and modulation type can be controlled during the demodulation process.

The IQ Record and Playback control allows the technical operator capture IQ samples in either our binary KIQ or our ARP IQ (CSV) format.

The Kestrel Wave Recorder (KWR) ™ is a basic audio recorded, designed to record the demodulated audio.

Our multi-channel audio streaming permits recording even while the audio | MUTE | button is active.



Receiver Configuration | v1.35xx

The operator can directly access the receiver or analyzer configuration dialog window for the purpose of dynamically adjusting any available demodulation parameters unique to the connected receiver or analyzer type.

The ability to dynamically add attenuation and adjust other available parameters, allows the operator to accomplish a walk-about RF search to pin-point the precise location of an emitter without overloading the ADC or saturating the receiver or analyzer, by adding attenuation, as required.

Full demodulator support is provided for Frequency Modulation (FM), Amplitude Modulation (AM), Lower Side Band (LSB), and Upper Side Band (USB).

FM | Frequency Modulation

AM | Amplitude Modulation

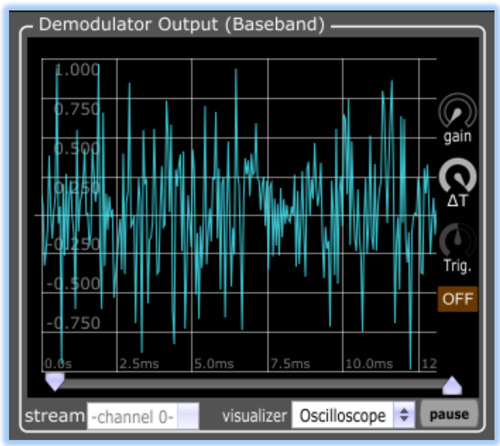
LSB | Single Side Band | Lower Side Band

USB | Single Side Band | Upper Side Band

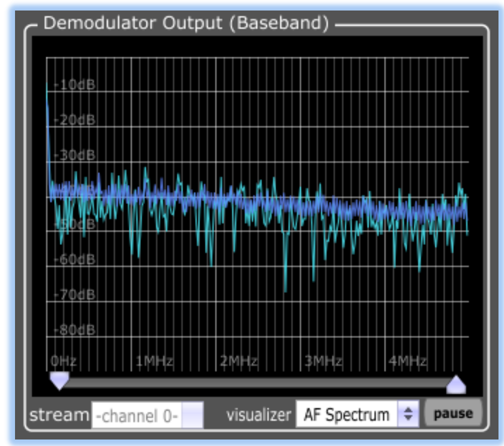
NTSC | Video Demodulation

It is possible to view the instantaneous real-time Intermediate Frequency (IFBW) of the receiver or analyzer utilizing the | RF Display (RFD) |, and characterize the signal utilizing the | AF Spectrum Display (ASD) | window.

The IF Bandwidth (IFBW) availability is a function of the SDR hardware receiver or analyzer, and legal values are dynamically generated and displayed when any particular receiver or analyzer type is selected within the SDR (Demodulation) Control Group.



Audio Oscilloscope Display (AOD) | 1.35xx



AF Spectrum Display (ASD) | v1.35xx

The | AF Spectrum Display (ASD) | window illustrates a typical FM Broadcast station and provides a clear visual representation of the Multiplex Baseband Spectrum including the L+R Monophonic component, Pilot Sub-Carrier, L+R Supressed Stereophonic Sub-Carrier and the ability to visually characterize the presence of Sub-Carrier Audio (SCA), subsidiary communication multiplex operation.

In the event that Sub-Carrier Audio (SCA) or other sub-carrier activity is present within the Signal of Interest (SOI), the operator can easily identify the presence of the sub-carrier within the spectrum and determine the frequency.

The | AF Spectrum Display (ASD) | trace and a background echo averaged trace allow the technical operator to observe even the smallest changes within the Signal of Interest (SOI) during visual review and analysis.

IF BW (Auto / Manual)

The Kestrel TSCM ® Professional Software estimates the instantaneous signal event bandwidth during the capture process and utilizes this value to automatically set the Intermediate Frequency (IF) during the demodulation process.

However, the automatic bandwidth capture may not always result in the best Intermediate Frequency (IF BW) setting based on the instantaneous modulation characteristics of the SOI at the moment of capture.

The technical operator may manually select any available IF Bandwidth (IFBW) accordingly in real-time during review of a demodulated signal event. Manual adjustment of the signal modulation type (FM, AM, LSB, USB) is also fully supported.

Demodulator (IF) Bandwidth Settings (USB-SA44B / USB-SA124B)
240 kHz
120 kHz
60 kHz
30 kHz
15 kHz
7.5 kHz

IF Bandwidth | v1.35xx

The available IFBW settings are specific to the SDR hardware deployed.

The operator can adjust the IF Bandwidth (IFBW) manually, in effect overriding the automatic instantaneous bandwidth captured during the demodulation process, if a more suitable IF Bandwidth (IFBW) is required or desired during analysis.

Depending on the nature of the actual signal event being analyzed, adjusting the IF Bandwidth (IFBW) and utilizing the available dynamically generated | Audio Filters | can result in significant improvement of the audio signal quality and demodulation characterization.

Demodulator (IF) Bandwidth Settings (Signal Hound | BB60C)
27 MHz | Hardware Maximum IFBW
25 MHz
20 MHz
15 MHz
8 MHz
5 MHz
3.75 MHz
2.5 MHz
2 MHz
1 MHz
500 kHz
250 kHz
125 kHz
62.5 kHz
50 kHz
30 kHz
15 kHz
10 kHz
7.5 kHz
5 kHz
2.5 kHz
1.25 kHz

IF Bandwidth | v1.35xx

The displayed filter options are dynamically generated based on the current IFBW setting selected by the operator.

The FFT based | Demodulation Visualizer | control group also provides additional analysis tools to assist the technical operator in both signal analysis and emitter location.

IF Filter Control (IFC) | Audio Filters

The Kestrel TSCM ® Professional Software supports the ability to select a range of dynamically generated filter options during the demodulation process.

IF Filter Control (IFC) | v1.35xx

The following IFBW Vs Filter Availability Chart demonstrates the wide range of dynamically generated Filter options available during the demodulation process.

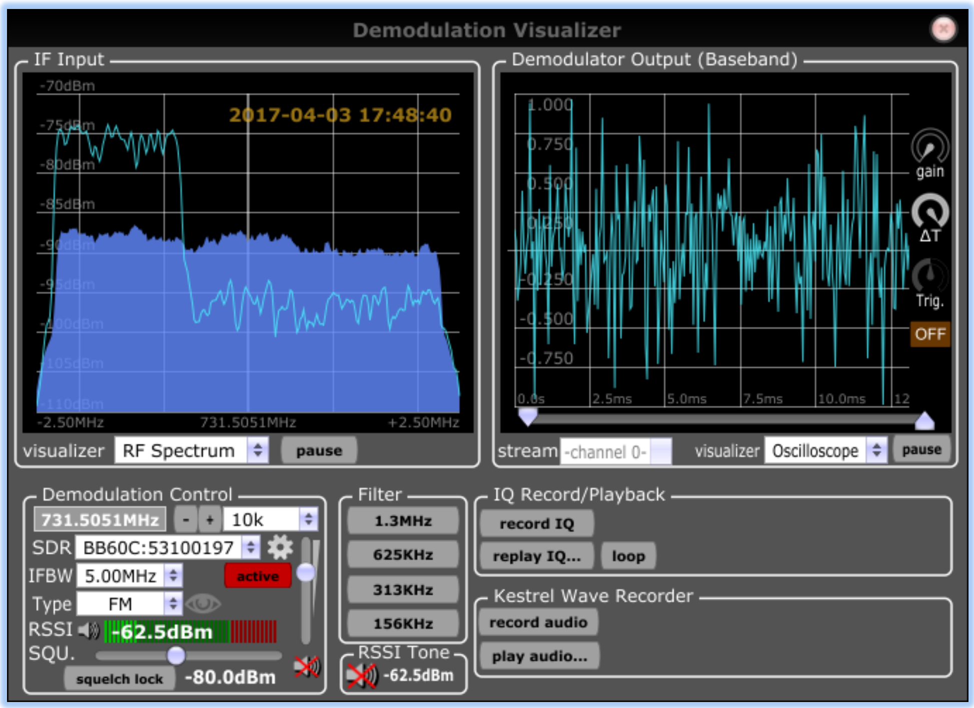
When any of the displayed | Audio Filters | are selected by the operator; the result is visually displayed within the | AF Spectrum Display (ASD) | as well as the demodulated audio stream.

IF BW Vs Filter Availability Chart (USB-SA44B / USB-SA124B)	
IFBW	**IF (Audio] Filter Availability**
240 kHz	120 kHz, 60 kHz, 30 kHz, 15 kHz
120 kHz	60 kHz, 30 kHz, 15 kHz, 7.5 kHz
60 kHz	30 kHz, 15 kHz, 7.5 kHz, 3.8 kHz
30 kHz	15 kHz, 7.5 kHz, 3.8 kHz, 1.9 kHz
15 kHz	7.5 kHz, 3.8 kHz, 1.9 kHz, 938 Hz
7.5 kHz	3.8 kHz, 1.9 kHz, 938 Hz, 469 Hz

IF Bandwidth Filter Chart | v1.35xx

IF BW Vs Filter Availability Chart (Signal Hound | BB60C)	
IFBW	**IF (Audio) Filter Availability**
27 MHZ	6.8 MHz | 3.4 MHz | 1.7 MHz | 844 kHz
25 MHz	6.3 MHz | 3.1 MHz | 1.6 MHz | 781 kHz
20 MHz	5.0 MHz | 2.5 MHz | 1.3 MHz | 625 kHz
15 MHz	3.8 MHz | 1.9 MHz | 938 kHz | 469 kHz
10 MHz	2.5 MHz | 1.3 MHz | 625 kHz | 313 kHz
8 MHz	2 MHz | 1 MHz | 500 kHz | 250 kHz
5 MHz	1.3 MHz | 625 kHz | 313 kHz | 156 kHz
3.75 MHz	938 kHz | 469 kHz | 234 kHz | 117 kHz
2.5 MHz	625 kHz | 313 kHz | 156 kHz | 78 kHz
1 MHz	500 kHz | 250 kHz | 125 kHz | 63 kHz
500 kHz	125 kHz | 63 kHz | 31 kHz | 16 kHz
250 kHz	63 kHz | 31 kHz | 16 kHz | 7.8 kHz
125 kHz	31 kHz | 16 kHz | 7.8 kHz | 3.9 kHz
62.5 kHz	16 kHz | 7.8 kHz | 3.9 kHz | 2 kHz
50 kHz	13 kHz | 6.3 kHz | 3.1 kHz | 1.6 kHz
30 kHz	7.5 kHz | 3.8 kHz | 1.9 kHz | 938 Hz
15 kHz	3.8 kHz | 1.9 kHz | 938 Hz | 469 Hz
10 kHz	2.5 kHz | 1.3 kHz | 625 Hz | 313 Hz
7.5 kHz	1.9 kHz | 938 Hz | 469 Hz | 234 Hz
5 kHz	1.3 kHz | 625 Hz | 313 Hz | 156 Hz
2.5 kHz	625 Hz | 313 Hz | 156 Hz | 78 Hz
1.25 kHz	313 Hz | 156 Hz | 78 Hz | 39 Hz

IF Bandwidth Filter Chart | v1.35xx

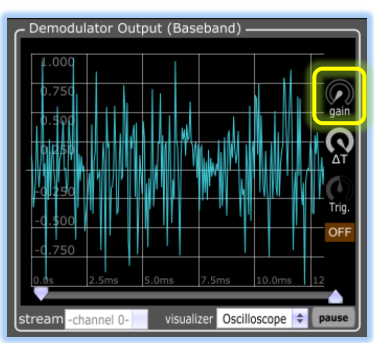


Demodulation Visualizer | v1.35xx

The Default view when the operator activates the | Demodulation Visualizer | control group, provides a real-time FFT based | RF Display (RFD) | and | Audio Oscilloscope Display (AOD) |.

Oscilloscope Gain Control

The | Audio Oscilloscope Display (AOD) | vertical reference scale can be adjusted by the technical operator, if required, utilizing the | Variable Gain Control (VGC) | located on the right side of the FFT window.



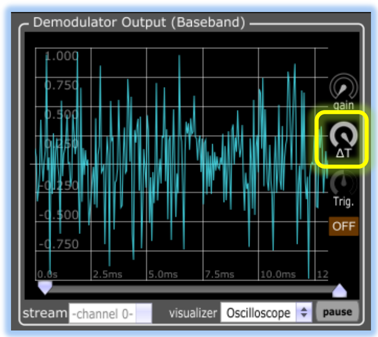
Audio Oscilloscope | Gain Control | v1.35xx

Oscilloscope DELTA “T” Control

When a trigger is detected, a sample is taken after a short time delay, and when the next trigger occurs, a short time increment, referred to has | DELTA “T” | is added to this delay and another sample is taken.

This process is repeated many times, with | DELTA “T” | added to each previous acquisition, until the time window is populated.

Sample points appear from left to right in sequence along the waveform when displayed on the oscilloscope display.

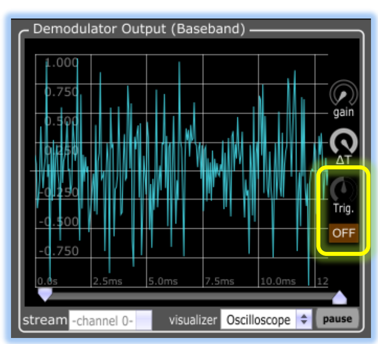


Audio Oscilloscope | Delta “T” Control | v1.35xx

Oscilloscope Trigger Control

The | Audio Oscilloscope Display (AOD) | trigger can be adjusted by the operator to trigger on either the rising peak or falling peak and the trigger level can be adjusted.

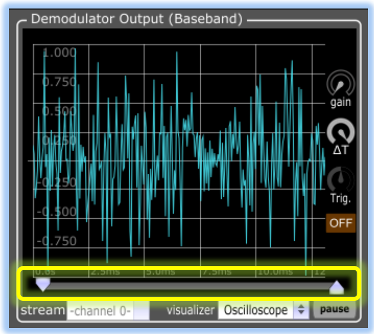
The default setting for triggering is “Off”.



Audio Oscilloscope | Trigger Control | v1.35xx

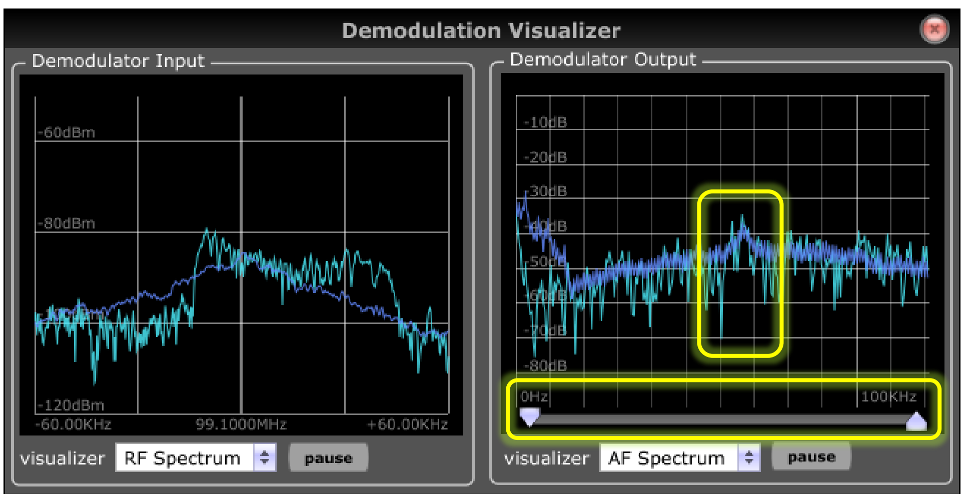
Oscilloscope Time Base Control

The | Audio Oscilloscope Display (AOD) | time base slider bar allows the operator to adjust the horizontal time base.



Audio Oscilloscope | Time Base Control | v1.35xx

The operator can select an | AF Spectrum Display (ASD) | FFT window alongside the real-time RF spectrum or other available FFT windows.



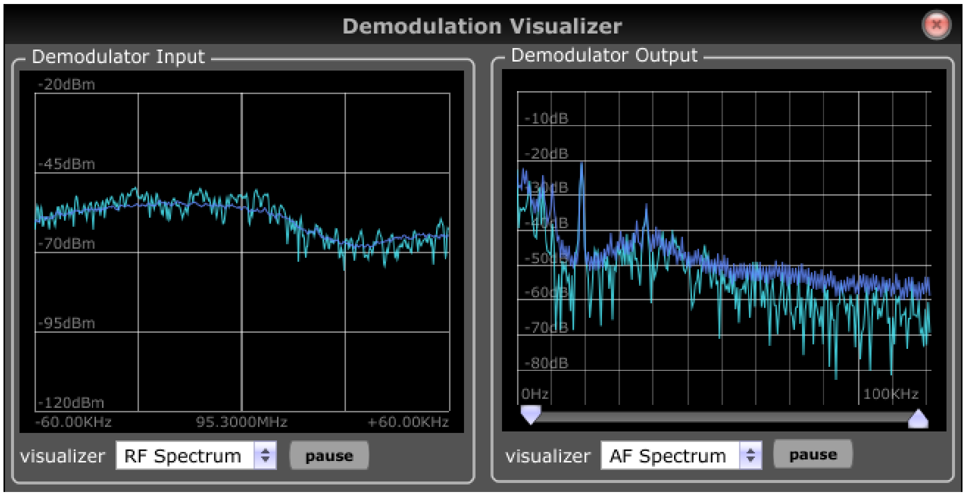
Demodulation Visualizer | v1.35xx

There appears to be Sub-Carrier Audio (SCA) at 64 kHz in the above | AF Spectrum Display (ASD) | example.

The | AF Spectrum Display (ASD) | is currently visualizing an FM broadcast station transmitting in a mono format rather than the more commonly observe stereo format.

The following example illustrates a typical commercial FM broadcast station transmitting a stereo signal.

All of the various signal component sub-carriers are visible on the | AF Spectrum Display (ASD) | FFT window for technical analysis.



Demodulation Visualizer | v1.35xx

Kestrel Wave Recorder (KWR) ™

The Kestrel TSCM ® Professional Software is equipped with an | Audio Record | feature that permits the capture and recording of demodulated audio sample files.

Files are automatically assigned a formatted file naming convention, and saved in the Kestrel Project File (KPF) directory structure.

The ability to record audio-based samples of various analog and / or digital demodulated audio, including the actual room audio from an analog Technical Surveillance Device (TSD), along with any audio acoustic feedback present from any Technical Surveillance Device (TSD) present, is fully supported.

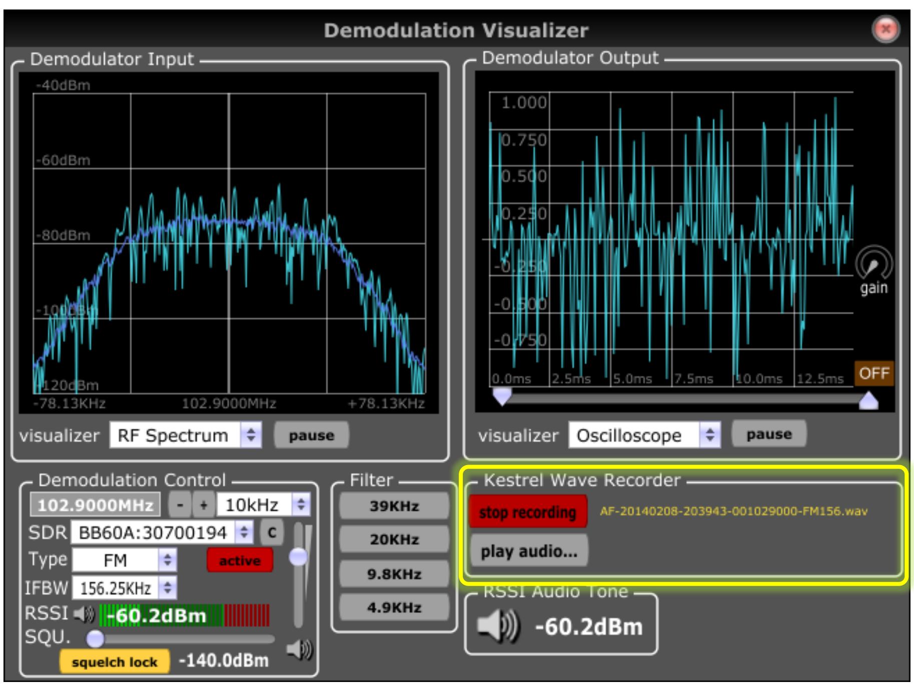
Audio files are saved in | WAV | file format within the default, or current working Kestrel Project File (KPF) ™ directory, and provide the operator with the unprecedented ability to store accurate evidence-based documentation for legal reasons, or training purposes.

The following chart represents the approximate (recording time Vs file size) values for manual event recording.

Kestrel Wave Recorder (Approximate * - Time Vs File Size)	
1 Minute	5.5 MB *
2 Minute	10.9 MB *
3 Minute	16.4 MB *
4 Minute	21.9 MB *
5 Minute	27.4 MB *
10 Minute	54.8 MB *
30 Minute	164.4 MB *
60 Minute	328.8 MB *

Kestrel Wave Recorder (KWR) | v1.35xx

The technical operator can easily build a sample audio signal reference database of any known, new or unidentified audio demodulation characteristics by recording a short audio sample of the signal event.



Kestrel Wave Recorder (KWR) | v1.35xx

The | Kestrel Wave Recorder (KWR) ™ | is activated when the technical operator presses the | RECORD AUDIO | button to automatically start the recording process.

The | RECORD AUDIO | button will display Stop Recording in RED.

Pressing the | RECORD AUDIO | button a second time terminates the record audio function and automatically saves the file in the default or currently selected Kestrel Project File (KPF) project directory.

The audio record feature is available at any time the | Demodulation Visualizer | control group is open, and the demodulation process is active.

The audio record function may be utilized when audio is active, when the MUTE button is active, and when the audio volume control is set at the minimum level.

This allows the technical operator to record audio without the audio being present within the target area, perhaps for security reasons.

A descriptive File Naming Convention (FNC) is automatically generated and will display various coded capture parameters and as observed in the above example image, the following file naming convention is generated and may be decoded by the technical operator.

AF-20120316-184407-000953000-FM120.wav

The File Naming Convention (FNC) may be decoded as follows;

AF = Audio File

20120316 = 2012-032-16 (Date)

184407 = 18:44:07 (Time)

000953000 = 95.3000 MHz (Frequency)

FM = Frequency Modulation (Type)

120 = 120 kHz (IF Bandwidth)

.wav = Waveform Audio Format (File Extension)

The | PLAY AUDIO | button will open a file dialog window and the technical operator is able to navigate, select and open any recorded | Kestrel Wave Recorder (KWR) | files.

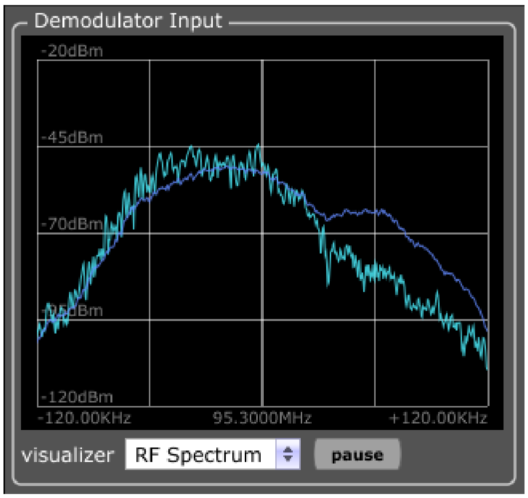
The application utilized a standard | WAV | file format that can be played by any number of third-party audio applications.

Demodulator Input - FFT Windows

The demodulator visualization process allows the technical operator to view a variety of FFT based windows that are directly related to the discrete demodulation and analysis of a Signal of Interest (SOI).

RF Display (RFD) | Real-Time IFBW

During the demodulation process, the operator is able to view a real-time | RF Display (RFD) | based on the Signal of Interest (SOI) Center Frequency (CF) and the default or operator selected Intermediate Frequency Bandwidth (IFBW).



RF Display (RFD) | v1.35xx

The real-time | RF Display (RFD) | may be paused for review, or to assist in screen capture.

The real-time RF Spectrum FFT window displays the demodulated SOI based on the currently set IF Bandwidth (IFBW).

The RF Display (RFD) is the default FFT window on opening the Demodulation Visualizer.

The reference level range can be adjusted utilizing a double mouse click on the ASD display, to re-scale the window to the current MIN / MAX level providing an optimal view.

TIP: The RF Spectrum Display (RSD) reference level and the settings of the Spectrum Display and Activity control group will have an effect on the RF Display (RFD) within the IF Demodulation Visualizer and it is recommended that the operator press the Auto Range button to ensure the optimal reference level in the IF FFT window.

RFD Pause Button

The technical operator may pause the real-time RF Display (RFD) by pressing the | **PAUSE** | button to freeze the display for review or screen capture.

IFBW Vs FFT Window

The following chart represents the IF Bandwidth (IFBW) in (kHz) versus the FFT Window SPAN (kHz) for each of the available wideband and narrowband options.

The chart represents the settings available for the Signal Hound (USB-SA44B / USB-SA124B) search receivers.

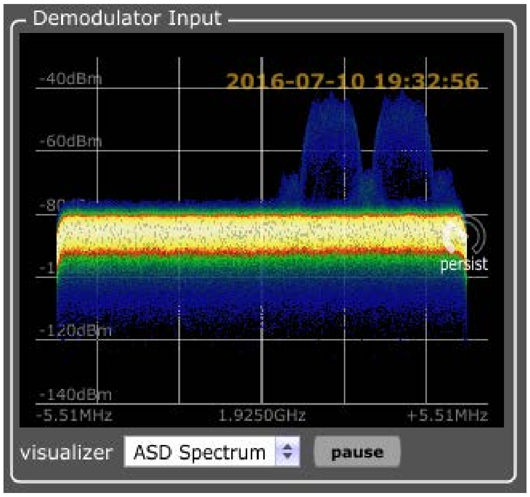
IF BW Vs FFT Window - The FFT Window (kHz) will mirror the IF BW in (kHz)		
IF BW (kHz)	**FFT Window (kHz)**	**Center Frequency (CF)**
240 kHz	240 kHz	120 kHz
120 kHz	120 kHz	60 kHz
60 kHz	60 kHz	30 kHz
30 kHz	30 kHz	15 kHz
15 kHz	15 kHz	8 kHz
7.5 kHz	7.5 kHz	4 kHz

IF Bandwidth | v1.35xx

The technical operator may adjust the IF Bandwidth (IFBW) at any time during the demodulation or signal analysis process.

Audio Spectral Density (ASD)

The ASD display is a real-time Spectral Density FFT display that provides enhanced signal level analysis during the demodulation process.



Audio Spectral Density (ASD) | v1.35xx

The ASD is located within the Demodulation Visualizer control group and can be selected during the demodulation process.

The persistence level is operator variable to attain the optimal display visualization.

Moving the | Persistence Control | to the left results in minimal persistence and moving the control to the right results in maximum persistence.

Moving the | Saturation Control | to the left results in minimal saturation and moving the control to the right results in maximum saturation.

The reference level range can be adjusted utilizing a double mouse click on the ASD display, to re-scale the window to the current MIN / MAX level providing an optimal view.

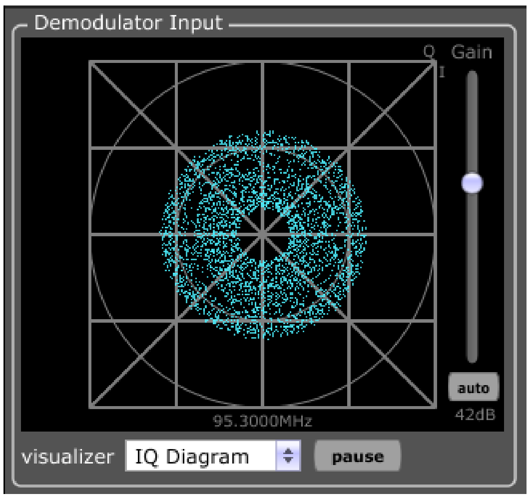
The ability to see potentially interfering signals can be seen with the ASD feature at any available IF bandwidth.

IQ Display (IQD)

During the demodulation process, the technical operator can view a real-time IQ Display (IQD) based on the demodulated Signal of Interest (SOI) Center Frequency (CF) and the automatic capture, or operator selected IF Bandwidth (IFBW).

The current Centre Frequency (CF) is dynamically displayed at the bottom of the IQ Display (IQD) window.

There is an Automatic Gain Control (AGC) feature and the technical operator is also able to manually adjust the gain of the real-time IQ Display (IQD) as required.



IQ Display (IQD) | v1.35xx

The | IQ Display (IQD) | FFT window allows the technical operator to view the "IQ Modulation commonly utilized for various digital processes, where "I" is the "in-phase" component of the waveform, and "Q" represents the “Quadrature” component of the waveform.

IQ Modulation is an efficient way to transfer intelligence or information, and it also works well with various commonly utilized digital formats.

When you modulate a carrier with a waveform that changes the carrier’s frequency slightly, it has both a real and an imaginary part, or an In-phase (I) and a Quadrature (Q) part.

IQD Pause Button

The technical operator may pause the real-time | IQ Display (IQD) | by pressing the | **PAUSE** | button to freeze the display for review or to assist with screen capture.

IQD Gain Control

The operator can manually adjust the gain (sensitivity) of the IQ FFT window utilizing the gain control slider bar.

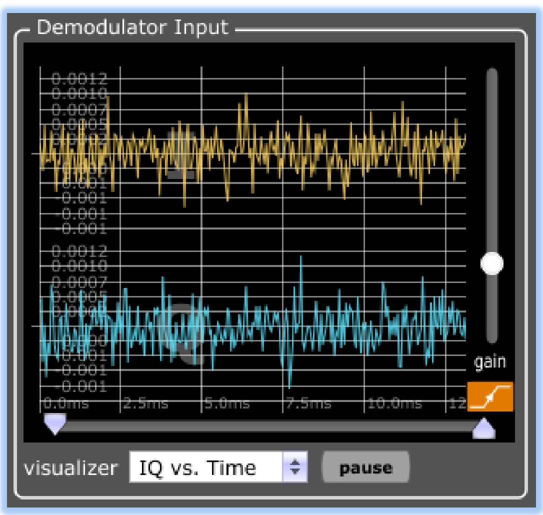
The | IQ Display (IQD) | gain slider control has an active control range from -20 dB to 80 dB and can be adjusted in real-time by the operator.

IQD Auto Range

The | AUTO | range button can be used by the operator to quickly set the | IQ Display (IQD) | to the optimal setting.

IQ Vs Time Plot

The IQ Vs Time Plot separates the | I | and | Q | components and displays the spectrum for each component independently against time.

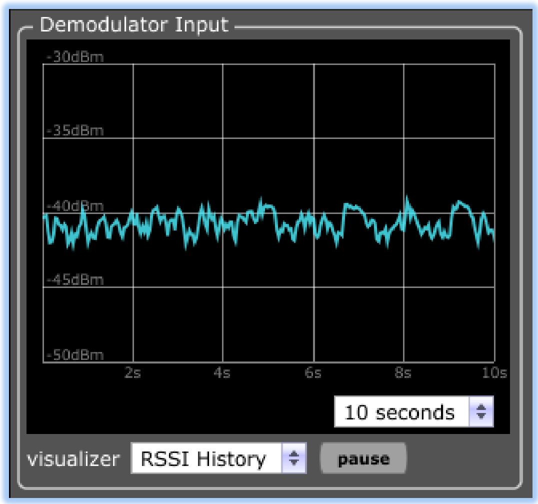


IQ Vs Time Plot | v1.35xx

Controls include the ability to increase or decrease the gain, and invoke up-slope and down-slope triggering.

RSSI History Display (RHD)

The | RSSI History Display (RHD) | FFT window is designed to allow the technical operator to observe the carrier power level for any given SOI as a function of time.



RSSI History Display (RHD) | v1.35xx

The operator can view a real-time | RSSI History Display (RHD) | based on the Signal of Interest (SOI) Center Frequency (CF).

The RHD feature may also be utilized as a simple RSSI signal strength-based direction finder to assist the operator in identifying the precise location of any SOI emitter, or signal source.

Historical Time Base (HTD)

The technical operator may set the RSSI | Historical Time Base (HTD) | for the FFT window to best represent the intended use and viewing preferences.

RSSI Historical Time Base Settings
10 Second
30 Second
1 Minute
5 Minute
10 Minute
30 Minute
1 Hour
2 Hour
5 Hour
10 Hour
24 Hour
48 Hour
72 Hour

RSSI History | v1.35xx

The technical operator can select and display the | Historical Time Base (HTB) | for a 10 Sec, 30 Sec, 1 Min, 5 Min, 10 Min, 30 Min, 1 Hour, 2 hours, 5 hours, 10 hours, 24 hours, 48 hours, and 72-hour windows.

This feature permits the technical operator to visually review and / or analyze signal strength over an extended period of time as long as the FFT Visualizer window remains active.

This feature can be useful in monitoring an unknown emitter, to characterize the device from a power perspective. For example, if the device is battery operated, the power curve should be evident over-time.

This feature is also extremely useful for characterizing RF occupancy and lighting control emissions within the target area, which tend to be intermittent and occupancy triggered.

RHD Pause Button

The | RSSI History Display (RHD) | may be paused for review or to assist with screen capture.

The | RSSI History Display (RHD) | FFT window provides the technical operator with the ability to monitor the RSSI level (dBm) in real-time or over an extended period of time.

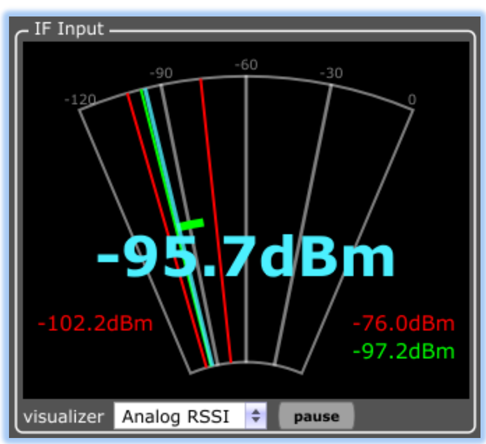
The FFT window can display as short as 10 seconds of RSSI values or up to 72 hours of RSSI values, currently the data will reset, if the FFT window is closed.

The RSSI history FFT can be utilized for localizing a potentially hostile signal source or emitter within the target area in a walk-about mode, while monitoring the RSSI History Display (RHD).

Analog RSSI Display (ARD)

The | Analog RSSI Display (ARD) | allows the technical operator to view the current RSSI level as well as the Minimum, Maximum Peak values, and limits in dBm.

The current signal event level is displayed in dBm and is large enough to be observed from across the room to facilitate walk-about signal localization techniques.



Analog RSSI Display (ARD) | v1.35xx

ARD | Pause Button

The | PAUSE | button can be utilized to freeze the display to assist in screen capture or analysis.

ARD | Digital Display Level (dBm)

There is a large digital amplitude display overlay within the Analog FFT window to allow the signal level (dBm) to be directly observed by the technical operator from a distance when utilizing the Signal Hound ™ search receiver or other supported analyzer in a walk-around direction finding mode.

ARD | Min / Max Level (dBm)

The Analog RSSI FFT window is a simple analog RSSI meter display that indicates and locks the Minimum signal and Maximum signal levels.

The current instantaneous real-time signal level is displayed along with a Digital RSSI Indicator for precise analysis in an easy to read format.

ARD | Average Level (dBm)

The Signal of Interest (SOI) Average RSSI level in dBm is also displayed for reference purposes.

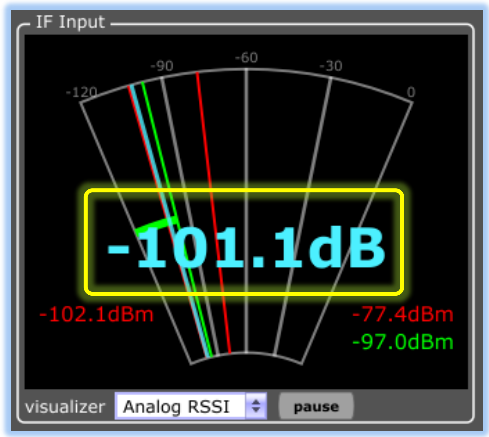
Active Signal Trending (AST) ™

The AST feature is an active graphical overlay that is co-located within the | Demodulation Visualizer control group | Analog RSSI Display (ARD) | and includes a powerful | Dynamic Trending Indicator (DTI) ™ | that provides immediate visual feedback to the technical operator as to the RSSI trend during walk-about direction-finding requirements.

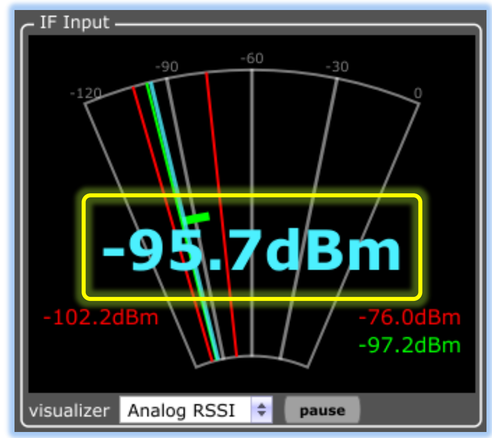
The ability to quickly determine whether the RSSI trending is weaker (negative), or stronger (positive) allows the technical operator to determine the emitter location visually, with absolute precision.

The amplitude (dBm) of a Signal of Interest (SOI) is often difficult to determine when only the RSSI levels are available, given rapid variation is received signal levels.

The | Dynamic Trending Indicator (DTI) ™ | provides the necessary feedback as to the amplitude trend of the SOI in real-time.



RSSI | Trending Display | v1.35xx



RSSI | Trending Display | v1.35xx

The ability to utilize the Kestrel TSCM ® Professional Software as an advanced, signal level RF locator minimizes the requirement for a separate broadband detector, by providing the | Minimum Signal Level | Average Signal Level | and | Maximum Signal Level | within a single | Analog RSSI Display |, as part of the real-time bandwidth, IF Input.

The | RSSI Tone Locator (RTL) ™ | is available, along with live demodulated audio of the emitter, as well as a | Digital RSSI Display | and a | Dynamic Trending Indicator (DTI) |.

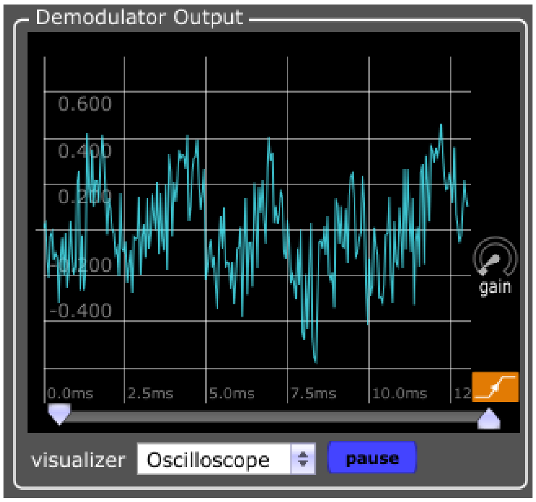
Additional advanced features include the | Kestrel Wave Recorder | and perhaps the most important feature, is the | IQ Record |, and | IQ Playback | capability.

The | Image Capture Tool (ICT) | can be invoked by the operator to capture a screen shot of the | Demodulation Visualizer | window, however, capturing an IQ sample provides the ability to playback the actual signal, as if it were a live OTA broadcast.

When utilized with the KestrelPrey III | Advanced RF Locator and the Kestrel Log Periodic (KLP) directional antenna, the technical operator can transition from desktop collection to walk-about direction finding, immediately, on the same primary equipment resource, already setup within a runtime environment.

Audio Oscilloscope Display (AOD)

The | Audio Oscilloscope Display (AOD) | feature provides the technical operator with the ability to visualize the demodulated audio content of the currently selected SOI, and provides the necessary Digital Signal Processing (DSP) and advanced filtering required for many of the analog and digital signal analysis functions associated with the Demodulation Visualizer control group.



Audio Oscilloscope Display (AOD) | v1.35xx

Audio Oscilloscope Display (AOD) is an important feature that provides the technical operator with the ability to visually identify and compare the presence of audio activity, by stimulating induced room audio, to determine if analog room audio is present within the demodulated audio of the currently selected Signal of Interest (SOI).

AOD | Pause Button

The technical operator can pause the AOD window, utilizing the | PAUSE | button to assist in capture utilizing the Image Capture Tool (ICT), or visual analysis.

Demodulation Control | Active Button

The demodulation control group is located on both the sidebar control group and within the Demodulation Visualizer control group.

The | ACTIVE | button allows the technical operator to cycle the demodulator ON and OFF without the need to access the Demodulation Visualizer.

The button is GRAY when the demodulator is disabled and the software will actively sweep the ROI or will resume sweeping the ROI when actively set to do so.

During | Single Receiver Operation (SRO) |, when the | Active | button is pressed, the current sweep process is paused and the demodulation process is active.

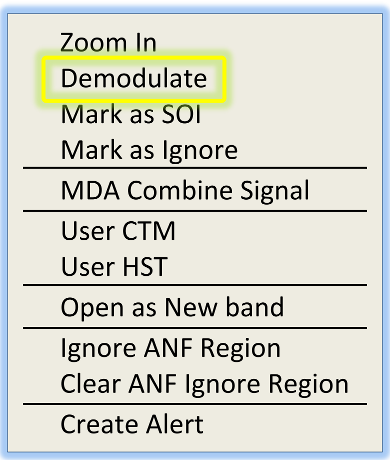
The demodulator button turns RED indicating that the demodulator is currently running and the sweep status display will indicate "Demodulator Running" and will display the current Center Frequency (CF) and IF Bandwidth (IFBW) of the demodulated SOI.

SOI Selection and Demodulation

There are several methods available for selecting a specific SOI for active demodulation, within the application.

The operator can initiate a left mouse click, hold and drag a shaded box over the | RF Spectral Display (RSD) | to select a specific SOI.

Once a signal event is selected, the operator releases the mouse hold and an option dialog box will appear on the screen.

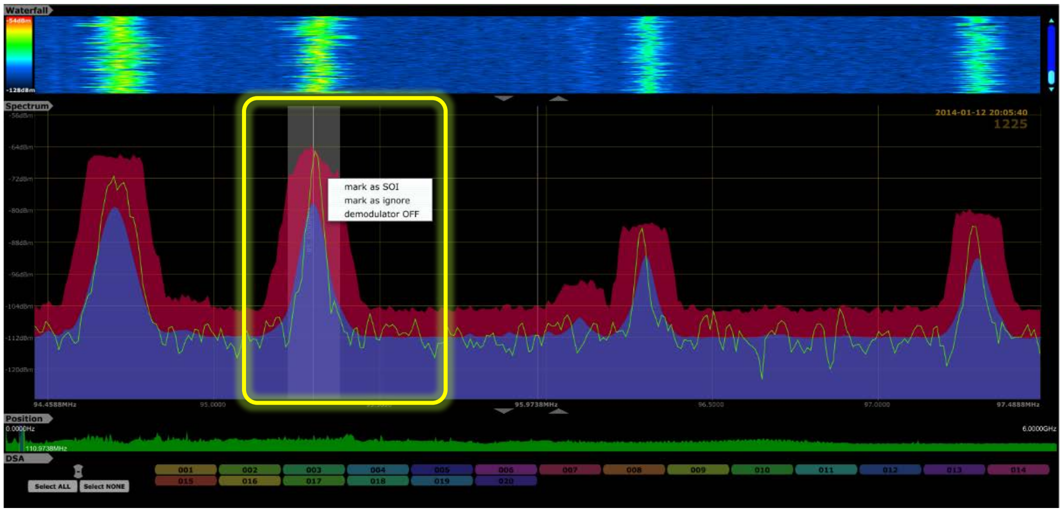


RSD Menu | v1.40xx

The operator can select the | Demodulate | option directly from the right mouse click menu list.

This method can be utilized for any SOI that is not already on the | Automatic Threat List (ATL) | and double mouse clicking on the gray demodulation shading overlay, can be used to quickly, enable and disable the demodulation control.

The technical operator can also use this method to first mark any signal event as a Signal of Interest (SOI) and enter the frequency on the SOI signal list by selecting the "Mark as SOI" menu option.



Demodulation Marker Menu | v1.35xx

Drag and Drop Technology (DDT)

Another unique method of demodulating a Signal of Interest (SOI) that is currently displaying on any of the | Automatic Threat Lists (ATL) | is to simply utilize the Kestrel TSCM ® Professional Software | "Drag-and-Drop" Technology (DDT) | to select and drag any frequency entry directly to the demodulation control group.

The demodulation process will begin immediately at the end of the current sweep cycle (if currently sweeping) or immediately when the sweep is currently paused.

Frequency Input Box (kHz) (MHz) (GHz)

When the technical operator has selected a SOI directly from the Graticule or has utilized the "Drag-and-Drop" feature, the frequency of the demodulated signal as entered or captured will be displayed within the frequency input box.

Demodulator Control Group | v1.35xx

The technical operator can manually adjust the demodulation frequency once entered or captured, utilizing the frequency input box as another control method when working with the demodulator.

TIP: The initial frequency value is that of the actual frequency captured and may or may not be the precise CF frequency of a SOI channel allocation. The technical operator can edit the frequency to adjust the CF if deemed necessary during the demodulation process. For example, if the frequency for a local FM broadcast station is captured and displayed has 102.8964 MHz the operator may manually adjust the frequency to 102.9000 MHz to achieve a better RSSI level and demodulation audio quality, if desired.

The "default" demodulation center frequency value whenever the application is first started, is 100.000 MHz.

This value will remain until changed by the technical operator manually or utilizing the "Drag-and-Drop" feature.

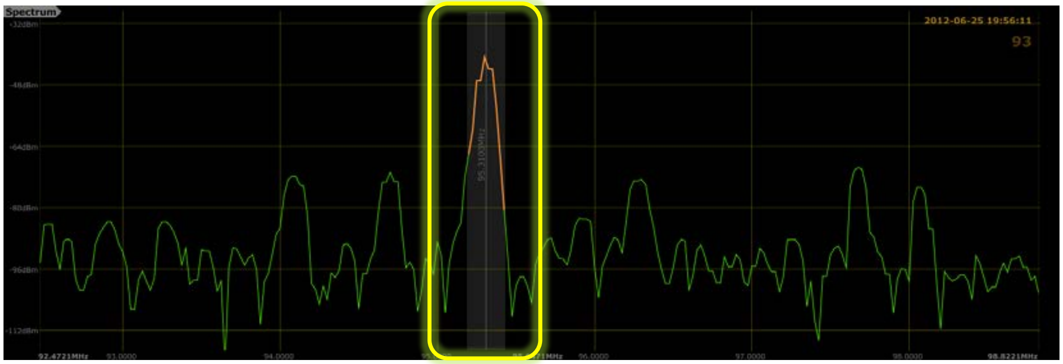
The demodulation process is an essential TSCM ® specific function, as it relates to the identification and verification of friendly or potentially hostile signal events.

The design and structure of the Kestrel TSCM ® Professional Software demodulator control group is an integral part of our advanced workflow management strategy.

To enhance technical operator situational awareness, the current demodulation Center Frequency (CF) is displayed on the | RF Spectrum Display (RSD) | as a light (Gray) shaded display marker, equal to the default, or currently set IF Bandwidth (IF BW).

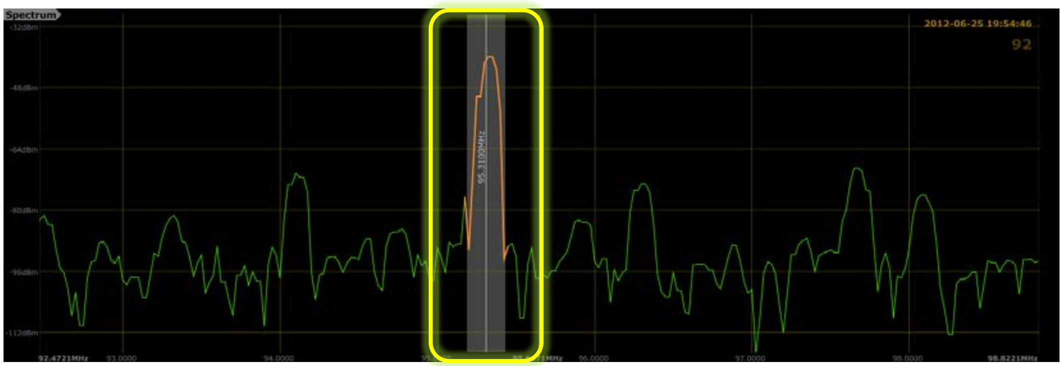
The following image illustrates "standby" demodulation as evidenced by the light (Gray) shading, along with the demodulation Center Frequency (CF).

The (Orange) display marker flag indicates that the technical operator has manually selected this signal event as a Signal of Interest (SOI).



Control Group | v1.35xx

The following image illustrates "active" demodulation as evidenced by the dark (Gray) shading, along with the demodulation Center Frequency (CF).



Control Group | v1.35xx

The (Orange) display marker flag in the above image; indicates that the technical operator has manually selected this signal event as a Signal of Interest (SOI).

Demodulation Frequency Control (DFC)

The demodulated Center Frequency (CF) may be adjusted by the technical operator utilizing the | **+** | **-** | frequency step control buttons and the decimal / digit value selection option box.

This allows the technical operator to setup the demodulator on once channel allocation and step (or tune) to the next channel allocation as is the case in the FM broadcast band, utilizing fixed 200 kHz channel spacing in North America.

Any combination of step frequency tuning is available utilizing the various step options available.

Frequency Step Adjustment Reference Chart	
000.0000	100 MHz Step | **+** | **-** |
000.0000	10 MHz Step | **+** | **-** |
000.0000	1 MHz Step | **+** | **-** |
000.0000	100 kHz Step | **+** | **-** |
000.0000 *Default*	10 kHz Step | **+** | **-** |
000.0000	1 kHz Step | **+** | **-** |
000.0000	100 Hz | **+** | **-** |

Demodulation Frequency Step | v1.35xx

This frequency control ability allows the technical operator to select a fixed step when working a known ROI such as the commercial FM broadcast band in a monitoring mode.

The technical operator can for example set the CF on a precise known channel and then set the STEP to 100 kHz.

The technical operator will be able to utilize the | **+** | **-** | buttons to step up or down to the next or previous CF by pressing the | **+** | **-** | button twice to achieve 200 kHz channel spacing, for the commercial FM band allocation.

The technical operator may also wish to review the guard band region selecting a 10-kHz step option, requiring 20 button presses to reach the CF of the next channel allocation.

This allows any signals between channel allocations to be checked for analog audio or telltale signs of the presence of a digital signal.

Manual Demodulator Operation

There are many operator centric methods to navigate, activate and utilize the demodulator functionality.

For example, the technical operator can manually enter the desired frequency of interest into the frequency input box located on the sidebar demodulation control group or within the demodulation visualizer while operating in the RF capture mode.

TIP: It is important to note that the Kestrel TSCM ® Professional Software can also be operated in an independent Communication Receiver Mode (CRM) without setting up a Kestrel Project File (KPF).

The technical operator simply enters the precise centre frequency, modulation type and the desired IF bandwidth.

Once these three (3) control groups are populated, the demodulator control button will indicate as ready and the CF + BW shading appears on the RF Spectrum Display (RSD) Graticule for the specific Signal of Interest (SOI).

This functionality assumes that the Positional Zoom Control (PZC) is adjusted to ensure that the CF of the SOI is currently displayed on the Graticule.

The technical operator is also able to utilize the STEP control for precise signal and frequency identification while still operating in RF capture mode.

This permits the technical operator to immediately activate the demodulator and or visualizer immediately for any anticipated periodic signal event that may be occurring in the ambient spectrum.

Audio Volume Control Slider

The demodulator includes an integrated audio level control and mute button.

This is an independent control that is separate from the host computer audio stream.

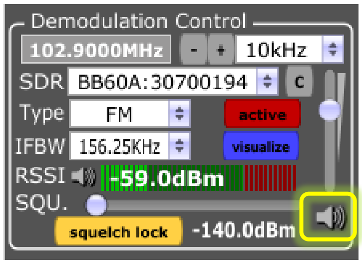
However, the host computer audio must be properly working and active; and it is recommended that the technical operator set the host computer audio control to 100 % and then utilizes the demodulation control group audio slider bar from within the application to control the audio output level from within the application.

It is essential that the technical operator review the mixer settings on the host computer to ensure the various setting are optimal and correct.

The Kestrel TSCM ® Professional Software does not control or over-ride the host computer audio during the installation or application start-up and therefore the correct settings are the responsibility of the technical operator.

Mute Button

Pressing the | **MUTE** | button does not mute the host computer audio and will only affect the demodulated audio within the Kestrel TSCM ® Professional Software.



Demodulator Control Group | v1.35xx

There are two (2) speaker buttons within the demodulation control group, the first is the RSSI Tone located on the left side of the control and the Mute (highlighted above).

The Kestrel TSCM ® Professional Software audio is currently not active in the above example as the Mute button is grayed out.

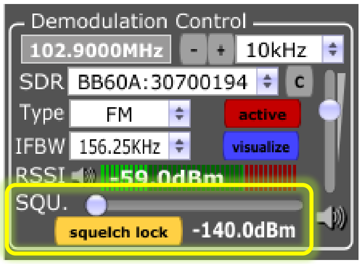
Pressing the | Mute | button a second time will activate the demodulated audio output stream.

Demodulator Control Group | v1.35xx

This unique design feature allows additional advanced sound functionality to be utilized in conjunction with the Kestrel TSCM ® Professional Software application.

Squelch Control Group

The | SQUELCH | control is co-located as part of both the sidebar demodulation control group and | Demodulation Visualizer | control group.



Squelch Control Group | v1.35xx

The | SQUELCH | control consists of a Squelch Threshold Slider Bar, Squelch Lock Button and Squelch Status Display indicator.

Squelch is often utilized to monitor intermittent or periodic signal events or channels, by preventing active audio (white noise or static) when a periodic or intermittent Signal of Interest (SOI) is not currently active.

The squelch control Slider Bar allows the technical operator to set the squelch control threshold at any level from the Ambient Noise Floor (ANF) from -140 dBm to 0 dBm.

Only active signal events that exceed the current or default squelch setting will result in active audio output.

When the technical operator exits the demodulation mode for any reason, the squelch control will | AUTO RANGE | to -80 dBm, ready for the next demodulation event.

The | SQUELCH CONTROL LOCK | button prevents the squelch setting from returning to the default value when the demodulator mode is exited for any reason during runtime.

The Squelch Status Display will display the default or current squelch setting and display as a GOLD background whenever squelch is currently active, preventing audio output.

Known Sound Source (KSS)

Advanced capability exists within the Kestrel TSCM ® Professional Software audio processing configuration and the host computer may be utilized to play a Known Sound Source (KSS) simultaneously along with the software demodulation function on demand.

This unique functionality allows the technical operator to utilize the host computer audio channel to output audio continuously, with the objective of activating Voice Operated Switch (VOX) devices, utilizing a technical operator selected Known Sound Source (KSS) audio file.

The Chirp Threat Mode (CTM) will actively over-ride the KSS audio when the Kestrel TSCM ® Professional Software, Threat Detection Algorithm (TDA) is running.

Digital RSSI Signal Strength Bar Graph (dBm)

The digital RSSI meter displays the current RSSI value of the demodulated Signal of Interest (SOI).

The current RSSI level may be utilized as a reference for comparative purposes or may be utilized for signal source localization in a direction-finding mode.

RSSI Locator Tone (RLT)

The | RSSI Locator Tone (RLT) | feature is an independent; amplitude based variable audio tone source that can be utilized during the audio demodulation process, or independently, when the demodulated audio mute or squelch control is active, to assist in the localization of near-field signal sources.

The | RSSI Locator Tone (RLT) | is a sophisticated RSSI signal source location tool with an amplitude sensitive audio tone alert and several different visual display options that provide technical operator with real-time feedback in the way of FFT Visualizer windows.

The ability of the technical operator to dynamically alter the IF sensitivity (IF sub-system) and the attenuation level, provides an excellent RSSI based walk-about direction-finding capability.

Demodulator Control Group | v1.35xx

When the | RSSI Locator Tone (RLT) | is selected, a variable amplitude-based audio tone is produced on the host computer speakers or externally connected speakers or headphones.

The audio pitch varies with the SOI amplitude (dBm) referred to as the Relative Signal Strength Indicator (RSSI) and provides both a Visual RSSI Meter and a varying Audio

Tone, consistent with the SOI signal strength as the technical operator moves about the target area.

The RSSI Tone provides the operator with the ability to pinpoint the source of the emission within the target area, once a hostile signal is suspected or identified.

In-fact, the RSSI Tone feature can be utilized to precisely pin-point the location of friendly signal sources as well, which is often the case with a wide variety of legitimate wireless devices that may be operating within the target area.

The technical operator can utilize a Yagi or Log-Periodic directional antenna to help pin-point the source of the emitter within the target area, or even confirm that the signal source is outside of the target area.

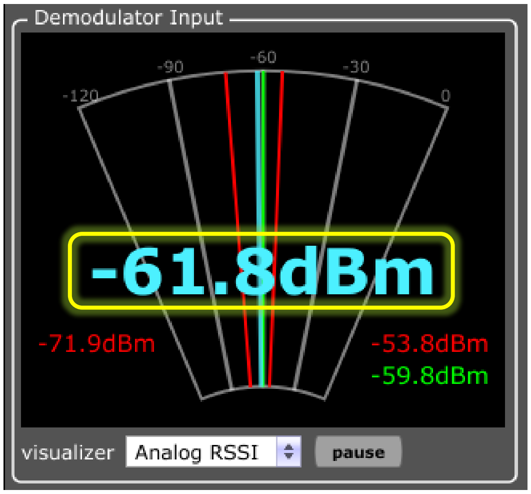
The RSSI Tone provides an audible, amplitude-based detection ability for the SOI when the Kestrel TSCM ® Professional Software is deployed in a basic direction-finding configuration.

Analog and digital (RF) based Technical Surveillance Devices (TSD) exhibiting continuous signal propagation can be easily located utilizing the Signal Search Mode – RSSI Tone feature.

Our | RSSI Locator Tone (RLT) | is unique in that the technical operator can monitor the demodulated target area analog room audio for any given Signal of Interest (SOI) and overlay a variable (amplitude controlled) RSSI Locator Tone (RLT) for maximum technical operator interaction and take to advantage of any acoustical feedback from the suspected Technical Surveillance Device (TSD) audio simultaneously.

The technical operator can utilize the | Analog RSSI Display (ARD) | along with the | RSSI Locator Tone (RLT) | to aid in emitter localization.

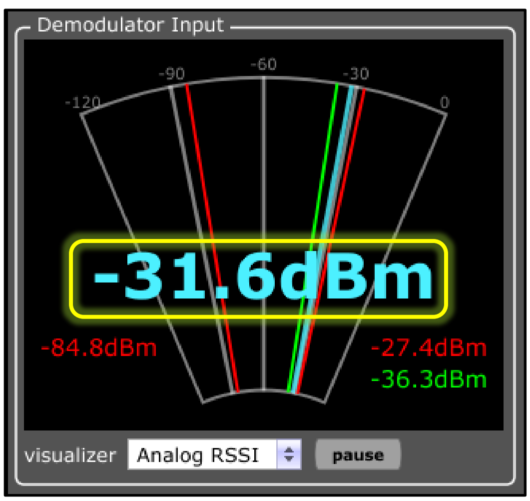
Consider the following example, as an elementary lesson in utilizing the Kestrel TSCM ® Professional Software to locate a typical low power Technical Surveillance Device (TSD) transmitting within the target area.



Analog RSSI Display (ARD) | v1.35xx

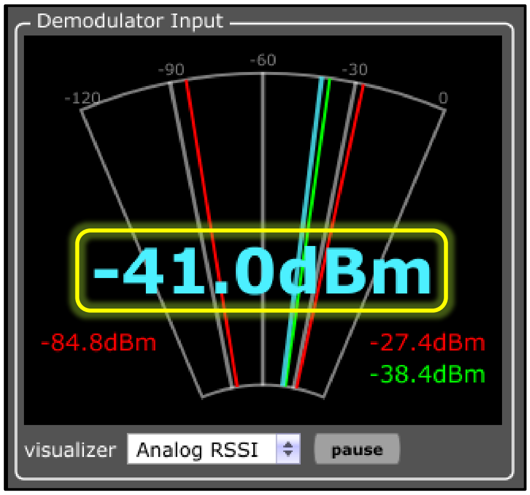
The technical operator has activated the | RSSI Locator Tone (RLT) | and is viewing the | Analog RSSI Display (ARD) | to monitor the RSSI level of the Signal of Interest (SOI).

The current RSSI level is -61.8 dBm at the technical operator's current position within a large corporate boardroom as illustrated in the above example.



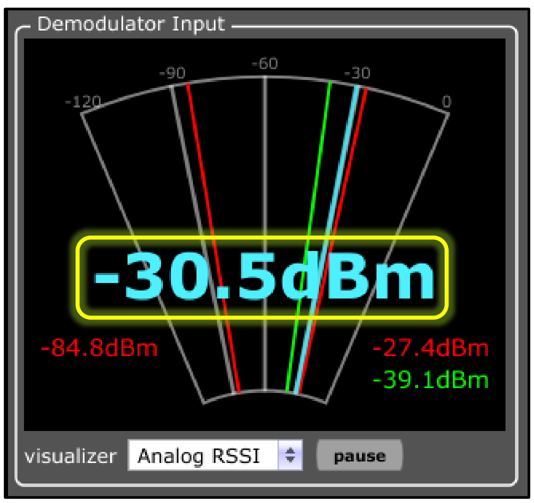
Analog RSSI Display (ARD) | v1.35xx

As the technical operator continues to move toward the opposite end of the boardroom, the RSSI level is observed to increase to -31.6 dBm indicating a 30.2 dB increase in the RSSI level as demonstrated in the example above.



Analog RSSI Display (ARD) | v1.35xx

As the technical operator continues to move toward the opposite end of the boardroom, the RSSI level is observed to decrease to -41.0 dBm indicating a 9.4 dB decrease in the RSSI level as demonstrated in the example above.



Analog RSSI Display (ARD) | v1.35xx

As the technical operator moves back toward the middle of the corporate boardroom, the RSSI level is observed to increase to -30.5 dBm indicating a 10.5 dB increase in the RSSI level and determined to be the actual location of the Technical Surveillance Device (TSD).

The ability to visually observe the RSSI level and utilize the RSSI Locator Tone (RLT) feature is a powerful and effective means of locating the precise location of any RF transmitters operating within the target area.

These visual and audible control elements may also be utilized together or totally independently.

The RSSI Tone responds to variations in signal strength (Low tone = Low RSSI) and (High tone = High RSSI).

When the technical operator is working in the near-field zone in a direction-finding capacity, the RSSI levels will eventually saturate the receiver or analyzer and the FFT visual indicators will likely display erroneous signal level information as the receiver saturates.

The software supports the ability to dynamically alter the IF Sensitivity and the hardware Attenuator during runtime.

When the signal level saturates the receiver, the technical operator can add Attenuation, decrease the IF Sensitivity, or both as may be required to minimize or prevent saturation.

It is recommended that the technical operator add steps of attenuation as receiver saturation becomes evident or is suspected as the walk-about search progresses.

This process will assist the technical operator in maintaining useable FFT visualization and RSSI values during the search.

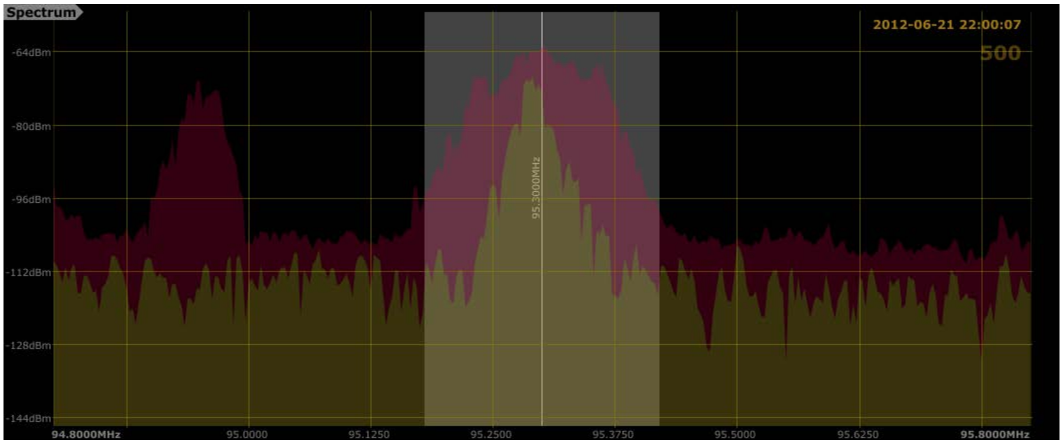
RF Spectrum Display (RSD) DEMOD Shading

The current Centre Frequency (CF), entered or displayed in the Demodulation control group is also represented on the RSD during runtime as a GRAY shaded area equal to the operated defined or default IF BW, whenever the frequency is within the current RF Spectrum Display (RSD) window.

The GRAY shaded area displays the IF BW based on the CF for the AM and FM demodulators.

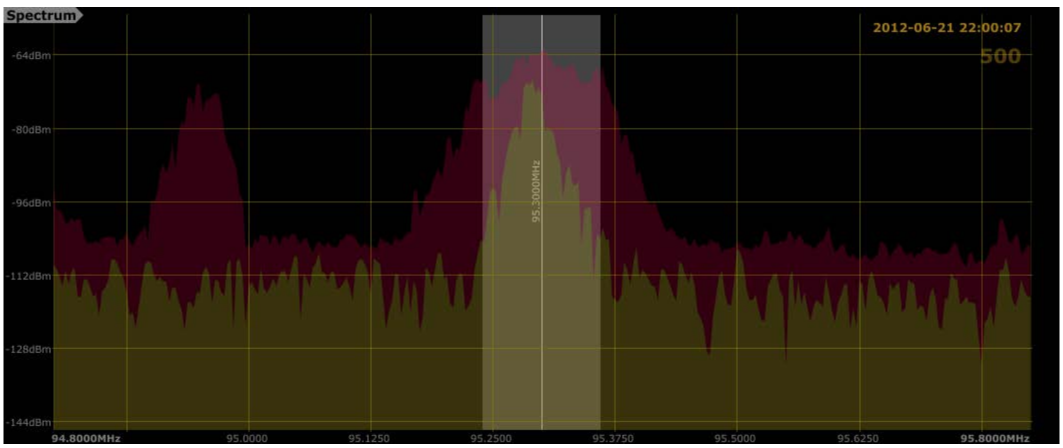
For the LSB and USB the GRAY shaded area represents half of the IF BW and displays the shift on the RF Spectrum Display (RSD).

The following images illustrate the Frequency Modulation (FM) and Amplitude Modulation (AM) shading for the (240 kHz) and (120 kHz) IF Bandwidths.



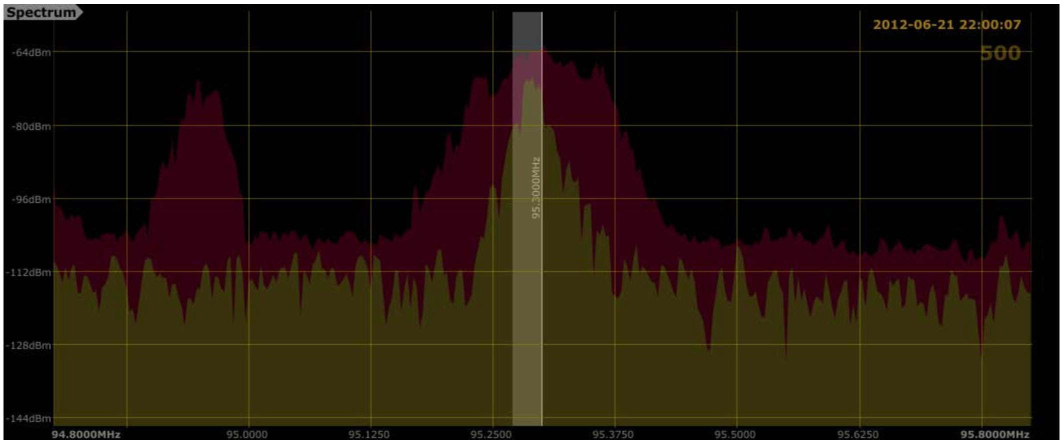
240 kHz (FM / AM) DEMOD Shading | v1.35xx

The Centre Frequency (CF) is displayed on the RF Spectrum Display as a reference along with a CF marker line.

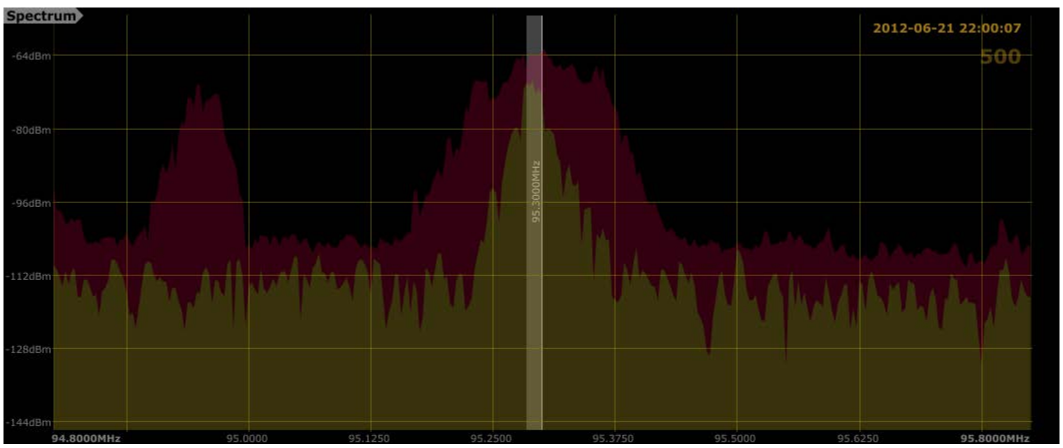


120 kHz (FM / AM) DEMOD Shading | v1.35xx

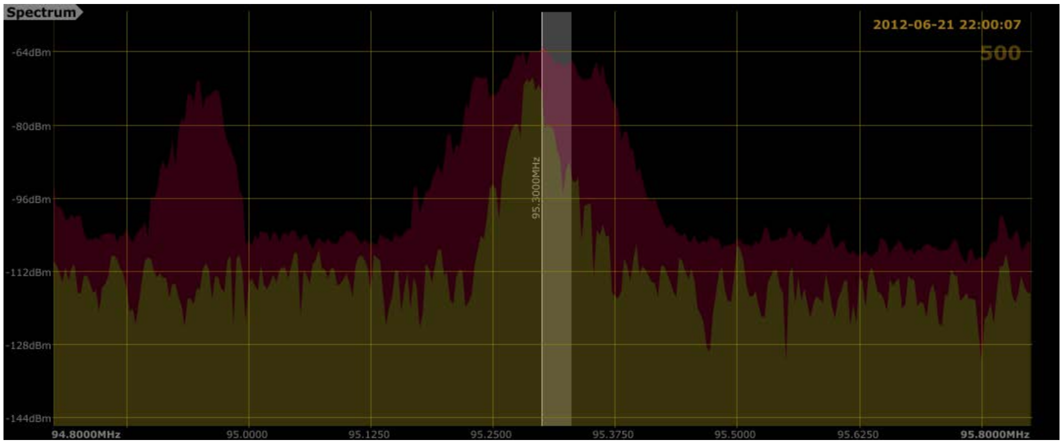
The following images illustrate the Lower Side Band (LSB) and Upper Side Band shading for the (60 kHz) and (30 kHz) IF Bandwidths.



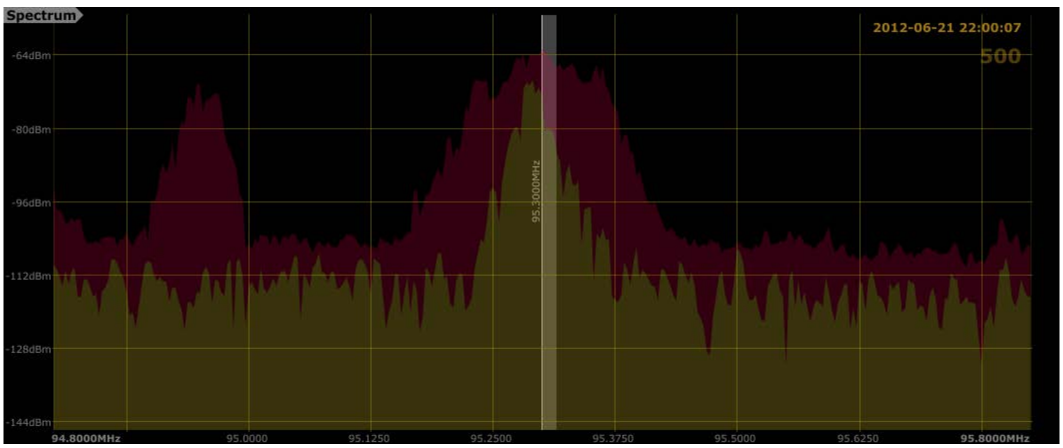
60 kHz (LSB) DEMOD Shading | v1.35xx



30 kHz (LSB) DEMOD Shading | v1.35xx



60 kHz (USB) DEMOD Shading | v1.35xx



30 kHz (USB) DEMOD Shading | v1.35xx

Kestrel IQ (KIQ) ™ | Operational Overview

The Kestrel IQ (KIQ) ™ feature is a very powerful professional level capability that permits the technical operator to capture | Periodic | or | Continuous | analytical IQ samples, for playback or exported analysis.

The technical operator can manually capture IQ samples from within the demodulation visualizer control group, or automate the capture process with triggered IQ samples, utilizing an optional, Automatic Export Control (AEC) ™ | OPT AEC module.

IQ data is a true representation of the captured signal event in every respect, permitting the signal to be played back, processed and analyzed as if it were live.

The term IQ refers to the | IN-PHASE | and | QUADRATURE | signal level components, when discussing IQ modulation, capture, recording and playback capability.

Signal level IQ can be difficult to analyze, for example, the measurement of the amplitude of a signal, when the peak value only momentarily can be observed.

Even in the simplest of signal events, the actual peak power (amplitude) may appear at 0°, 180°, 360° momentarily depending on the period and to make it even more difficult, the signal contains a positive and negative frequency, which exhibit the same apparent signal characteristics.

When the technical operator utilizes IQ data, the result is that we are no longer limited to the measurement of a 2-dimension plot, and we now see the signal in 3 dimensions.

The "I" is in fact a 2-dimensional projection of the signal, if we look from the side, similar to what we see on an oscilloscope.

The "Q" is what we see if we look at the signal from above, we see a relatively similar rendering, with the exception that there is now a 90° difference in phase.

In the example above, the time axis is counter-clockwise, meaning that the frequency is positive, however, where the rotation is clockwise, we would still see the same "I" projection, but the "Q" will now represent a negative frequency.

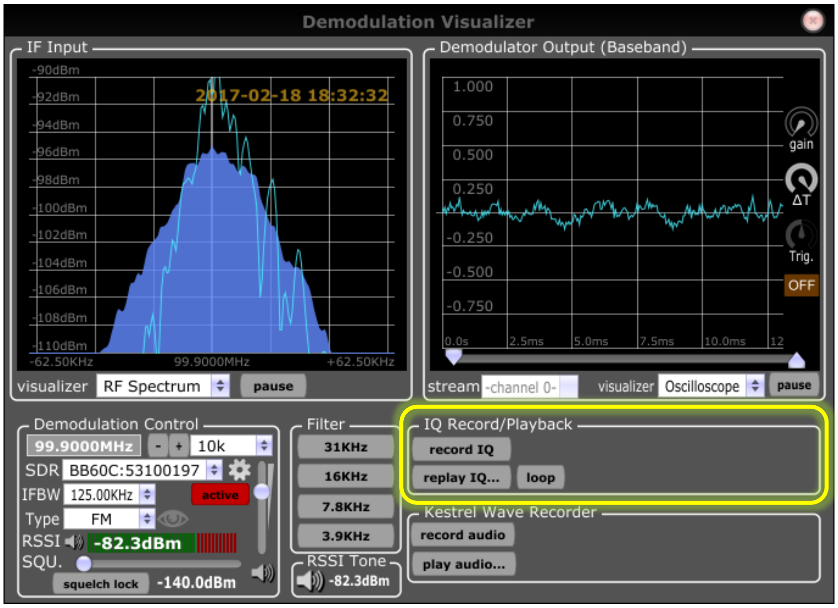
Kestrel IQ | Recording (KIQ | CSV | WAV)

The ability to manually record IQ samples is fully supported as a standard included feature, allowing the technical operator to | RECORD IQ | to our proprietary | KIQ | file format or other industry standards | CSV | WAV | file formats.

Recording IQ allows a Signal of Interest (SOI) event to be precisely captured, processed and rendered for real-world playback and detailed analysis.

This process is accomplished by activating the demodulation feature at the desired receiver Centre Frequency (CF) and IFBW of the Signal of Interest (SOI), within the Demodulation Visualizer control group.

The ability to monitor the live demodulated signal is fully supported during the IQ capture process.



IQ Record and Playback | v1.34

The current configuration provides three (3) IQ recording options from within the Demodulation Visualizer control group.

When the | RECORD IQ | button is pressed, a selection menu is presented with the option to | RECORD BINARY (KIQ) |, | RECORD (CSV) | and | RECORD (WAV) |.

Depending on the requirement, the operator can choose a quick select option of | 1 Sec | 2 Sec | 5 Sec | 10 Sec | 20 Sec | 60 Sec | or | CONTINUOUS | as an IQ sample recording time in any of the three (3) IQ recording formats.

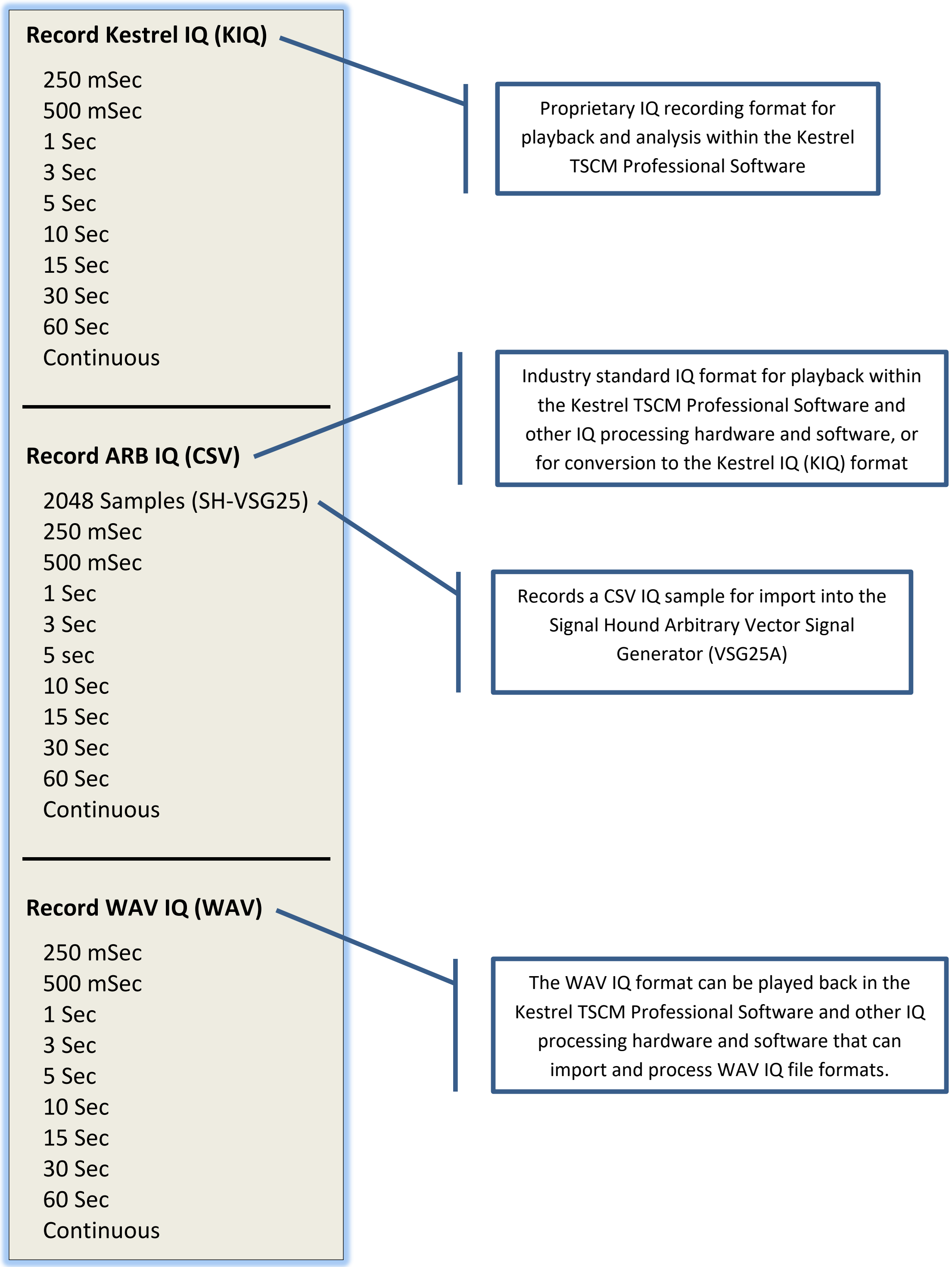
Selecting the desired recording option, immediately invokes runtime IQ recording based on the selected parameters, and begins the capture and write process to the Kestrel Project File (KPF) | IQ Directory |, unless the location has been changed by the operator.

The File Naming Convention (FNC) is automatically generated and optimally formatted for logical file storage in the following | FNC | format;

| IQF-20160630-083312-008612875-IFBW30.KIQ |

In decoding the illustrated example, the operator can determine the recording parameters | IQF (IQ FILE) | 20160630 (DATE | YEAR MONTH DAY) | 083312 (TIME | HOURS MINUTES SECONDS) | 008612875 (CENTER FREQUENCY (CF) | MHz) | 30 (IF BANDWIDTH) | kHz | KIQ | (Capture File Format).

| IQF-20160630-083312-008612875-IFBW30.CSV |



IQ Formats | v1.40xx

In decoding the illustrated example, the operator can determine the recording parameters | IQF (IQ FILE) | 20160630 (DATE | YEAR MONTH DAY) | 083312 (TIME | HOURS MINUTES SECONDS) | 008612875 (CENTER FREQUENCY (CF) | MHz) | 30 (IF BANDWIDTH) | kHz | CSV | (Capture File Format).

Kestrel IQ | Playback (KIQ | CSV | WAV | XML)

There is a built-in IQ playback capability within the software that allows runtime play back of IQ file samples, without interrupting the active collection process.

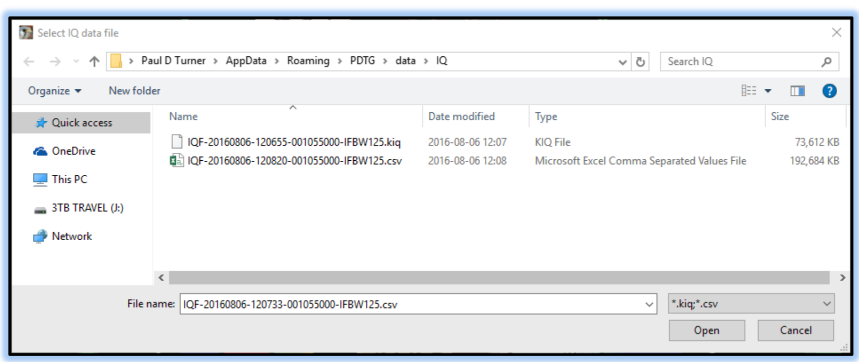
In-fact, no radio hardware is required for IQ playback.

This powerful feature provides the technical analyst with the ability to immediately play back sample IQ files from within the current runtime project, or from historical files in | KIQ |, | CSV | or | WAV | XML | file formats.

The | XML | format support allows playback of Signal Hound Spike Software IQ samples providing the | IQ | and | XML | files are located in the same directory.

The ability to import supported IQ files such as | IQ XML | is also possible and we have included a utility to convert | CSV | files to our proprietary | KIQ | file format for more efficient playback, and file size reduction over the larger | CSV | file format.

The ability to sub-sample during playback of | KIQ | files and | CSV | files when converted to | KIQ | file format, utilizing the build in file converter utility is also supported.



IQ File Management | v1.40xx

During playback of IQ files, the operator or analyst can alter the | Mode (Type) | across all available demodulators | AM | FM | SSB (USB / LSB) | in real-time.

During playback, the center frequency is demodulated at the recorded IFBW selected by the operator during the recording process can be monitored and all FFT windows are displayed in a real-world signal environment.

Kestrel IQ | Repetitive Playback Loop

The ability to repetitively | LOOP | the playback process allows the technical operator to effectively loop the IQ file for continuous analysis.

This is particularly useful during the playback of short IQ files that would otherwise need to be opened for playback multiple time during the analysis cycle.

The loop function is activated by pressing the | LOOP | button.

The | LOOP | button can be enabled before selecting the IQ file for playback.

Kestrel IQ | Slider Bar

During active playback of an IQ sample file, a positional slider bar indicates the current playback position in real-time.

The operator can manually drag the slider bar backward and forward to alter the position of the playback file.

Kestrel IQ | Sub-Sample (Start | Stop) Tabs

During IQ playback the technical operator can loop the playback of the IQ sample and adjust a | START | and | STOP | time control tab to generate a shorter time-based sub-sample loop of a longer playback file.

The operator can dynamically adjust the | START | STOP | positioning to time-isolate Signals of Interest (SOI) contained within the larger IQ file sample.

When working in a sub-sampled playback mode, it is possible to save the sub-sample potion of the file as a new | KIQ | file.

In the event the technical operator utilized the | CSV IQ | format, the IQ File Converter Utility can be first used to concert the | CSV | to | KIQ | in order to utilize this advanced IQ handling process.

Kestrel IQ | CSV to KIQ | Conversion Utility

The ability to convert | CSV | to | KIQ | file format is fully supported when the technical operator attempts to open a | CSV | file.

The technical operator can either select convert to | KIQ | or simply continue playback as a | CSV | file.

Converting to | KIQ | generally results in a smaller | KIQ | playback file size and takes advantage of proprietary features such as time-based IQ sub-sampling and file save capability.

It is important to note that neither of these processes will alter the original IQ Sample and with only result in a separate new file from the original format.

Kestrel IQ | Write Buffer Operation (WBO) ™

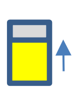
The capture and write process of complex IQ data can easily exceed the write ability of an HDD or SSD common on most laptop computers by overwhelming the IQ buffer.

Our unique | WBO | operation is a multi-stage operator visible write buffer display that allows for greater efficiencies in the capture process and provides metrics to the technical operator as to the ability of the machine to handle the IQ write process at different bandwidths and record times.

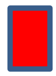
Our | Kestrel Buffer Status (KBS) | display is a small indicator box that appears either continuously of intermittently, during the IQ capture / write process. The following describes the various display parameters.

Flashing Outline (Periodic) | Accessing the buffer intermittently, with only limited processing and write delay to the storage drive and Continuous IQ capture is possible in this state.

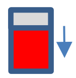
Solid Outline (Occasionally Flashing) | If in this state, the buffer is intermittently or continuously being accessed and is likely on the threshold of exceeding the write buffer capacity. It may be necessary to reduce the capture bandwidth or the IQ sample capture time.



Solid (Yellow - Increasing) | Capture is currently accessing the buffer and writing to the storage drive at a lower rate. Continuous capture will not be possible beyond write buffer saturation, which will occur once the buffer limit is reached and recording discontinuity may occur.



Solid (Red – 100%) | Write buffer is full (buffer-saturated) and IQ capture activity stops until buffer recovery. IQ data streaming is not continuous and the active capture process stops. The recommended operator response is to | Stop IQ |capture and allow buffer to clear. It will be necessary to reduce the IQ capture bandwidth, recording time or combination of both if continuous recoding is required.



Solid (Red - Decreasing) | Captured data is currently being written to the storage drive from the buffer at a reduced transfer rate based on the processor loading and other factors. This state will occur when the | Quick Select Menu | IQ capture time has been reached (completed) or the recording process is interrupted by the operator technical. Technically, IQ capture is possible and will resume, if still active, but the recorded IQ sample file will be discontinuous.

Solid (Gray – Background) | Buffer is now clearing; however, the IQ sample file is still being written to the storage drive from the buffer. Please wait until the buffer box outline is no longer visible to begin another IQ recording or playback operation. If the IQ directory I opened, it will be possible to see that the file write process is still in process.

Buffer (Not Visible) | The IQ sample file write process is complete and the technical operator can begin a new recording or playback of any captured IQ sample file.

NTSC | PAL Video Demodulation

The ability to demodulate analog NTSC | PAL composite video signals is not an easy task given the complexity of the waveform.

The NTSC standard is a product of the 1950's yet remains a viable and widely utilized signal type, particularly with many of the available wireless spy cameras.

Since many of this operate in the 900 MHz ISM and 2.4 GHz ISM bands, there will be significant noise from a adjacent channels and even signals sharing the same bandwidth.

This makes it difficult to pull a stable video signal out of the noise for demodulation and frankly, once identified, the technical operator is advised to simply track the RF signature for localization purposes.

The signal includes many different component parts and there are a number of fundamental differences between NTSC and PAL signals.

The ability to demodulate NTSC | PAL analog video is fully supported across the entire range of the supported Software Defined Radio (SDR) hardware, including powerline emitters.

The Kestrel TSCM ® Professional Software can render analog video with a powerful software driven algorithm and decoder to acquire and display decoded monochrome and colour NTSC video on a resizable video decoder window.

In-fact, near full screen video is possible making it easier to identify visual location detail within the decoded image.

The algorithm automatically determines the metrics of the NTSC waveform and displays the signal characteristics and signal metrics, including negative and positive synchronization pulse polarity.

The operator may force negative or positive synchronization where the signal is perhaps too weak to automatically lock the signal.

The NTSC | PAL video decoder is located within the Demodulation Control Group and is simply to use.

The operator selects the signal for demodulation and adjust the IF bandwidth and modulation mode as required.

Pressing the | EYE | button activates the video decoder and image display window to render the video.

Tuning is accomplished either in the | RF Spectrum Display (RSD) | or within the | Audio Spectral Density (ASD) | display.

Video Demodulation | v1.39xx

Acquisition metrics include | POLARITY (POS | NEG) | (NUMBER OF) PIXELS | (NUMBER OF) LINES | (HORIZONTAL) THSYNC | (VERTICAL) TVSYNC | TACTIVE | BLACK (LEVEL) | WHITE (LEVEL) |.

Once the technical operator identifies a Signal of Interest (SOI) that may analog video, the signal can be selected for demodulation in the Demodulation Visualizer utilizing the RF Spectrum Display (RSD), Audio Spectral Density (ASD), Audio Oscilloscope Display (AOD), and Audio Spectrum Display (ASD), and other display windows.

Once a Signal of Interest (SOI) is set in the demodulation visualizer, the operator can press the | EYE | button to display the demodulated image.

Tuning and fine tuning is accomplished by adjusting the center frequency of the signal waveform as required. The modulation type can be selected for both AM and FM video sources.

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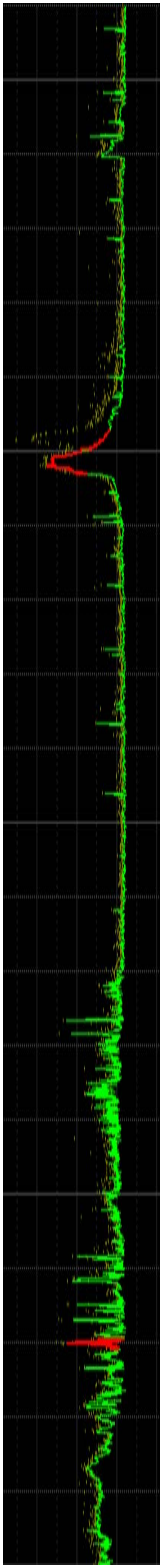
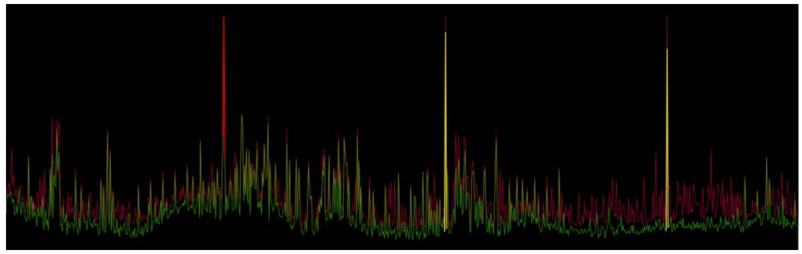
Intentionally Left Blank



Chapter 14

Signal Recognition and Analysis (SRA) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Signal Recognition and Analysis (SRA) ™

The Radio Frequency (RF) spectrum is relatively small and occupies the lower end of the electro-magnetic spectrum.

Electro-magnetic energy or waves is characterized by either frequency, the number of sinusoidal oscillations or “cycles” per second specified in Hertz (Hz) where 1 Hz = 1 cycle per second or wavelength.

This is the distance traveled by 1 cycle over time, of an electro-magnetic wave in free space, also referenced as propagation.

Electro-magnetic radiation travels at a constant speed of 300,000 km / sec in free space.

The ambient RF spectrum environment is the complex, dynamic and constantly changing work environment of the technical operator, as new wireless technologies are introduced, older technology is decommissioned and spectrum bands are constantly resigned and reallocated.

The technical operator must develop a considerable working knowledge and understanding of the RF spectrum and the signal environment specific to the operational threat level encountered.

The recognition of an ever-expanding range of analog and digital signal types as well as the ability to recognize and separate friendly signals from potentially hostile signal events is a key deployment consideration.

The technical operator will soon learn with experience that the outward appearance of any particular signal event will rarely will give up all of its secrets without considerable real-time operator assisted review and considerable post event analysis.

However, the so-called outward appearance of any signal event is often the first clue as to the type and purpose of the signal encountered.

The second clue is often the region of the spectrum in which the Signal of Interest (SOI) is found to be operating.

From an analysis perspective, it is often what is, or may be lurking within any given signal event that must be closely examined by the technical operator.

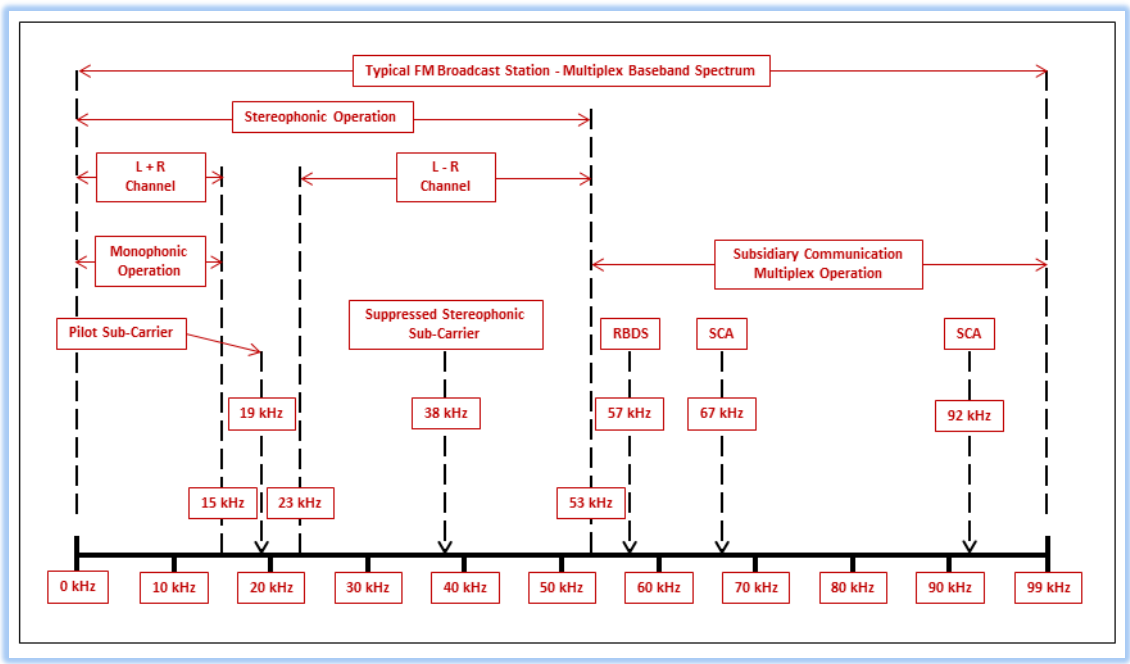
The ability of the technical operator to closely examine the entire Range of Interest (ROI), taking into account each Signal of Interest (SOI) at the appropriate threat consideration and level is essential.

A systematic and methodical approach to signal analysis and review, typically provides a relatively high degree of certainty that any given signal event is not hostile in nature.

This approach requires not only the knowledge and experience of a qualified technical operator, but also a wide range of specialized TSCM specific RF signal analysis and analytical resources.

Multiplex Baseband | AF Spectrum

The following chart illustrates the typical FM Broadcast Station | Multiplex Baseband spectrum as might be observed within the Kestrel TSCM ® Professional Software during active demodulation of a Signal of Interest (SOI) utilizing the Demodulation Visualizer control group display tools, such as the AF Spectrum Display (ASD) window for the purpose of signal analysis.

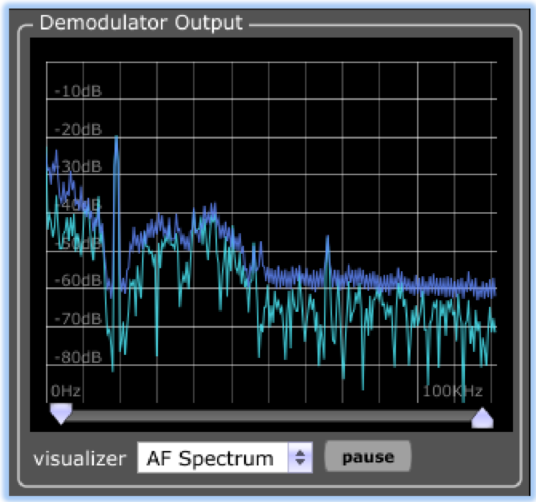


Multiplex Baseband Spectrum | v1.37xx

To better illustrate the basic principles of elementary signal level analysis, consider a typical FM broadcast signal, as observed and captured during active deployment, and viewed within the Demodulation Visualizer control group | AF Spectrum Display (ASD).

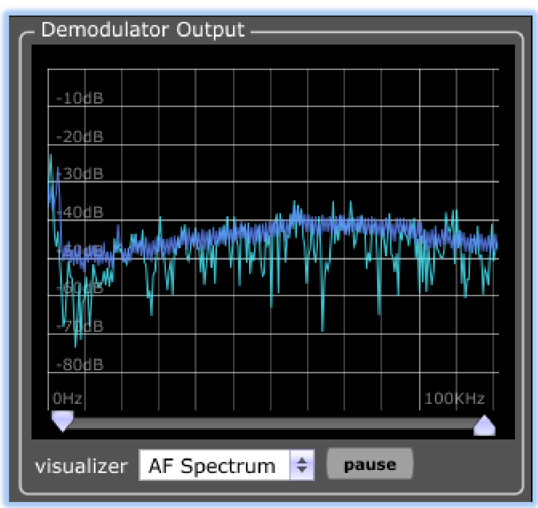
Numerous validating factors can be observed and validated, to better determine whether the Signal of Interest (SOI) is in fact a commercial broadcast station or a cleverly placed emitter, containing room audio.

The ability to validate the signal and visualize channel content is fully realized when the AF Spectrum is reviewed by the technical operator.



AF Spectrum (Stereo) | v1.37xx

The above image represents the signal characteristics as might be observed by the technical operator within the | AF spectrum Display (ASD) | of a typical FM commercial broadcast station transmitting in a standard stereo broadcast mode.



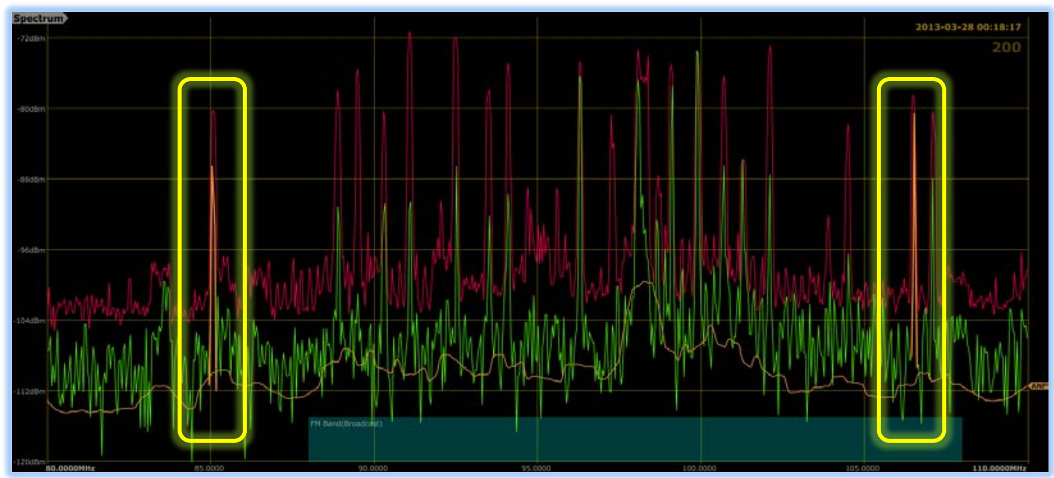
AF Spectrum (Mono) | v1.37xx

The above image represents the signal characteristics as might be observed by a technical operator within the | AF Spectrum Display (ASD) | of a typical FM commercial broadcast station transmitting in a standard mono broadcast mode.

Spectral Images

On occasion the technical operator will observe mixing artifacts and what often will display as “out-of-band” discrete signal events that at first glance, do not appear at the expected frequency or band allocation and may have intelligence not consistent with the area of the spectrum in which it is observed.

The following is an excellent working example of a typical spectral image.



IF Image | v1.37xx

For example, during analysis of the displayed spectrum, the technical operator observes a signal event at 85.1 MHz (you will note that this is outside (and below) of the FM broadcast band allocation) as illustrated in the above spectrum plot with the FM band Channel Profile displayed as a visual reference.

During the analysis phase, the technical operator demodulates the signal and during station identification, determines that the signal event is actually an FM broadcast station at 106.5 MHz (you will note that this signal event is within the FM broadcast band allocation) and the 85.1 MHz signal is a spectral image of this signal.

If we do the math, we find that the “out-of-band” image is 21.4 MHz below the actual CF fundamental signal event at 85.1 MHz

The Intermediate Frequency (IF) is typically at 10.7 MHz and the image is double the IF value.

Example: 106.5 MHz – 85.1 MHz = 21.4 MHz (10.7 MHz + 10.7 MHz = 21.4 MHz)

HD FM Radio Broadcast Standard

High Definition FM Radio broadcasts may be observed within the FM broadcast band allocation more and more frequently across North America.

The Center Frequency (CF) signal appears as would any normal FM broadcast signal, however, there are also well-defined digital sidebands to the right and left of the signal event that overlap older adjacent channel allocations.

In North America, FM broadcast stations are licensed to transmit within 100 kHz of spectrum bandwidth and require 200 kHz of spectrum allocation.

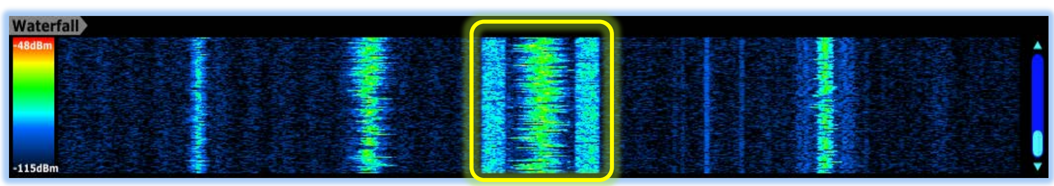
15 kHz of the modulation bandwidth is utilized by the analog (monaural) audio (baseband) with the remainder of the allocation available for stereo, speciality broadcasts, RBDS and other services.

Normally, an analog broadcast station will have the full 100 kHz of analog bandwidth and utilizes an additional 70 kHz for the digital signal content, and a 30 kHz, guard band.

HD FM Radio requires 400 kHz of available spectrum bandwidth allocation.

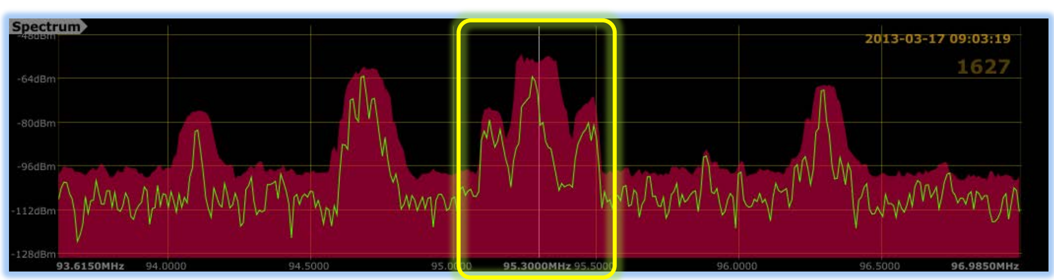
Traditional existing analog sub-carriers at 67 kHz and 92 kHz will need to be decommissioned to establish the HD radio service and can later be restored as digital sub-channels.

The following WFD and RSD spectrum plots illustrate the signal characteristics of the digital sidebands.



WFD HD FM Broadcast | v1.37xx

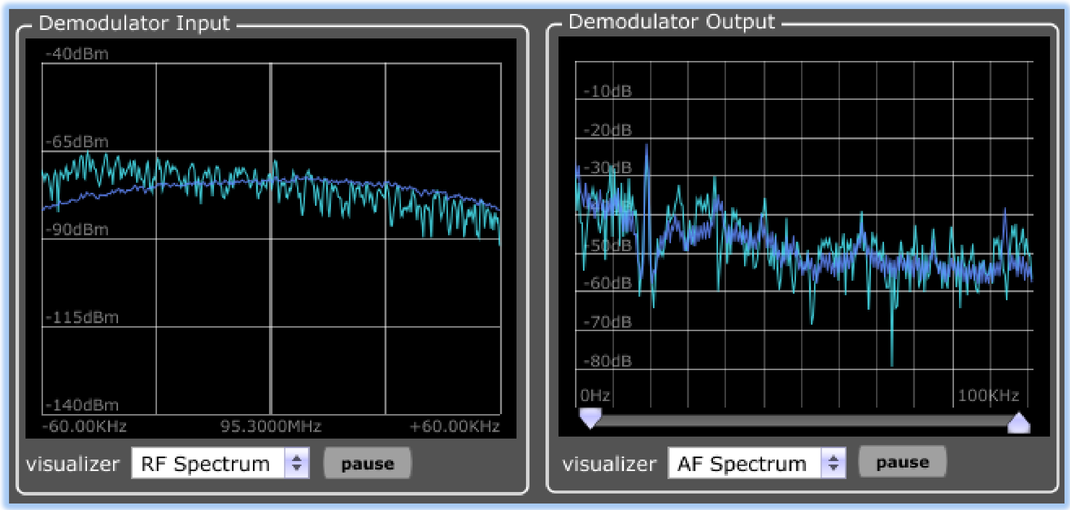
The Waterfall (WFD) indicates the presence of four (4) FM broadcast stations, with the station displayed at CF broadcasting in HD FM as evidence by the digital sidebands.



RSD HD FM Broadcast | v1.37xx

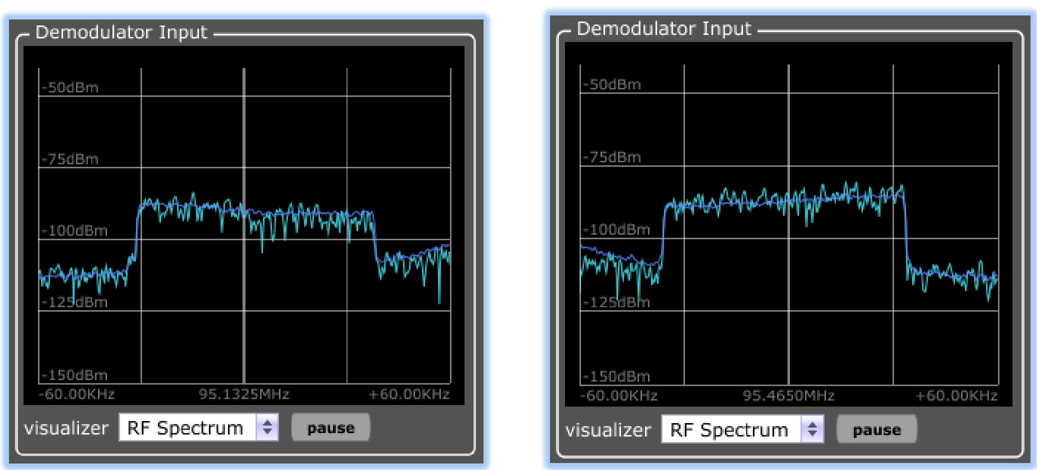
The RF Spectrum Display (RSD) above clearly illustrates the HD FM signal characteristics observed on typical spectrum analyzer trace display.

Utilizing the Kestrel Demodulation Visualizer control group, the technical operator is able to view in significant detail the HD digital sidebands by adjusting the CF up or down for receivers with a limited instantaneous IF bandwidth.



FM 93.5 Demodulation Visualizer | v1.37xx

The above image represents the CF of the station utilizing the 120 kHz IFBW filter with the analog audio demodulated in FM mode.



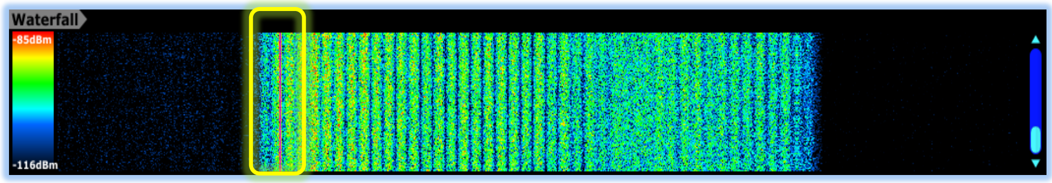
FM 93.5 Digital LSB / USB - Demodulation Visualizer | v1.37xx

The image on the left is the Digital LSB and the image on the right is the Digital USB as viewed within the Demodulation Visualizer utilizing the 120 kHz IFBW filter.

ATSC | Digital TV Broadcast

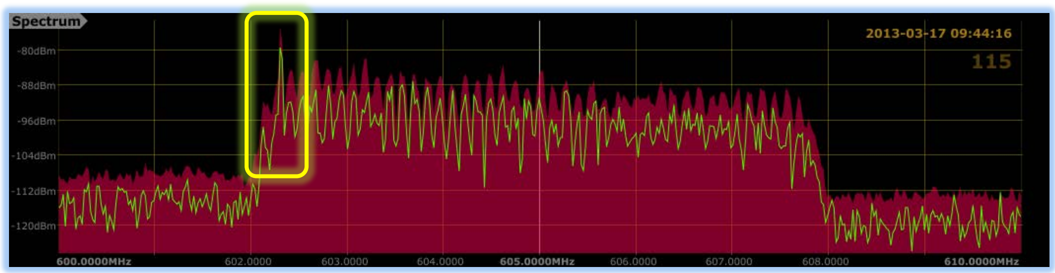
ATSC Digital TV signals are easy to identify unless the signal is distant and therefore possibly hiding within the noise floor level of the spectrum trace display.

ATSC Digital signals utilize (6 MHz) of spectrum bandwidth, the same as was allocated for NTSC Analog commercial broadcast signals.



ATSC WFD | v1.37xx

The characteristic ATSC Pilot signal is visible within the WFD and RSD.



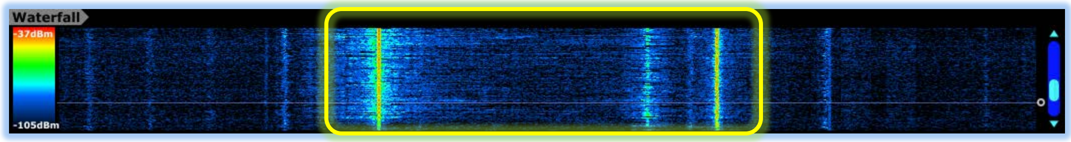
ATSC RSD | v1.37xx

ATSC Digital commercial broadcast signals display a distinctive identifying characteristic referred to as the ATSC Pilot signal, as can be seen on the left side of the WFD and RSD illustrated in the example above.

NTSC | Analog TV Broadcast

NTSC Analog TV signals have generally been phased out or decommissioned in North America with some notable exceptions in distant or rural areas that are not well serviced by ATSC service.

NTSC Analog signals will still be observed during some RF inspections and the technical operator needs to be familiar with the signal characteristics which might be mistaken for multiple discrete signal events.

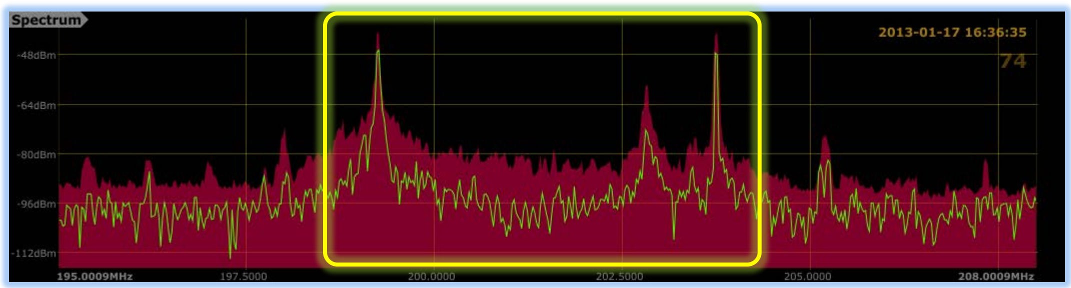


NTSC WFD | v1.37xx

Utilizing Live View Analysis (LVA) ™, the technical operator has selected (Trace 74) for review and analysis.

The NTSC Analog signal as illustrated appears as three (3) separate signal events, with the signal on the left representing the video carrier and the signal on the right representing the audio carrier.

The lower level signal to the left of the audio carrier signal is the colour burst signal.



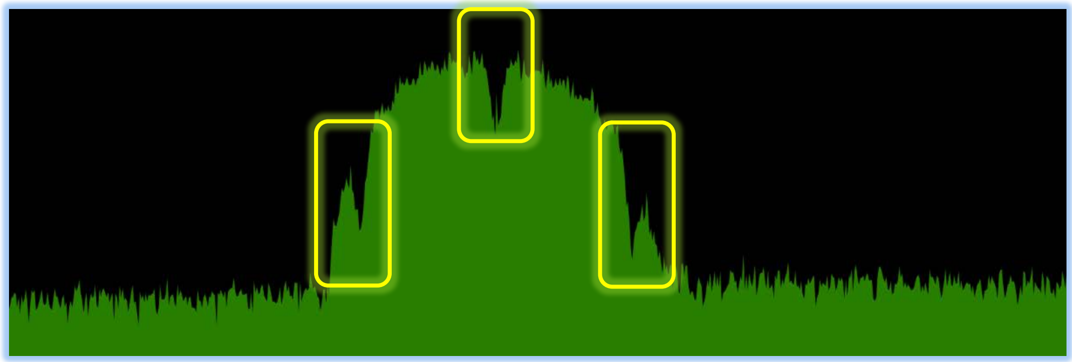
NTSC RSD | v1.37xx

The total spectrum bandwidth is 6 MHz and the delta between the video CF and the audio CF is 4.5 MHz.

The video portion of the signal is Amplitude Modulation (AM) and the audio portion of the signal is Frequency Modulation (FM) for the purpose of demodulation and audio analysis.

Binary Phase Shift Keying (BPSK)

The following Wi-Fi RF spectrum plot was captured in the ISM 2400 band allocation and illustrates an excellent example of (802.11b) data transmitted on a single channel utilizing Binary Phase Shift Keying (BPSK) modulation.

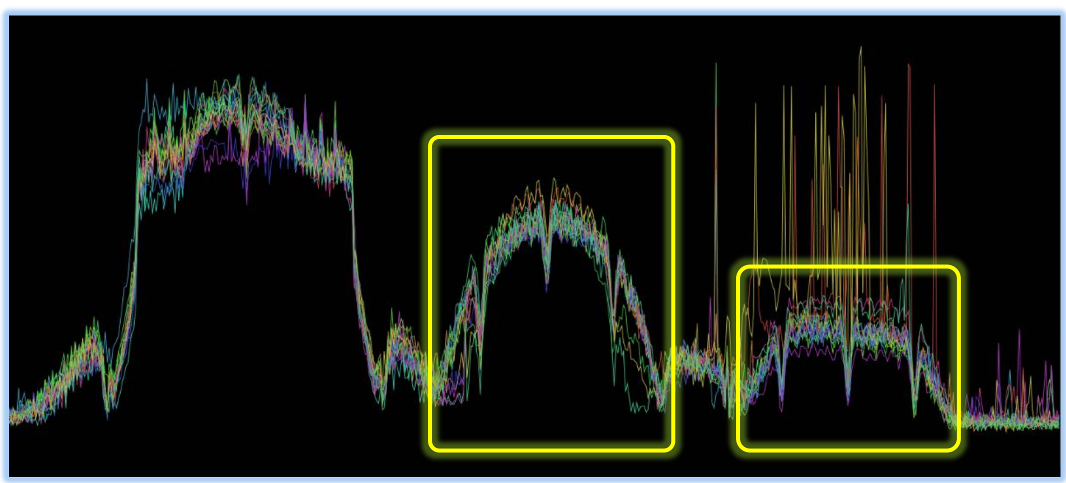


WI-FI (BPSK) | v1.37xx

The Real-Time Event (RTE) trace illustrates several important identifying characteristics including the center frequency and side lobe notches.

Signal bursts are fast and often difficult to identify, and the Peak Envelope Capture (PEC) may be distorted by over lapping Wi-Fi channels and other signal types operating within the same band allocation, such as microwave ovens, baby monitors, cordless telephones, surveillance cameras, Bluetooth devices and a wide variety of consumer and commercial Audio / Visual transmitters.

The following Kestrel TSCM ® Professional Software, Differential Signal Analysis (DSA) spectrum plot represents a relatively clean view of various discrete signal types found to be operating within the ISM 2400 spectrum allocation band, including two (2) BPSK bursts as described above.

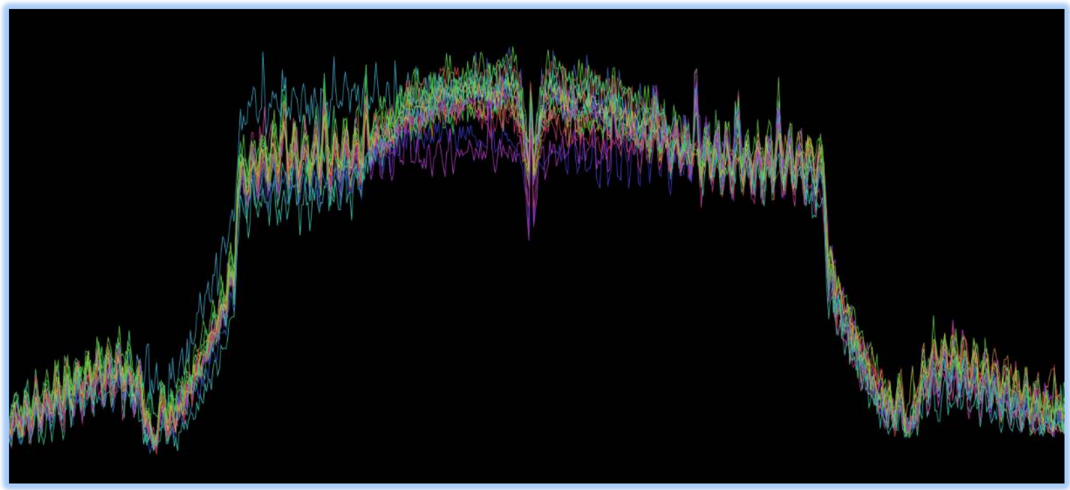


ISM 2400 | v1.37xx

The DSA plot of the second BPSK signal also clearly indicates the presence of another type of discrete signal event operating and overlapping within the same channel allocation.

The high amplitude, narrow band signal spike grouping is limited to only three (3) of the DSA locations displayed.

This signal appears to be Frequency Hopping Spread Spectrum (FHSS), typical of 2.4 GHz cordless telephones, digital baby monitors and wireless surveillance video cameras that operate within the ISM 2400 band allocation.



ISM 2400 | v1.37xx

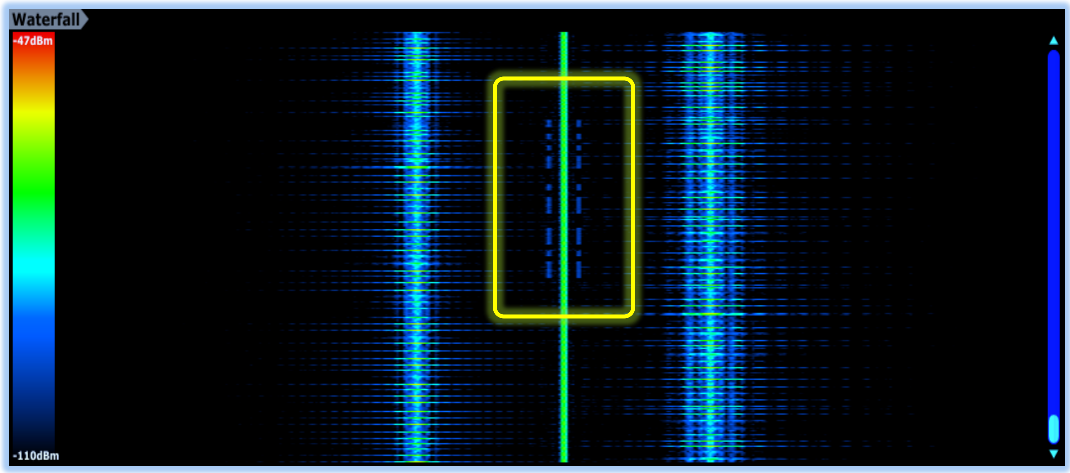
Another type of Wi-Fi signal, utilizes Orthogonal Frequency-Division Multiplexing (OFDM).

In an OFDM modulation scheme, the band is divided into sub-channels.

There are 64 sub-carriers using Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK), or either Quadrature Amplitude Modulation (16-QAM) or (64-QAM).

Air Navigation | Station Identifier

The following waterfall plot represents the analytical value of the Waterfall Display (WFD) in resolving hidden transmitter intelligence riding on the analog carrier.



Air Navigation Identifier (Morse code) | v1.37xx

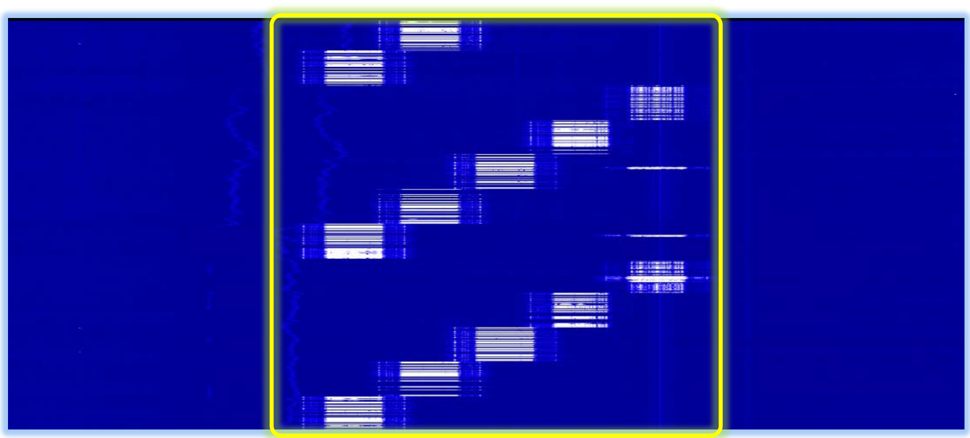
The ability of the technical operator to utilize the WFD to read Morse code is realized when the Waterfall Display (WFD) is zoomed at a narrow Resolution Bandwidth (RBW) on an analog carrier.

In the above example, the three (3) digit station identifier can be visually observed and can be resolved at the intelligence level.

DECT 6.0 | Digital Signature Characterization

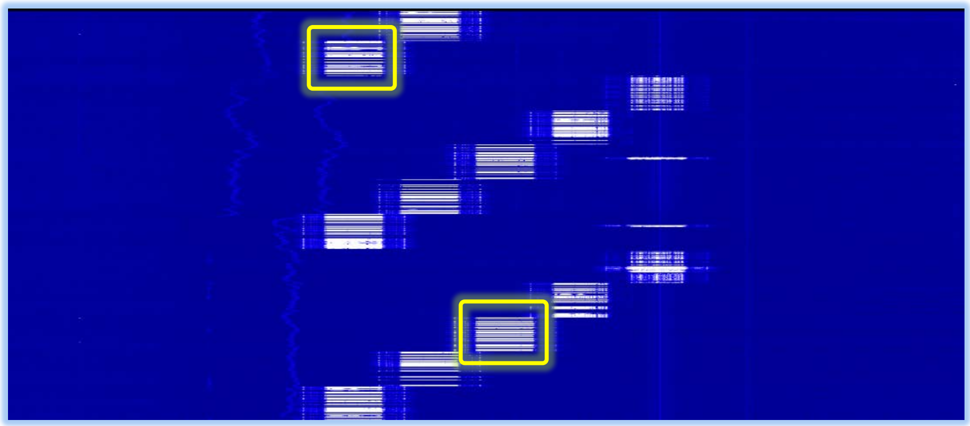
One of the core advantages of the Kestrel TSCM ® Professional Software is the ability to facilitate extended field deployment with the objective of developing complex RF digital signatures and characterization related patterns over many days, weeks, or months.

The following example illustrates digital pattern analytics for a Waterfall Display (WFD) displayed time period of approximately 12-hours, detailing the DECT 6.0 polling profile.



DECT 6.0 TDSA ™ (Polling) Plot | v1.39xx

Time Differential Signal Analysis (TDSA) ™ provides the means of capturing complex digital patterns and RF signatures over an extended period of time for wireless devices operating within the target area, for a detailed pattern signature analysis.



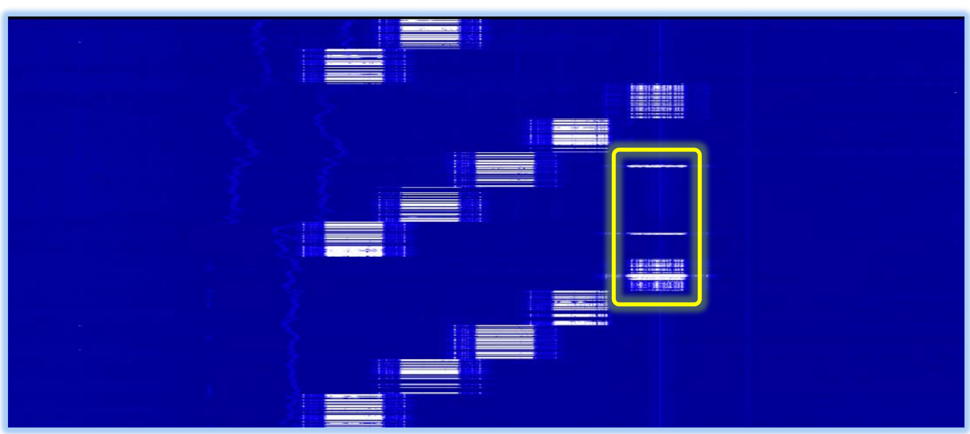
DECT 6.0 TDSA ™ Plot | v1.39xx

Each activity block as highlighted above represents a precise one (1) hour time block before the single source DECT 6.0 hardware initiates a downward sequential channel hop at predictable intervals that are easily observed utilizing TDSA ™.

The digital pattern and channel power are essentially identical when the cordless phone device is not receiving or placing a call.

The two (2) short bursts < CH 4 > represent outgoing call activity, as does the embedded signal highlighted below.

DECT 6.0 channel designation is < CH 0-1-2-3-4 > making up the 5-channel system operating within ITU | REGION 2 | from 1920 MHz to 1930 MHz.



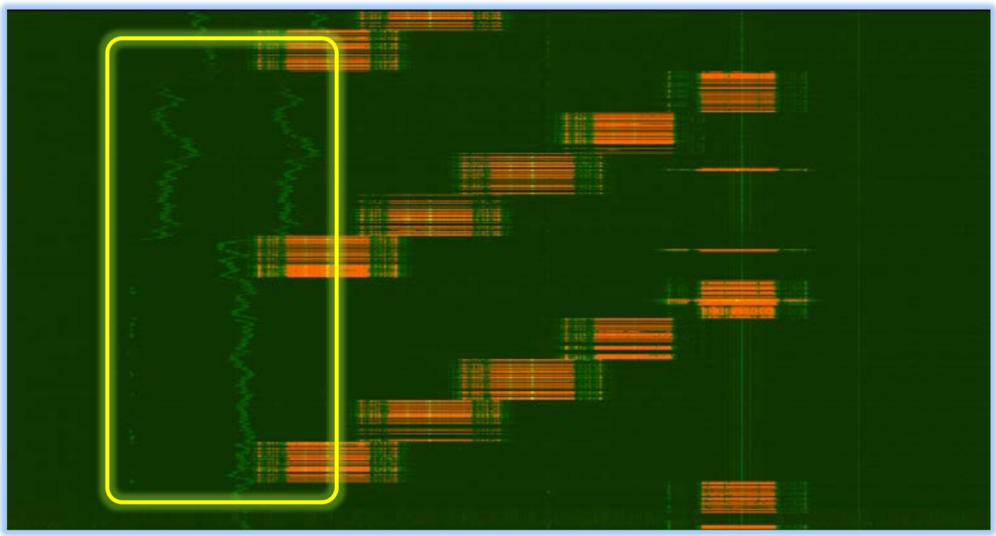
DECT 6.0 TDSA ™ Plot | v1.39xx

There is one more analytical mystery to be solved within the above and below Waterfall Display (WFD) plot!

The random patterning on the right side of the waterfall in the vicinity of < CH 0 > is the internal local oscillator of a wireless mouse on another computer near the collection platform.

Often such signal events (interference) have extremely low power profiles, and are difficult to visualize in the presence of strong nearby signals such as the DECT 6.0 signals observed.

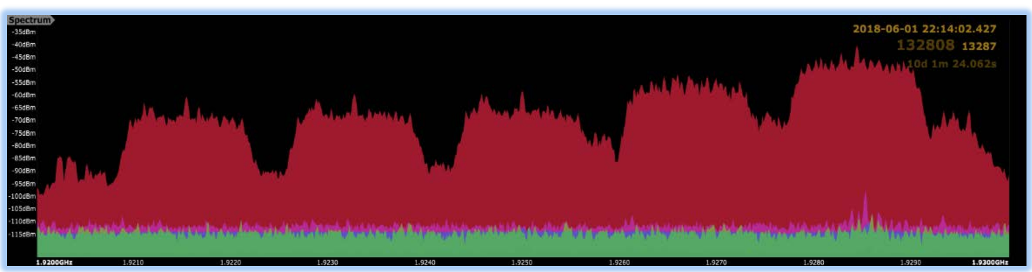
Changing the Waterfall Display (WFD) colour palette can often bring to life additional spectral artifacts during operator analysis, as illustrated below.



DECT 6.0 TDSA ™ Plot | v1.39xx

The next sequence of plots shows the activity rendered via the TDSA ™ capability.

The monitoring platform has been running for a period of 240 hours, and the first plot indicates the 10-day Peak Envelope Capture (PEC) ™ trace.

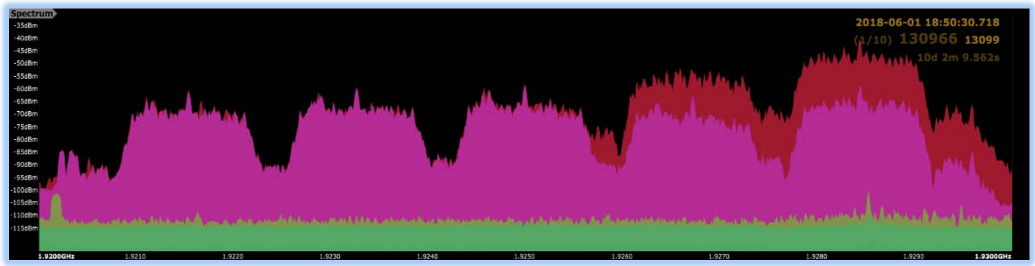


DECT 6.0 TDSA ™ PEC Plot | v1.39xx

As signal activity is captured during runtime via the TDSA ™ feature, in this case, a period of 24-hours, as defined by the technical operator, the violet trace represents the channel level activity anytime from the beginning of the | PERIOD | to the end of the | PERIOD | directly against the “project level”, Peak Envelope Capture (PEC) ™ trace.

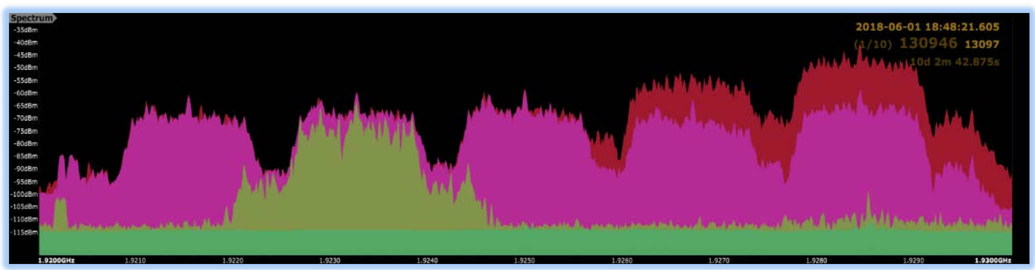
The TDSA ™ period-based peak will automatically reset at the end of each operator defined | PERIOD |.

The following image displays the 10-day peak (RED) Vs the past 24-hour peak (Violet).



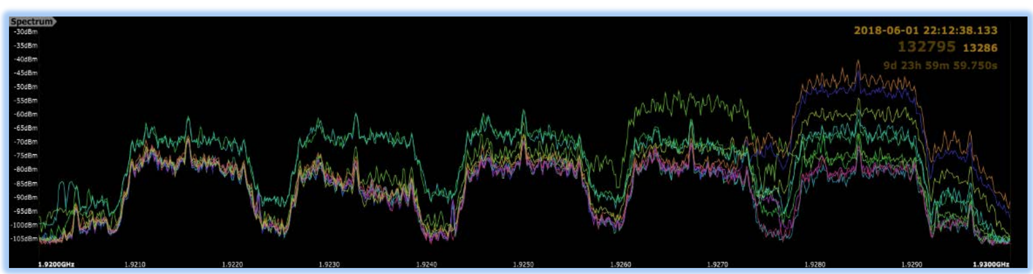
DECT 6.0 TDSA ™ Time Period Plot | v1.39xx

The following plot illustrates a Real-Time Event (RTE) ™ burst captured on < CH 1 > during runtime against the “project” and TDSA ™ peak.



DECT 6.0 TDSA ™ RTE Plot | v1.39xx

The following image represents the TDSA ™ time comparative plot over a period of 240 hours or 10-days, with an operator defined 24-hour | PERIOD | in which a single Kestrel Super Trace (KST) ™ represents all events captured within the 24-hours of trace data.

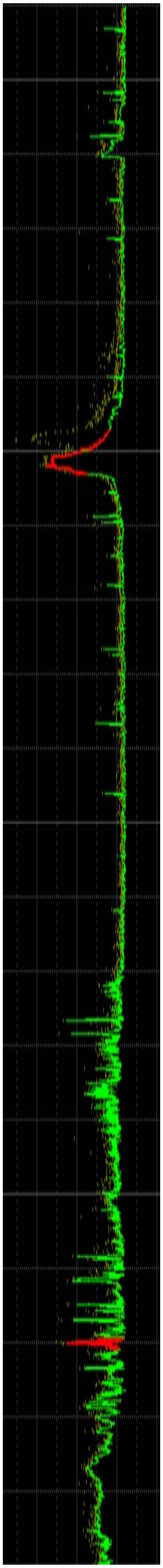


DECT 6.0 TDSA ™ Time Plot | v1.39xx

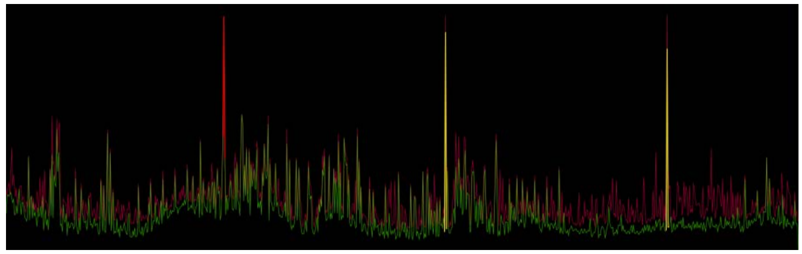
TDSA ™ is a powerful feature allowing the technical operator to see signal level activity with clarity and meaning.

Intentionally Left Blank

Intentionally Left Blank



Chapter 15



Project and File Management

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

File and Project Management

The Kestrel TSCM ® Professional Software utilizes a somewhat complex, but uniquely intuitive project file management structure that features a sophisticated (default) fail safe auto save mechanism to help protect against trace data loss during deployment, and generally allows the technical operator to recover, and reopen Kestrel Project Files (KPF) ™, should a computer malfunction, or application crash occur during runtime collection.

In the event of any host computer or Kestrel TSCM ® Professional Software application instability, the project file structure can generally be opened as a historical file, and restarted after the receiver initialization process is re-established, once the host computer, search receiver, and software application are successfully restarted.

Our advanced runtime memory management, consisting of an established default setting, and automatic file save algorithm permits the capture of moderately large data files that need to be processed for (write) storage to the local, or network storage device, and remain available for post event analysis and review.

Live View Analysis (LVA) ™ utilizes live runtime, and post capture data streams to provide access to continuous spectrum, trace and waterfall data, for post event analysis by the technical operator whenever the recording control is active.

There are three (3) important modes of operation available depending on the deployment strategy, including CRM, ARM, and ERM operation.

Collection and Recording Mode (CRM) ™

The Collection and Recording Mode (CRM) ™, is the defaulted to the (1 / n = 1) control setting, providing a measure of runtime fail safe data protection.

All runtime spectrum, trace and waterfall data are continuously written to the local, or network storage device assigned, and is therefore permanently available for technical operator review during post event analysis, and for post event report generation.

The typical Kestrel Project File (KPF) ™ size will vary, and will likely be extremely large, in the order of 35 GB per hour, when capturing a single Range of Interest (ROI) with an operational deployment bandwidth of 6 GHz at 20 kHz RBW on the Signal Hound BB60C.

Analysis and Review Mode (ARM) ™

The | Analysis and Review Mode (ARM) ™ | provides significant technical operator flexibility and programmability, providing for an extraordinary measure of active file size management during runtime.

The technical operator can deploy the system in a basic Spectrum Analyzer (SA) mode of operation, without writing any spectrum, trace, or waterfall data to the local, or network storage device.

With this mode of operation, only the display buffer data is available for review during runtime and no data is available for post analysis and review.

There is a | REC | button located on the | Spectrum Display and Activity | control group that | STARTS | and | STOPS | the write process "on-the-fly".

The technical operator may initiate the | START | and | STOP | the write process at any time on demand during runtime.

In order to facilitate file size management during deployment, the | REC | control group also includes an advanced write control (1 / n) = | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 250 | 500 | 1000 |combination box option list, representing the actual number of recorded traces that occur during runtime capture with (1 / 1) being real-time, and (1 / 5) representing (1) in (5) spectrum traces being written to the local, or network storage device.

The technical operator can manually enter any (1 / n =?) value into the combination text box, between (1 and 10000), such as | 15 | 25 | 30 | 75 | 1500 | 2500 | 5000 | 10000 | for example.

Both the | REC | and (1 / n =?) programming option settings, may be adjusted "on-the-fly" to accommodate rapidly changing mission or deployment specific requirements, and objectives.

The | ARM | REC | functionality is not a global feature and therefore is spectrum band independent, allowing the widest possible write file size management programmability.

The selection of different (1 / n =?) values for each active spectrum band allocation, or Range of Interest (ROI) permits independent write file size management, across all active spectrum tabs.

As a deployment methodology, consider a scenario in which the technical operator assigns a full ROI (9 kHz to 6 GHz) bandwidth sweep at (1 / n = 1) providing real-time recording, and other sub-bands at (1 / n = 3), or optionally, no spectrum recording at all, for the secondary sub-band spectral tabs running in Spectrum Analyzer Mode (SAM) ™.

The technical operator can simply create additional spectral tabs, to visually monitor specific regions (sub-bands) of the spectrum but may decide that there is no need to actively record the data, since the primary full ROI is being recorded in real-time at (1 / n = 1) and would be available should the need to review or analyze SOI spectrum activity.

Selecting a menu value of (1 / n = 50), results in controlled file write management, where (1 / n = 50) results in the building of a Peak Envelope Capture (PEC) trace block, consisting of 49 combined PEC traces, written as a single Kestrel Super Trace (KST) ™.

This finalizes the (1 / n = 50) trace count sequence block.

Selecting a custom value of 15, results in controlled write file management; where (1 / n = 15) results in the building of a Peak Envelope Capture (PEC) trace, consisting of 14 combined PEC traces, written as a single Kestrel Super Trace (KST) ™.

The following chart represents the write compression time inaccuracy that results during post review and analysis playback of the Kestrel Project File (KPF) ™.

ARM | KST | Compression Time Accuracy (BB60C) TSB 6000 @ 20 kHz RBW				
ARM 1 / n =?	**Sweep Time (mSec)**	**Time (Sec) Compression**	**Time (Min) (Sec) Compression**	**Frames per Sec (FPS)**
1	250	0.25 Sec	0.25 Sec	4
2	250	0.50 Sec	0.50 Sec	4
5	250	1.25 Sec	1.25 Sec	4
10	250	2.50 Sec	2.50 Sec	4
20	250	5 Sec	5 Sec	4
25	250	6.25 Sec	6.25 Sec	4
50	250	12.5 Sec	12.5 Sec	4
100	250	25 Sec	25 Sec	4
250	250	62.5 Sec	1 Min + 2.5 Sec	4
500	250	125 Sec	2 Min + 5 Sec	4
1000	250	250 Sec	4 Min + 10 Sec	4
Custom Value | Manual Entry | Legal Value Range (n=1 to n=10000)				
2500	250	625 Sec	10 Min + 25 Sec	4
5000	250	1250 Sec	20 Min + 50 Sec	4
7500	250	1875 Sec	31 Min + 15 Sec	4
10000	250	2500 Sec	41 Min + 40 Sec	4

ARM | (1 / n =?) Time Compression | v1.35xx

Display Vs Capture in ARM Mode

The (1 / n =?) value does not affect the displayed spectrum trace, or waterfall data during runtime and the technical operator is able to view spectrum trace and waterfall data regardless of the (1 / n =?) value selected, however, this is displayed data only, and will not be available for review beyond the buffer size limit, or operator-initiated state change.

The technical operator is cautioned that only recorded data elements will be available for post event analysis.

When the technical operator simply wishes to utilize the Kestrel TSCM ® Professional Software in a standard | Spectrum Analyzer (SA) | mode of operation, the record (write) feature may be disabled all together or operated in an enhanced (1 / n =?) mode.

The | Spectrum Analyzer (SA) | enhanced mode of operation, requires that one of the (1 / n =?) values from real-time Capture (1 / n = 1), to (1 / n = 10) + PEAK spectrum data capture be selected, providing a threat-level based, measured element of trace capture, while minimizing the actual (write) storage space required during runtime.

The (1 / n =?) value selection alters the write algorithm to record a specific sequence of captured | TRACE + PEAK | data for traces that are not specifically recorded.

TIP: The (1 / n =?) recording algorithm, captures and records the PEAK spectrum data over the entire (1 / n =?) interval rather than an arbitrary (1 of n) trace, so that the PEAK trace data is preserved and is therefore not lost when operating in a Spectrum Analyzer (SA) enhanced file size management, write process mode.

Rather than simply discard trace level information that is not being recorded under the write compression method, the | MAX PEAK | sum value of all of the processed | PEAK | spectrum data is not lost for any discrete signal events that may have appeared within the trace level data and will only appear within the Kestrel Super Trace (KST) ™.

File size management efficiencies are realized, and <u>no</u> spectrum data is lost during the (1/n=?) capture process, due to the MAX PEAK capture nature of the enhanced (1 / n =?) feature.

Waterfall Buffer Clear (WBC) ™ | Button

The | Waterfall Buffer Clear | button allows the technical operator to display only the Waterfall Display data, directly associated with the (1 / n =?) write function value.

The | WBC | button removes all unsaved WFD trace data, to better focus operator's attention on a substantially smaller, compressed WFD data foot print.

As an example; whereby the technical operator initiates a runtime environment consisting of (1 / n = 100), and has collected 30,000 spectrum traces, and then presses the | PAUSE | button followed by the | WBC | button, results in the display of 300 Kestrel Super Traces (KST) being displayed for easy operator analysis, consisting of all 30,000 compressed Peak Envelope Capture (PEC) traces.

This concept means that the technical operator needs to review only 300 WFD traces, representing all of the captured peak data from the full 30,000 traces.

It is essential to understand that Live View Analysis (LVA) ™ will respond to the active trace count recorded as represented in the Analysis and Review Mode (ARM) ™ (1/n =?) trace reference chart below.

Analysis and Review Mode (ARM) ^{TM} (1 / n =?) Trace Reference Chart		
(1 / n =?)	**Recorded Trace Count + Peak Trace Data**	**Example | KST**
n = 1	Real-Time Capture – All traces are recorded	1, 2, 3
n = 2	Every 2^{nd} Trace is Recorded + Peak Data	2, 4, 6
n = 5	Every 5^{th} Trace is Recorded + Peak Data	5, 10, 15
n = 10	Every 10^{th} Trace is Recorded + Peak Data	10, 20, 30
n = 20	Every 20^{th} Trace is Recorded + Peak Data	20, 40, 60
n = 25	Every 25^{th} Trace is Recorded + Peak Data	25, 50,75
n = 50	Every 50^{th} Trace is Recorded + Peak Data	50, 100, 150
n = 100	Every 100^{th} Trace is Recorded + Peak Data	100, 200, 300
n = 250	Every 250^{th} Trace is Recorded + Peak Data	250, 500, 750
n = 500	Every 500^{th} Trace is Recorded + Peak Data	500, 1000, 1500,
n = 1000	Every 1000^{th} Trace is Recorded + Peak Data	1000, 2000, 3000

Project File Structure | v1.35xx

The ability of the technical operator to define a custom 1 / n = < custom value > is also supported, adding additional capability for extended collection periods, including 1 / n = 10000.

The following chart illustrates some of the possible custom user-defined values that might be utilized for extended collection periods.

The technical operator can manually enter any custom value between 1 / n = 1 to 1 / n = 10000.

Analysis and Review Mode (ARM) ™ (1 / n) Trace Reference Chart		
(1 / n =?)	**Recorded Trace Count + Peak Trace Data**	**Example**
n = 2500	Every 2500th Trace is Recorded + Peak Data	2500, 5000, 7500
n = 5000	Every 5000th Trace is Recorded + Peak Data	5000, 10000, 15000
n = 10000	Every 10000th Trace is Recorded + Peak Data	10000, 20000, 30000

Project File Structure | v1.35xx

A key benefit of the | Analysis and Review Mode (ARM) | is the project file size management capability, resulting in significantly smaller write file size storage foot print.

This benefit is realized during both operator assisted and long-term Remote Spectrum Surveillance and Monitoring (RSSM) deployment.

Post event analytics and Live View Analysis (LVA) is significantly enhanced as a result of literally thousands of less trace data to review.

Event Recording Mode (ERM)

The Kestrel TSCM ® Professional Software includes a fully automated Event Recording Mode (ERM).

Intuitive artificial intelligence and advanced design level predictive logic are expertly coded into a highly-advanced Kestrel TSCM ® Professional Software technology that allows our software to begin active | ALERT ZONE | capture, and control of the write storage recording process, ahead of the actual signal event appearing within the ambient RF spectrum.

The Great Kestrel ® utilizes keen eyes, a photographic memory, and maybe even a little psychic ability to produce for the technical operator, a clear picture of any alert zone-based capture and trace level recording of any Signal of Interest (SOI), leading up to its appearance, for the duration of the event, and for a period of time beyond the active alert.

This innovative feature permits the technical operator to build a detailed picture of what occurred within the ambient spectrum environment leading up to the Signal of Interest (SOI) alert appearance and provides absolute control over file size management and ensures that all new and periodic signal events are well documented and available for post event analysis and review.

It's possible to record up to 60 seconds of real-time trace data before any DAA alert zone based spectral recording of any signal event, with continuous capture and recording for the duration of the event and up to 60 seconds beyond the duration of the event.

The default setting is 5 Seconds leading and following the DAA alert.

The | ARMED RECORD | setting menu is accessed by right mouse click on any of the clean gray space of the | CONTROLS | window, or by selecting the | SPECTRUM | ALERTS | ARMED PRE / POST BUFFERING | menu option.

Analysis and Review Mode (ARM) ™ Armed Record Options
Record Setting [Leading DAA Event] [Following DAA Event]
0 Sec | Records Active DAA Alert Only
1 Sec | Records +1 Second [Leading] and [Following] DAA Alert
2 Sec | Records +2 Seconds [Leading] and [Following] DAA Alert
5 Sec | Records +5 Seconds [Leading] and [Following] DAA Alert
10 Sec | Records +10 Seconds [Leading] and [Following] DAA Alert
20 Sec | Records +20 Seconds [Leading] and [Following] DAA Alert
30 Sec | Records +30 Seconds [Leading] and [Following] DAA Alert
60 Sec | Records +60 Seconds [Leading] and [Following] DAA Alert

Project File Structure | v1.35xx

The | ARM | feature only records active | DAA Alerts | and a short period of time leading and following the event and not normal runtime spectrum data.

The Kestrel® Event Recording Mode (ERM) allows for active runtime deployment and the provision for the automatic recording of spectrum events, traces and waterfall data based on technical operator programmable alert settings utilizing the Dynamic Alert Annunciator (DAA) feature.

Active recording is initiated, based on the technical operator defined (1 / n =?) Analysis and Review Mode (ARM)™ settings and the DAA Alert zone detection sensitivity-based programming.

This mode of operation is enabled utilizing the | ARM | button, located on the Spectrum Display and Activity control group.

Regardless of the technical operator programmed (1 / n =?) runtime setting, the Event Recording Mode (ERM) is accomplished in Real-Time (1 / n = 1), and capture continues for a period of time beyond the active DAA alerting event.

The amount of spectrum trace and waterfall data written to the local or network storage device will be reduced significantly as a result of the (1 / n =?) decimation value selected, and dependent upon the number of spectrum alert events detected.

Kestrel Project Files (KPF) Handling

It can take seconds or several minutes to open extremely large | Kestrel Project Files (KPF) | for post event analysis and review, on host computers that have limited processing capability or insufficient memory resources.

The technical operator must give the host computer sufficient time to open, load and process large project files, even on a higher performance host computer.

The technical operator must not assume that the host computer has crashed during the process of opening large | Kestrel Project Files (KPF) | as the computer may freeze temporarily during the loading process.

Once the | Kestrel Project File (KPF) | fully loads, the technical operator will be able to conduct post analysis review on each active spectral band allocation captured and review the data on a trace by trace basis.

TIP: The Kestrel TSCM ® Professional Software project files are unlike what the technical operator may be familiar with, as found in typical productively software files that are significantly smaller and easily handled by the host computer operating system and available memory allocation. The Kestrel Project File (KPF) structure can easily result in project directories and individual file sizes in the Gigabyte (GB) range in a relatively short period of time.

It may be necessary to press the | AUTO RANGE | button to set the reference level to the optimal level.

Once the technical operator completes an analysis of the first spectral band allocation, selecting the next available spectral tab will load the data for that specific spectral band allocation, the same way as the first band and the process may take some time depending on the actual | Kestrel Project File (KPF) | size.

This process is repeated for each available spectrum band allocation tab that the technical operator wishes to review.

The ability to maintain full and unrestricted real-time and post analysis functionality with our Live View Analysis ™ (LVA) feature, is a direct result of our proprietary file and project management structure.

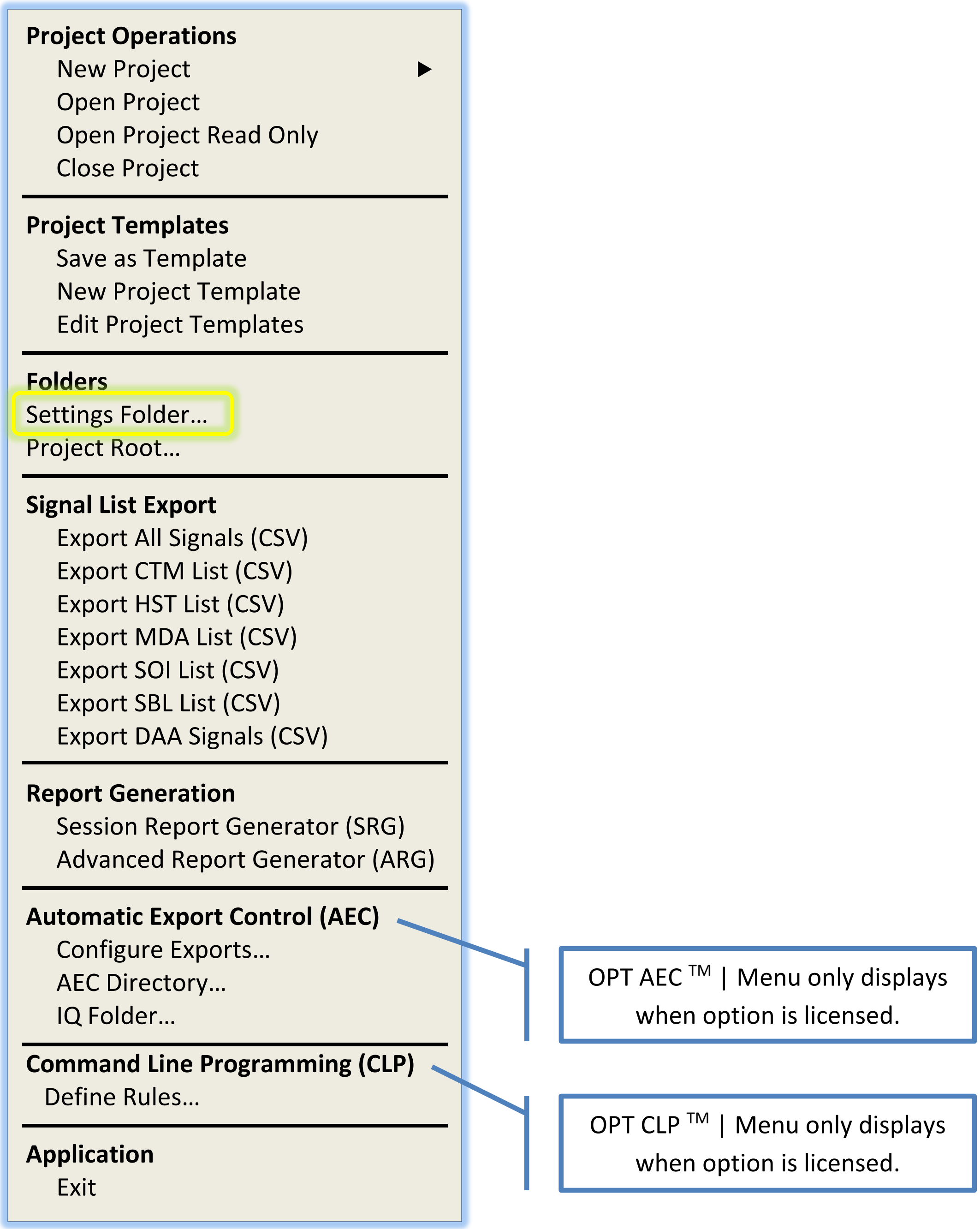
Settings Directory

There are a number of transportable custom defined operator files resident within the Kestrel TSCM ® Professional Software.

The ability to store, backup, move to another system platform and retrieve a wide range of Kestrel ® system files such as the | SpectralProfiles.spf | database, | Operator Signal List (OSL) ™ |, and the | Colour Map | system level files, provides both security and convenience.

Master CSV files (databases) may be copied to a removable media card or other storage location, as required.

The ability to create, edit and maintain CSV files is fully supported within the Kestrel TSCM ® Professional Software application and is an essential security feature, as the ability to work the master CSV file or use the built in database utilities provided for many of the features.



Settings Folder | v1.40xx

The technical operator does not need to recreate the customized Spectral Profile list when working on another computer as the | SpectralProfiles.spf | database file can easily be transported on removable media for use on another host computer running the Kestrel TSCM ® Professional Software.

Any number of unique working Spectral Profile databases may be created and selected by the technical operator.

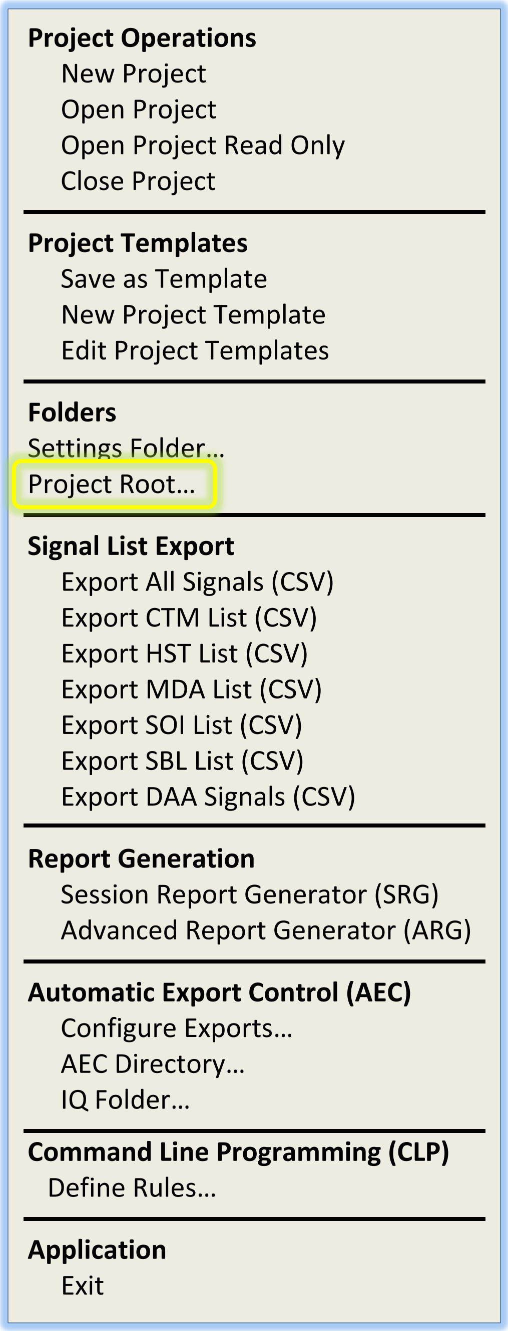
The technical operator can create a custom spectral profile for each deployment location that is unique to the specific target area, or for a variety of security reasons.

Individual working directories may be created for each client location, and for supported search receivers or analyzer hardware.

Additional | FILE | menu options are available when the | Automatic Export Control (AEC) ™ | OPT AEC | option is activated for the installation.

Project Root Directory

By default, the Project Root Directory will be the software installation directory, or other file directory location, if changed by the operator during the installation process.



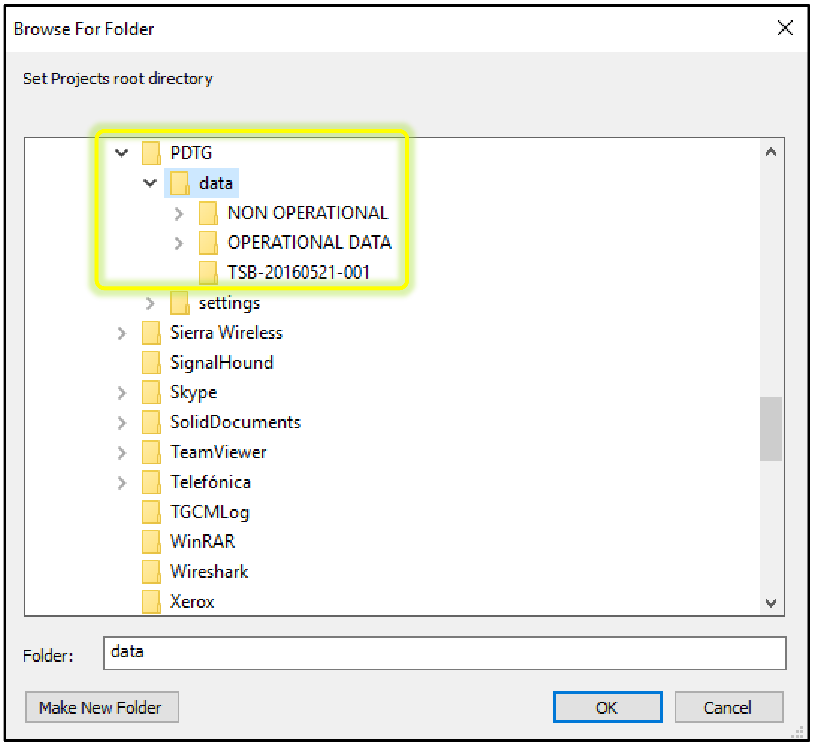
Project Root | v1.40xx

The technical operator is able to create and set, as the default, a new Project Root Directory utilizing the | FILE | PROJECT ROOT | menu option.

It is strongly recommended that the technical operator create a desktop shortcut, names | Kestrel TSCM DATA | for easy access to Kestrel Project Files (KPF) ™ data.

The | FILE | menu also allows the technical operator to export any of the various signal lists as a (.CSV) file format.

The (.CSV) file can be opened with a number of third-party productivity applications such Microsoft Excel ™ and other spreadsheet and database programs.



Project Root Directory | v1.35xx

The above example illustrates the ability of the operator to set the | Project Root | location as desired and create a consistent directory and File Naming Convention (FNC) to manage deployment files for each sweep, or each sweep location.

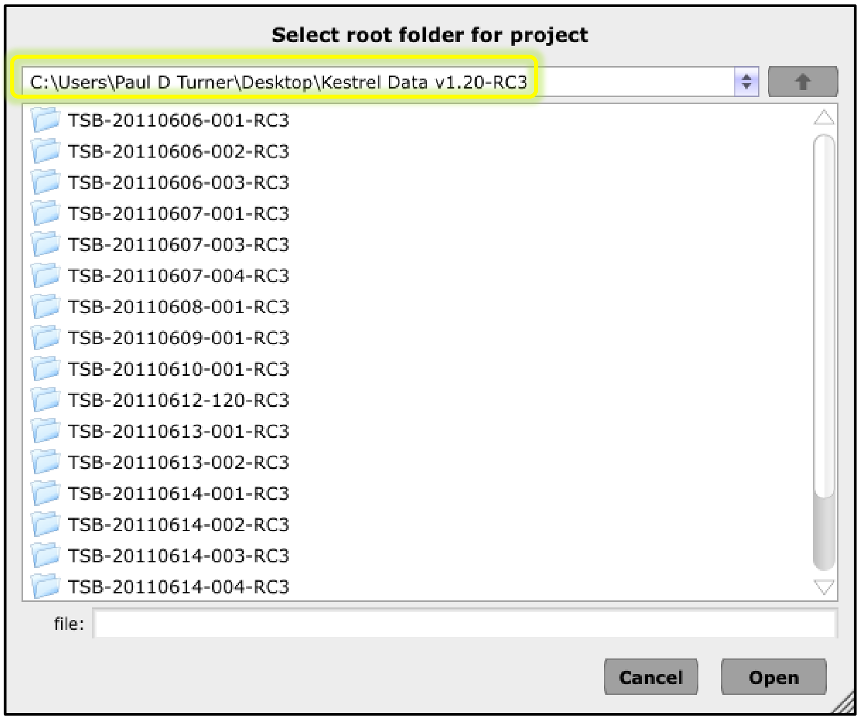
After the search receiver or analyzer initialization process is complete and the Analyzer Control dialog window is closed, the technical operator is able to set the Project Root Directory location.

The technical operator enters the project file name within the project description control group may press the | Folder | button in the | Setup Wizard | to verify or set the desired directory location.

Setup Wizard | v1.40xx

This task can also be accomplished by selecting the | FILE | PROJECT ROOT | menu option.

The | FOLDER | button functionality allows the technical operator to review and change the | Project Root Directory | without the need to first exit the Setup Wizard.



Select Root Folder | v1.35xx

The “Select Root Folder for Project” window will be displayed indicating the current “Project Root” directory.

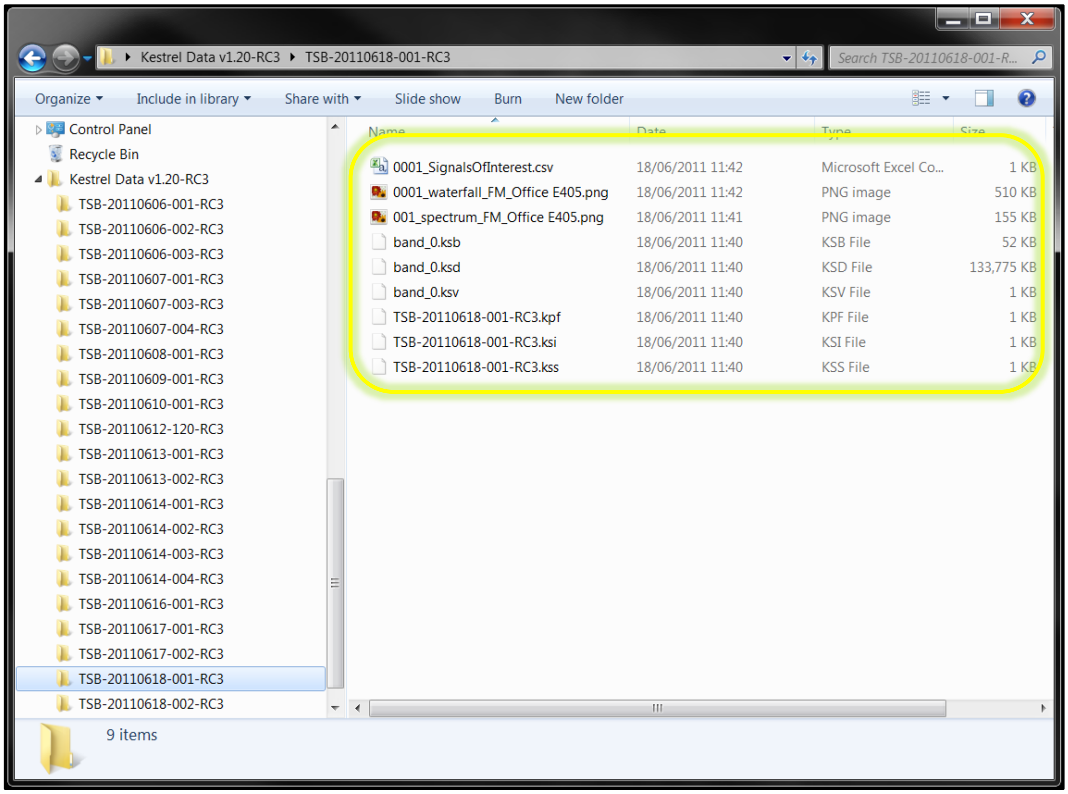
Once the technical operator has set the default “Project Root Directory”, all future Kestrel Project Files (KPF) and related folders containing deployment specific files will automatically be placed in the selected root directory location.

Project Root Directory

Once the technical operator has established a “Project Root Directory” it is an easy task to locate and review individual project files in the future.

It is absolutely essential that the technical operator take the necessary steps to setup and manage the “Project Root Directory” and establish a formal File Naming Convention (FNC).

Considerable flexibility exists within the Kestrel Project File (KPF) structure providing the technical operator with the opportunity to customize and control the project file management process.



Project Root Directory | v1.35xx

The above example illustrates the ability to quickly locate specific files of interest when a consistent File Naming Convention (FNC) is utilized to generate a deployment database file structure.

The technical operator has selected the project directory “TSB-20110618-001-RC3” and can explore the directory contents for specific files that may be of interest, such as screen capture or audio files.

Kestrel ® File Structure

There are a number of proprietary files utilized to store various elements of the complex streaming data, control, state and viewing options within the Kestrel TSCM ® Professional Software.

These are proprietary system files that are utilized by the Kestrel TSCM ® Professional Software and are not designed to be machine viewable.

Only the Kestrel Project File (KPF) ™ is used to open a saved project file for technical operator runtime and post review and analysis.

All other files are referenced by the Kestrel Project File (KPF) and data extraction is controlled and processed by this file.

When the technical operator opens the Kestrel TSCM ® Professional Software application (with or without a search receiver or analyzer connected) and selects the | FILE | OPEN PROJECT | or | OPEN READ ONLY PROJECT | menu option, all available project files will be displayed within their respective default file directory.

TIP: It is essential that the technical operator not alter, delete, or rename any of the Kestrel TSCM ® Professional Software project directories, or files, as doing so will prevent the ability to open the project file in the future. The structural integrity of the file must be maintained.

This policy includes the actual | Project File Directory (KPF) |, and all sub-file references, as renaming the directory will cause a loss of project file integrity and prevent the ability of the technical operator to open the historical project file for post analysis review, or for the purpose of restarting collection.

In the event that the directory or project file names are changed, preventing file historical project file from opening, the technical operator must restore the original directory and file names.

Should it be absolutely necessary to change the directory file naming convention, the operator must also change all project file instances with the same name, residing within the project directory.

It is not recommended that the operator alter the project directory or the project file names, however, the capability exists within the software to do so, should it be required to correct file naming convention errors.

Prior to making changes any to the project or file naming structure, it is strongly recommended that the technical operator make a backup copy of the historical project in its current state.

The Kestrel ® file structure is complex and should not be altered or changed without considering the potential consequences.

Operators are encouraged to consider and define a formal project file classification standard to limit the need to alter project directory and files post collection.

Never attempt to alter the file naming convention while the project is open, or during runtime, as this can potentially cause file corruption or damage the data contained within the directory and file structure.

The following table provides guidance as to a possible file naming convention and methodology to classify and maintain separation of operation Vs other projects.

File Naming Convention (FNC)	
TSB	TSB-20200329-001 | Technical Security Branch (TSB) ™ File
OPS	OPS-20190323-001 | Operational File
DEV	DEV-20190214-001 | Development File
TRN	TRN-20190519-001 | Training File
REF	REF-20200329-001 | Reference File
ARG	ARG-20190630-001 | Advanced Report Generator (ARG) File

FNC | v1.40xx

Understanding the Kestrel Project File (KPF) structure is essential for professional technical operators.

The following provides some insight as to the function and purpose of these files for familiarization.

The file extensions that are highlighted in ***BOLD** text are affected by any change in the operator defined file naming convention as per the following list.

Please note that other file extensions may also be affected depending on what features were utilized during runtime collection.

Any file within the project file directory, that exhibits the original file naming convention, must be changed to reflect the altered project file directory name originally assigned by the technical operator.

Failure to do so, may result in file corruption, or the inability to open the historical file in the future.

As previously noted, it is essential that the technical operator make a full backup of the original project, prior to making any changes to the file naming convention or project file structure.

Please note that the majority of the project files are not human readable and altering or changing the file extensions may result in corrupted data, which may not be recoverable or repairable.

Should such a situation arise, it is possible that our development group, can repair or extract all or some of the data from a corrupted file.

The entire file can be submitted in a multi part compressed file format, to support@pdtg.ca, or uploaded to our Drop Box account, or to our proprietary cloud-based network drive for analysis.

Contact us for access to these resources, if required.

There may be a charge associated with the data recovery process, as this function is elevated to our development group.

Project File Structure | Proprietary	
***KAM**	Kestrel Alarm
***KCL**	Kestrel Command Line
KCP	Kestrel Colour Pallet
KCS	Kestrel Configuration Script
KEC	Kestrel Export Control
KIQ	Kestrel IQ
***KLM**	Kestrel Locations
***KPF**	Kestrel Project File
KPT	Kestrel Project Template
KRG	Kestrel Report File
KSB	Kestrel Spectrum Band
KSD	Kestrel Spectrum Data
KSH	Kestrel Spectrum History
***KSI**	Kestrel Signals Information
***KSS**	Kestrel Spectrum State
KSV	Kestrel Spectrum View
SPF	Spectral Profile File
TCA	Kestrel Spectrum Cache
TLF	Table File

Project File Structure | v1.40xx

There are a number of working support files that are proprietary to Kestrel ®, but also provide export capability to working CSV table files.

These files include the | CPM | OSL | and | SPF | file formats, for which data can be imported and exported via CSV master files, that reside external to the application.

It is essential the technical operator maintain a working knowledge of the various file formats and related export capabilities for each of the above internal database files.

Working Support Files | Proprietary	
CPM	Channel Profile Mask
FDB	Frequency Database
OSL	Operator Signal List
SBL	Spectrum Baseline Logging
SDR	Software Defined Radio

Project File Structure | v1.40xx

There are a number of additional support files that may also be stored either within the Kestrel ® project file structure, or external to the application.

These support files can generally be opened without having first run the Kestrel TSCM ® Professional Software application and take advantage of third-party applications and productivity software running on the host computer.

Project File Structure | Support	
CSV	Comma-Separated Values
WAV	Waveform Audio File
PNG	Portable Network Graphics
JPG	Joint Photographic Group
GIF	Graphics Interchange Format
PDF	Portable Document File
TXT	Text File
LOG	Log File

Project File Structure | v1.37xx

Project File Size

The following tables provide real-world examples of the average project file storage requirements based on the declared sweep parameters for each individual table for the specific receiver, or spectrum analyzer.

The tables are not interchangeable with other receivers, or spectrum analyzers, and actual testing should be accomplished to determine the anticipated file size, based on runtime requirements.

The project file size is dependent on the actual number of active spectral windows tabs or bands, RBW settings, ambient RF environment, active threat level programming, number of data points transferred by the search receiver or analyzer and deployment time.

It is strongly recommended that a large capacity SSD storage device, be utilized for extended deployment and collection times.

TIP: Before deployment for the first time in an unattended operational deployment, based on a specific set of collection criteria, it is strongly recommended that the technical operator run a controlled test to determine the approximate (1 Hour) collection storage requirements and multiply this figure by the number of intended collection hours.

The following example is based on actual collected data from an extended single Range of Interest (ROI) band allocation (DC to 4400 MHz) @ 51 kHz (RBW).

Signal Hound (USB-SA44B) - DC to 4400 MHz @ 51 kHz RBW	
Collection Time	***Approximate Project File Size***
240 Hours	80 GB
120 Hours	40 GB
72 Hours	24 GB
48 Hours	16 GB
24 Hours	8 GB
12 Hours	4 GB
6 Hours	2 GB
3 Hours	1 GB
1 Hour	335 MB
30 Minutes	168 MB
15 Minutes	84 MB
5 Minutes	28 MB
1 Minute	6 MB

Actual Data Collection | v1.35xx

The following example is based on actual collected data from an extended single Range of Interest (ROI) band allocation (DC to 1000 MHz) @ 6.4 kHz (RBW).

Signal Hound (USB-SA44B) - DC to 1000 MHz @ 6.4 kHz RBW	
Collection Time	***Approximate Project File Size***
20 Hours	41 GB
10 Hours	21 GB
5 Hours	11 GB
3 Hours	6 GB
2 Hours	4 GB
1 Hour	2 GB
30 Minutes	1 GB
15 Minutes	500 MB
5 Minutes	167 MB
1 Minutes	33 MB

Actual Data Collection | v1.35xx

The following example is based on actual collected data from an extended single Range of Interest (ROI) band allocation (DC to 4400 MHz) @ 26 kHz (RBW).

Signal Hound (USB-SA44B) - DC to 4400 MHz @ 26 kHz RBW	
Collection Time	***Approximate Project File Size***
120 Hours	80 GB
96 Hours	64 GB
72 Hours	48 GB
48 Hours	32 GB
24 Hours	16 GB
12 Hours	8 GB
6 Hours	4 GB
3 Hours	2 GB

Actual Data Collection | v1.35xx

The data collection and file management process, creates a complex and separate independent file structure for each active Range of Interest (ROI), or Spectrum Band window, initialized by the technical operator.

The following values represent the actual collected data from an extended single Range of Interest (ROI) band allocation (DC to 4400 MHz) @ 51 kHz (RBW) deployment of 31 collection days.

Signal Hound (USB-SA124B) - DC to 4400 MHz @ 51 kHz RBW	
Collection Time	***Approximate Project File Size***
744 Hours (31 Days)	453 GB
720 Hours (30 Days)	438 GB
480 Hours (20 Days)	292 GB
240 Hours (10 Days)	146 GB
168 Hours (7 Days)	102 GB
120 Hours (5 Days)	73 GB
72 Hours (3 Days)	44 GB
48 Hours (2 Days)	30 GB
24 Hours (1 Day)	16 GB

Actual Data Collection | v1.35xx

The following example file size table is based on actual collected data from an extended single Range of Interest (ROI) band allocation (DC to 6000 MHz) @ 20 kHz (RBW).

The following file size values are based on actual field trials and qualification testing of the Collection and Recording Mode (CRM).

The values in | RED | indicate extremely large Kestrel Project Files (KPF) and require extended storage capacity that may not be available on a standard computer hardware or laptop computers.

The values in | YELLOW | indicate large project files that may utilize a large percentage of the storage device capacity and may leave only a limited working hard-drive space for the Operating System (OS) and virtual memory allocation.

The values in | GREEN | indicate relatively large, but acceptable Kestrel Project File (KPF) sizes for most typical laptop computers.

Signal Hound (BB60C) - DC to 6000 MHz @ 20 kHz RBW (Typical) File Size							
Runtime Collection (Hours) (Days)	***1 / n = 1***	***1 / n = 2***	***1 / n = 5***	***1 / n = 10***	***1 / n = 20***	***1 / n = 50***	***1 / n = 100***
720 Hours (30 Days)	33.6 TB	16.1 TB	6.60 TB	3.06 TB	1.22 TB	507 GB	253 GB
240 Hours (10 Days)	11.2 TB	5.36 TB	2.20 TB	1.02 TB	408 GB	169 GB	84.2 GB
120 Hour (5 Days)	5.60 TB	2.68 TB	1.10 TB	510 GB	204 GB	84.7 GB	42.1 GB
72 Hour (3 Days)	3.36 TB	1.61 TB	660 GB	306 GB	122 GB	50.8 GB	25.2 GB
48 Hour (2 Days)	2.24 TB	1.07 TB	440 GB	204 GB	81.6 GB	34.0 GB	17.0 GB
24 Hour (Day)	1.12 TB	536 GB	220 GB	102 GB	40.8 GB	17.0 GB	8.40 GB
12 Hours	558 GB	268 GB	110 GB	51.2 GB	20.4 GB	8.50 GB	4.20 GB
8 Hour	279 GB	134 GB	55.2 GB	25.6 GB	13.6 GB	5.60 GB	2.80 GB
4 Hour	139 GB	67.2 GB	27.6 GB	12.8 GB	6.80 GB	2.80 GB	1.40 GB
2 Hour	69.6 GB	33.6 GB	13.8 GB	6.40 GB	3.40 GB	1.40 GB	701 MB
1 Hour	34.8 GB	16.8 GB	6.90 GB	3.20 GB	1.70 GB	706 MB	350 MB
30 Min	17.4 GB	8.40 GB	3.50 GB	1.60 GB	857 MB	353 MB	175 MB
15 Min	8.70 GB	4.20 GB	1.70 GB	792 MB	427 MB	175 MB	88.0 MB

Signal Hound (BB60C) - DC to 6000 MHz @ 20 kHz RBW (Typical) File Size						
Runtime Collection (Hours) (Days)	***1 / n = 250***	***1 / n = 500***	***1 / n = 1000***	***1 / n = 2500***	***1 / n = 5000***	***1 / n = 10000***
720 Hours (30 Days)	104 GB	49.8 GB	24.6 GB	9.96 GB	4.98 GB	2.49 GB
240 Hours (10 Days)	34.6 GB	16.6 GB	8.3 GB	3.32 GB	1.66 GB	830 MB
120 Hour (5 Days)	17.3 GB	8.30 GB	4.15 GB	1.66 MB	829 MB	415 MB
72 Hour (3 Days)	10.4 GB	5.01 GB	2.49 GB	995 MB	498 MB	249 MB
48 Hour (2 Days)	6.91 GB	3.32 GB	1.69 GB	663 MB	332 MB	166 MB
24 Hour (1 Day)	3.46 GB	1.66 GB	829.4 MB	332 MB	166 MB	83.0 MB
12 Hours	1.73 GB	829 MB	414.7 MB	166 MB	82.9 MB	42.1 MB
8 Hour	1.15 GB	553 MB	277 MB	111 MB	55.3 MB	28.1 MB
4 Hour	576 MB	277 MB	138.2 MB	55.3 MB	28.1 MB	13.8 MB
2 Hour	288 MB	138 MB	69.1 MB	27.6 MB	13.8 MB	6.90 MB
1 Hour	144 MB	69.1 MB	35.1 MB	13.8 MB	6.91 MB	3.50 MB
30 Min	72.0 MB	34.6 MB	17.3 MB	7.00 MB	3.51 MB	- - -
15 Min	36.0 MB	18.0 MB	8.64 MB	3.50 MB	- - -	- - -

Actual Data Collection | v1.40xx

Kestrel ® Project Templates (KPT) ™

The technical operator can create any number of Kestrel Project Templates (KPT) ™ directly, from the included Project Template Editor (PTE) window.

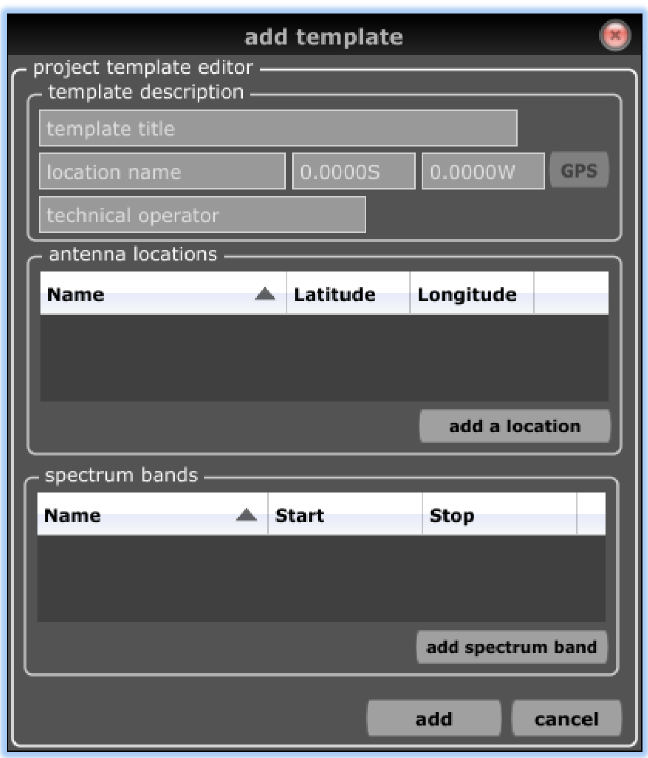
The ability of the technical operator to define, edit, delete, and save, current Kestrel Project Files (KPF) ™ as working templates, is fully supported.

This feature meets our operator centric, work-flow oriented philosophy, and is a very powerful resource.

The technical operator can pre-configure any number of spectrum band allocations, which are then stored in the settings directory, and contain a persistent set of project templates.

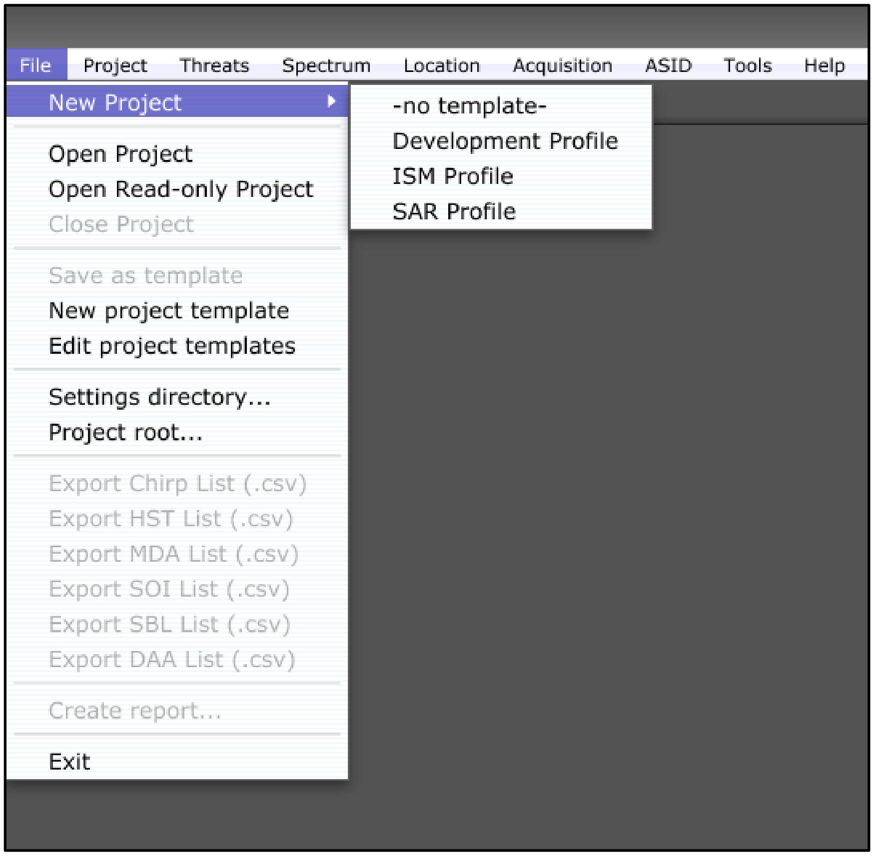
It is also possible to define and create a new base template only. This feature is accessed from the | FILE | NEW PROJECT | NEW PROJECT TEMPLATE | menu option.

This opens the | ADD TEMPLATE | PROJECT TEMPLATE EDITOR |, which allows the technical operator to provide a | TEMPLATE TITLE | LOCATION NAME (Optional) | TECHNICAL OPERATOR (Optional) | and add any number of | ANTENNA LOCATIONS | and | SPECTRUM BANDS | to the profile.



Project Template Editor | v1.35xx

This allows the technical operator to select the profile again in the future from the | NEW PROJECT | template profile menu list, which has been operator programmed, to open multiple spectrum bands.



File Menu Structure | v1.35xx

The | EDIT PROJECT TEMPLATES | menu option allows the technical operator to display a list of all available | PROJECT TEMPLATES | by title, and the number of SPECTRUM BANDS | set.

This dialog window also allows the technical operator to | EDIT | COPY | DELETE |, existing | PROJECT TEMPLATES |.

Once the technical operator has defined at least one (1) template, it will display under the | FILE | NEW PROJECT | menu, and can be selected, rather than creating a | NEW PROJECT | and imputing all of the project parameters such as multiple spectra.

Alternatively, the technical operator can simply access the | FILE | NEW PROJECT | menu, and open a new project without a template, by selecting the | NO TEMPLATE | menu option.

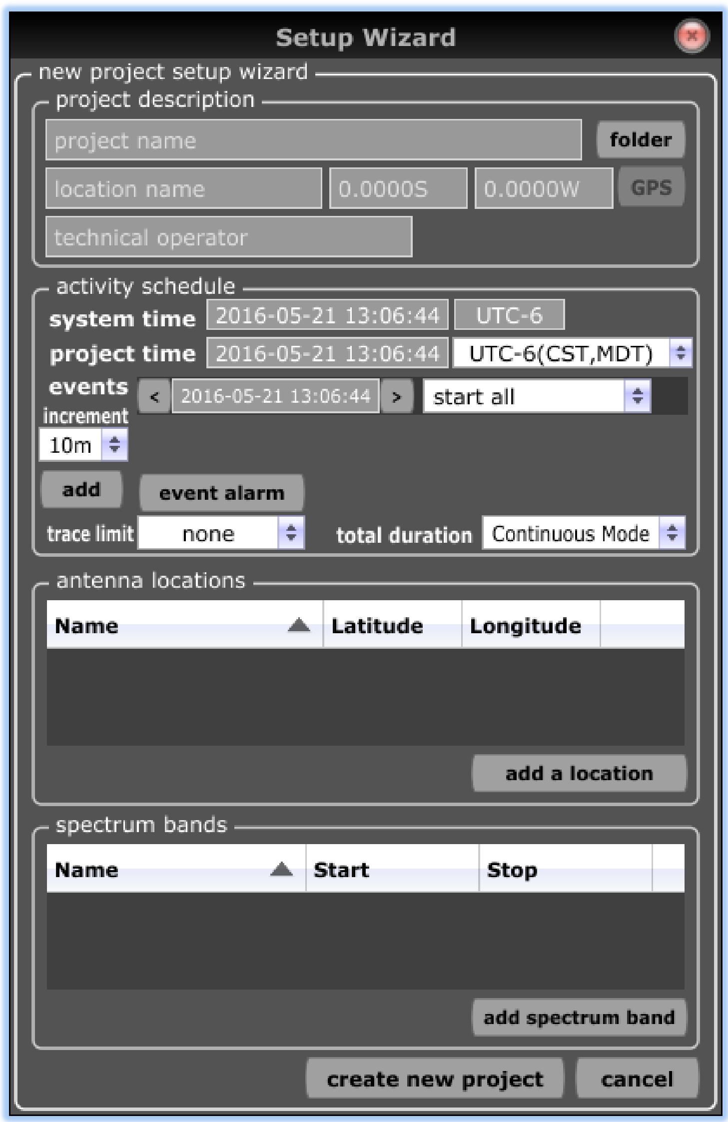
Selecting the | NO TEMPLATE | menu option, displays the | SETUP WIZARD | dialog window.

The technical operator can define the runtime project parameters, specific to the assignment.

The operator can edit the template profile list, and also generate a template from the currently active Kestrel Project File (KPF).

Any number and type of deployment profiles can be created by the technical operator, edited, stored, and recalled, for common deployment parameters, and operational strategies.

The ability to pre-configure a working template for different physical locations, or specific reoccurring collection and analysis parameters, and requirements, is fully supported within the Kestrel TSCM ® Professional Software.



New Project Setup Wizard | v1.35xx

Kestrel TSCM ® Professional Software, supports the ability to save the current project as a template for future use.

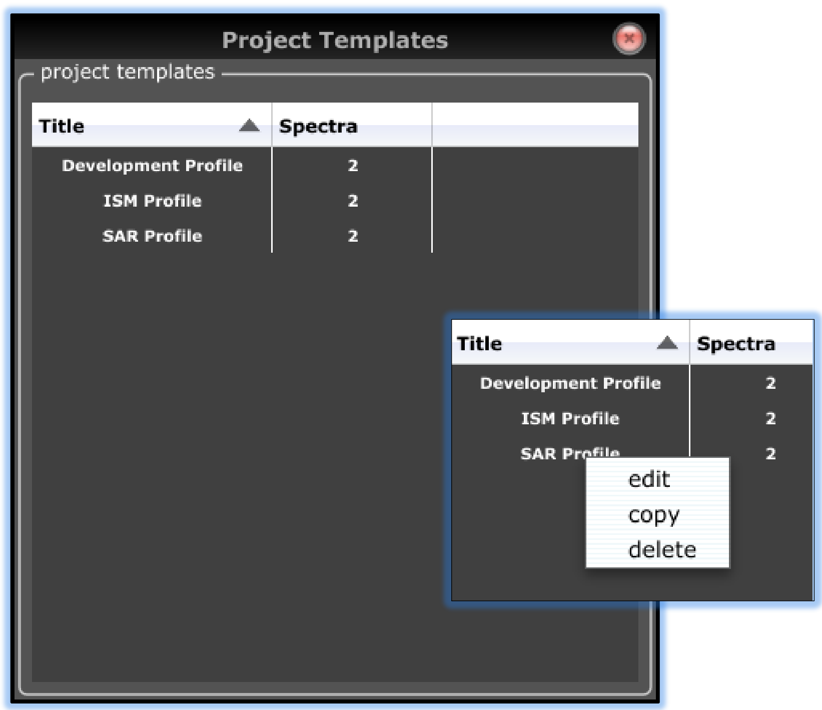
It is also possible to edit and delete the profile once saved.

This feature is valuable when the original project contains identifying client information that needs to be removed from the new template.

The edit | EDIT PROJECT TEMPLATES | dialog window is accessed from the | FILE | EDIT PROJECT TEMPLATES | menu.

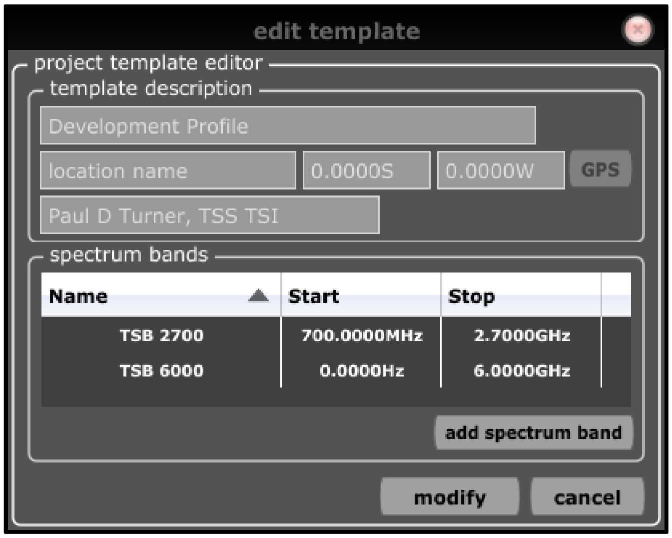
This displays a working list of all current project templates, which can be reviewed, edited, copied, or deleted from this dialog window.

The template | TITLE | and | NUMBER OF SPECTRA | for each profile are displayed.



Project Templates | v1.35xx

Selecting | EDIT | invokes the | PROJECT TEMPLATE EDITOR | dialog window.



Project Template Editor | v1.35xx

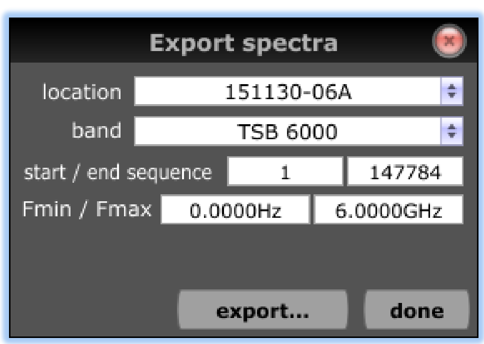
Export Spectra | CSV Format

The ability of the technical operator to select and export operator defined blocks of spectra data as a | CSV | file format, permits yet another form of advanced data storage, and the ability to conduct external signal analysis with the assistance of third-party applications.

The operator defined spectra | CSV | export, includes advanced filtering options to refine the exported data, minimizing the file size and storage foot print.

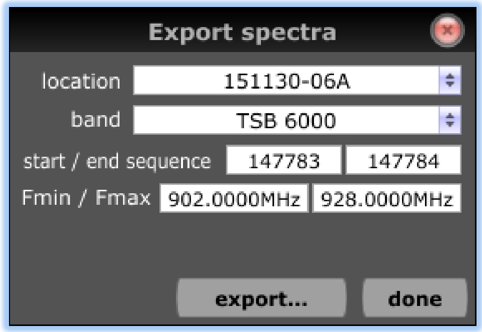
The | Export CSV Spectra | feature supports the ability to select any available | LOCATION | and | BAND |, as well as any number of specific traces, by selecting the | START | and | STOP | trace count, within a currently active, or post collection, historical Kestrel Project File (KPF).

The | Export CSV Spectra | is accessed under the | SPECTRUM | SPECTRUM SET | menu.



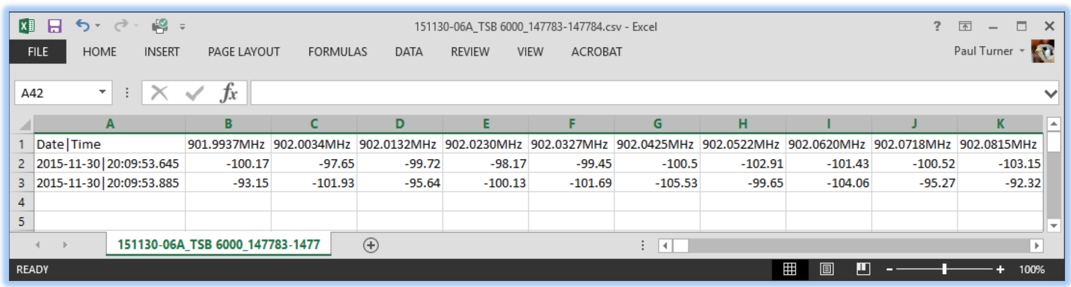
Export CSV Spectra | v1.35xx

The | Export Spectra | dialog window displays, permitting the technical operator to define the export parameters.



Export CSV Spectra | v1.35xx

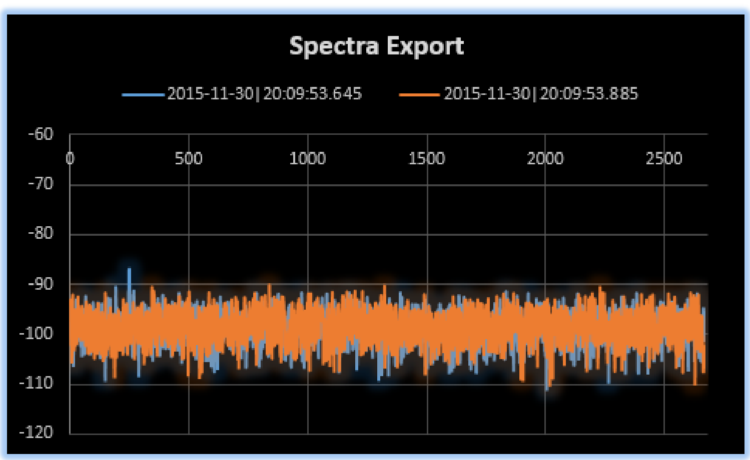
The above example illustrates the technical operator's ability to filter the export data from location 151130-06A, band TSB 6000, trace 147783 to 147784, spectra from 902.0000 MHz to 928.0000 MHz.



	A	B	C	D	E	F	G	H	I	J	K
1	Date|Time	901.9937MHz	902.0034MHz	902.0132MHz	902.0230MHz	902.0327MHz	902.0425MHz	902.0522MHz	902.0620MHz	902.0718MHz	902.0815MHz
2	2015-11-30|20:09:53.645	-100.17	-97.65	-99.72	-98.17	-99.45	-100.5	-102.91	-101.43	-100.52	-103.15
3	2015-11-30|20:09:53.885	-93.15	-101.93	-95.64	-100.13	-101.69	-105.53	-99.65	-104.06	-95.27	-92.32
4											
5											

Export CSV Spectra | v1.35xx

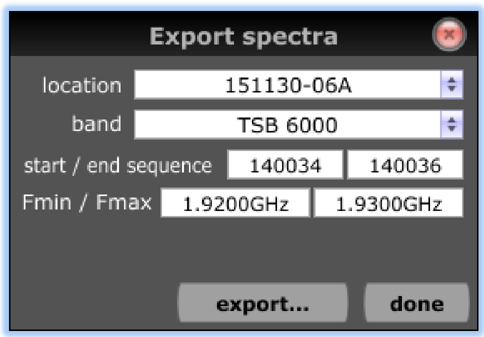
The above example illustrates the partial CSV data exported by the technical operator for trace 147783 and 147784.



Export CSV Spectra | v1.35xx

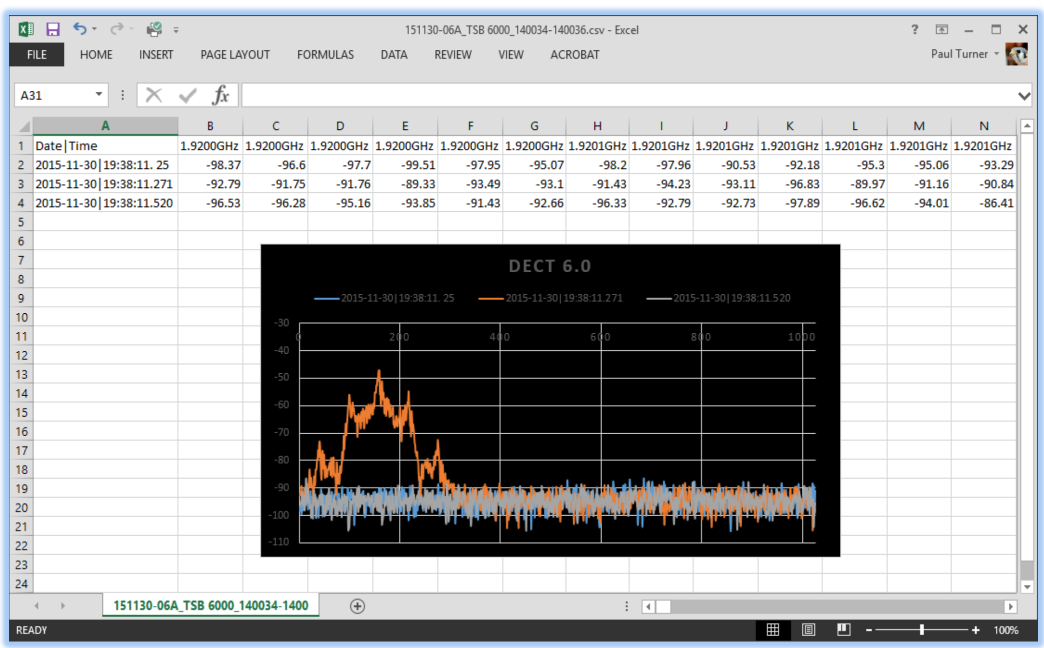
Utilizing the advanced graphing features of Microsoft Excel, the technical operator has rendered a graphic representation of the 902 MHz to 928 MHz band for traces 147783 and 147784 as a direct comparative, displaying 2660 data points against the reference level.

To illustrate another example of the power of the | Spectra CSV Export | feature, the technical operator has filtered data for location 151130-06A, band TSB 6000, traces 140034, 140035, and 140036, representing the ITU Region 2 DECT 6.0 band 1.9200 GHz to 1.9300 MHz.



Export CSV Spectra | v1.35xx

The resulting data output of the operator selected ITU Region 2 DECT 6.0 spectrum band, illustrates a single channel burst, captured during trace 140035.



Export CSV Spectra | v1.35xx

The ability of the technical operator to capture the raw spectra data for trace level analysis is a very powerful feature.

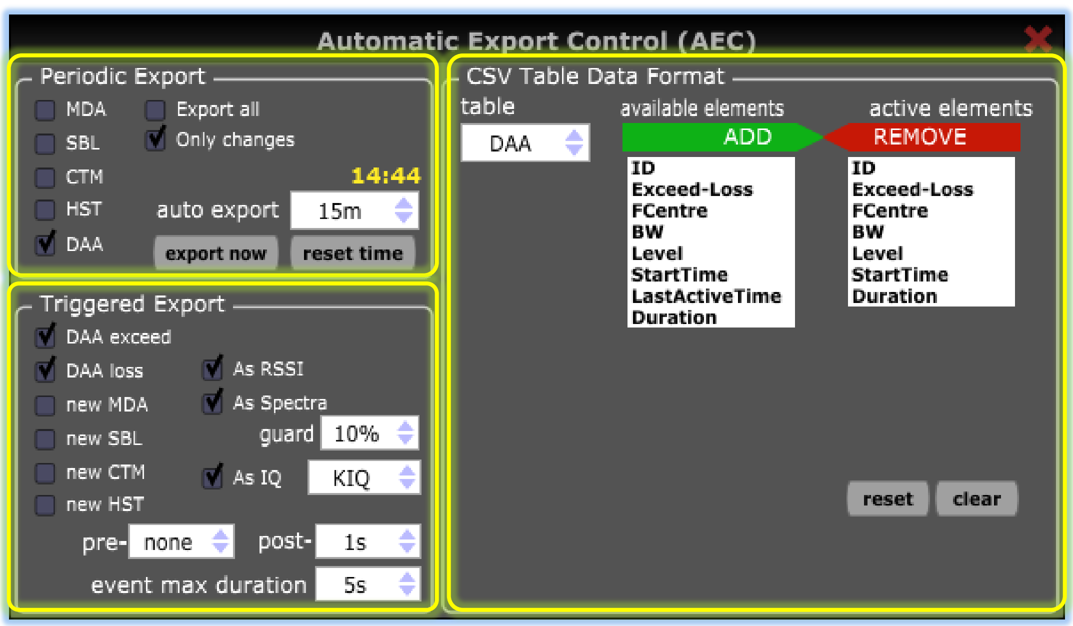
Automatic Export Control (AEC) ™ | OPT AEC

The ability to program periodic automatic export of many aspects of the data collection process based on | PERIODIC TIME |, or a | TRIGGERED |spectral event, is supported as an advanced | OPT AEC | component of the Kestrel TSCM ® Professional Software.

AEC is a powerful component utilized during unattended Remote Spectrum Surveillance and Monitoring (RSSM) ™ to provide the technical operator with analytical, CSV based files for targeted programmable Spectra, RSSI, and runtime IQ data samples.

AEC ™ provides an element of fail-safe data management when deployed in hostile environments, as AEC ™ files are exported on a timed or event triggered basis and may be stored on network based or cloud storage media.

The | Automatic Export Control (AEC) ™ | programming dialog window is accessed from the | File | Configure Exports | menu option.



Automatic Export Control (AEC) | v1.40xx

The optional | Automatic Export Control (AEC) ™ | module requires a separate Activation Security Key (ASK) ™ to enable the feature within the software for active deployment.

The AEC ™ module is an optional | OPT AEC | extension feature that is designed for use in Remote Spectrum Surveillance and Monitoring (RSSM) ™, and other deployment applications.

Periodic Export | Control

The AEC | PERIODIC EXPORT | control group allows the technical operator to program a | TIME | based export of one (1) or more Automatic Threat Lists (ATL) such as the | MDA | SBL | CTM | HST | DAA | when selected active during runtime.

The | PERIODIC EXPORT | control generates a series of timed | CSV | export files programmed to automatically export to an operator definable storage location.

Support for both | PERIODIC | and | TRIGGERED | elements of the AEC feature may be programmed for use to work together or independently as required at the deployment level.

Periodic Export | Control Group | v1.40xx

The ability to select either | EXPORT ALL | or export | ONLY CHANGES | allows the operator to export the entire current ATL signal list on export, or export only subsequent incremental changes based on an operator programmed time interval.

The technical operator can define the | AUTO EXPORT | trigger time by selecting a value from the | AUTO EXPORT | selection box.

The | PERIODIC | timed automatic export feature supports operator defined values of | ***OFF – Default*** | 1H | 3H | 8H | 12H | 24H | 48H | 72H | options, and the ability to define any other value.

For example, the technical operator can define | 1M < minute > | 2H < hours > | 10D < days > | as legal value entries as periodic timed export.

The result is a repetitive count down time trigger that automatically exports the operator selected formatted CSV table data for the various active signal lists.

When active, the AEC feature will automatically export the selected CSV files subject to the | AUTO EXPORT | time value.

Additional operator controls include an | EXPORT NOW | button to immediately trigger on demand, a programmed export cycle.

The | RESET TIME | button resets the countdown timer back to the programmed time interval.

AEC Directory | Export

The actual export storage location can be custom defined by the technical operator, by navigating to | FILE | AEC DIRECTORY | to select the desired storage location for all exported CSV formatted files, if desired.

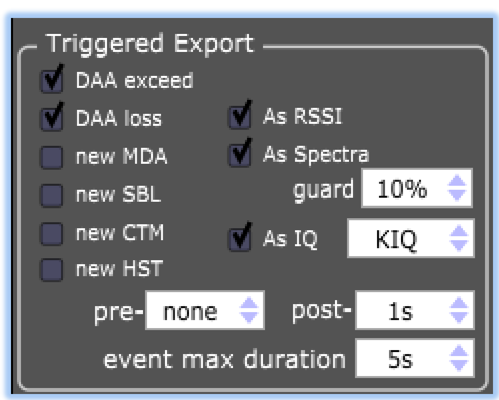
IQ Files Root | Export

The export storage location can be custom defined by the technical operator, by navigating to | FILE | IQ Files Root | menu option to select a separate and independent storage location for exported | ARP CSV | and | BINARY KIQ | formatted files.

This is particularly useful for network storage, and handling of relatively large files, for post event hand-off processing, and operator analysis.

Triggered Export | Control

The | AUTOMATIC EXPORT CONTROL (AEC) ™ | feature can be programmed to export | RSSI | SPECTRA | ARP IQ CSV | and | BINARY KIQ | data based on an operator defined | TRIGGERED EXPORT | event.



Triggered Export | Control Group | v1.40xx

The | TRIGGERED EXPORT | control feature supports the triggered export of new detections, including | DAA < Exceedance > | DAA < Loss > | New MDA < Exceedance > | New SBL < Exceedance > | New CTM < Detection > | New HST < Identification>.

Triggering is subject to either operator-defined threshold settings, or the software's automatic signal characterization of the presence and identification of analog audio emitters (transmitters) operating within the target area, including associated Signal of Interest (SOI) harmonic content, whenever the CTM and / or HST features are active.

The | TRIGGERED EXPORT | control feature exports CSV data files for | RSSI | SPECTRA | for triggered Signals of Interest (SOI).

Support for | ARP IQ | and | BINARY KIQ | formats for runtime of | IQ Export | data is a very complex process within the underlying code architecture and it is essential that the technical operator fully understand the capabilities and limitations for this level of operation.

The File Naming Convention (FNC) provides sufficient detail to identify and sort the ARP CSV or the BINARY KIQ files.

FORMAT: AEC-IQF-DAA-(149.7703MHz)-EXCEED-20170314-214951-001497708-IF30

DECODING: AEC | IQ FILE | DAA TRIGGER | FREQUENCY | TYPE | DATE | TIME | FREQUENCY | IF BANDWIDTH

Support for | PRE | and | POST | buffering is a powerful analytical tool that provides operator defined | 100 mSec | 250 mSec | 500 mSec | 1 Sec | 2 Sec | ***5 Sec (Default)*** | 10 Sec | buffering.

Within the present context of the current implementation of triggered IQ, | PRE | buffering is not yet implemented, since no IQ data is recorded within a runtime sweep environment.

Basically, it is not possible to sweep and demodulate at the same time, as is required to record IQ sampling.

IQ triggering requires that the runtime sweep environment first be stopped upon detection of a triggering event, and that the demodulator be started, in order to capture and process IQ data, on a single search receiver.

This is only a concern with short duration bursts of less that approximately 250 mSec

This is a known limitation within the first implementation of the AEC control, and it means there is a short logic switching delay in hand-off from the active runtime sweep environment to an IF based demodulation mode, of between 100 mSec and 200 mSec, and this can be problematic for short duration SOI bursts, as noted.

Utilizing | Dual Receiver Operation (DRO) | reduces this delay, and enhances runtime integrity significantly, within the current implementation, as the second receiver does all the heavy lifting on direct hand-off, while the primary search receiver continues in an uninterrupted runtime search environment.

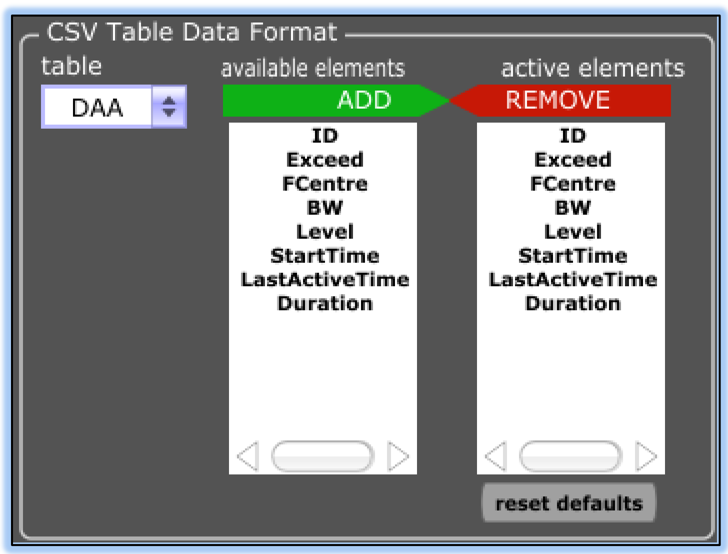
Our Software Development Group (SDG) has devised a method of operating within an IFBW runtime environment, providing essentially a real-time collection mode based on the search receivers design IFBW.

This capability will be available in the next phase of the | TRIGGERED IQ | implementation, to allow | PRE | buffering capability within the real-time | IF | runtime environment.

CSV Table Data Format

The CSV table data programming capability permits the operator to define the desired data elements to be exported to the | CSV | file.

The operator can select all available options, or selectively export specific data elements, or remove previously selected elements.



DAA | CSV Table Data Format | v1.40xx

This level of customization provides the technical analyst with precision data elements for post review and analysis, or for use as hand-off programming data for third-party hardware.

Each | EXPORT TYPE | MDA | SBL | CTM | HST | DAA | associated with an Automatic Signal List (ATL) CSV file, can be independently defined with operator selected table values, referred to as | ACTIVE ELEMENTS |.

This level of technical operator defined customization is a powerful feature that provides | ADVANCED AEC FILTERING |, and therefore an important level of data qualification for the | ACTIVE ELEMENTS | actually exported and available for technical analysis.

Advanced AEC filtering is another important | File Size Management | tool by further reducing the actual file sizes of exported data files.

Defining the | CSV Table Data Format | begins with the technical operator selecting the | EXPORT TYPE | for CSV output programming, which displays a list of | AVAILABLE ELEMEMTS | that can then be selected individually and dragged to the | ACTIVE ELEMEMTS | window.

Each of the | EXPORT TYPE | Automatic Threat List (ATL) data sets, include options specific to the export type selected.

Export | File Naming Convention (FNC)

AEC exported |CSV | files are automatically assigned a preformatted | FNC | format. The following table outlines the | FNC | for the | Periodic Export | control group.

Periodic Export | File Naming Convention (FNC) | CSV Format					
Export	**Date**	**Time**	**Rx Type**	**Rx S/N**	**Location**
MDA	20160521	041319	BB60C	52100097	160520-02-001A
SBL	20160521	041319	BB60C	52100097	160520-02-001A
CTM	20160521	041319	BB60C	52100097	160520-02-001A
HST	20160521	041319	BB60C	52100097	160520-02-001A
DAA	20160521	041319	BB60C	52100097	160520-02-001A

Periodic Export | File Naming Convention | v1.35xx

To illustrate the decoding of the automatic FNC format, consider the following example;

MDA-20160521-041319-BB60C-52100097-160520-02-001A.CSV

MDA = Automatic Threat List (ATL) | Export Type

20160521 = Year | Month | Day

041319 = Hours | Minutes | Seconds

BB60C = Software Defined Radio (SDR) | Rx Type

52100097 = Rx Serial Number

160520-02-001A = User-Defined Antenna < Collection > Location

< Date > | < Level >| < Room / Area > | Room / Area Sub-Location

.CSV = Microsoft Excel | Comma Separated Values File

Command Line Programming (CLP) ™ | OPT CLP

The CLP ™ feature is an independent extension of the Automatic Export Control (AEC) ™ module.

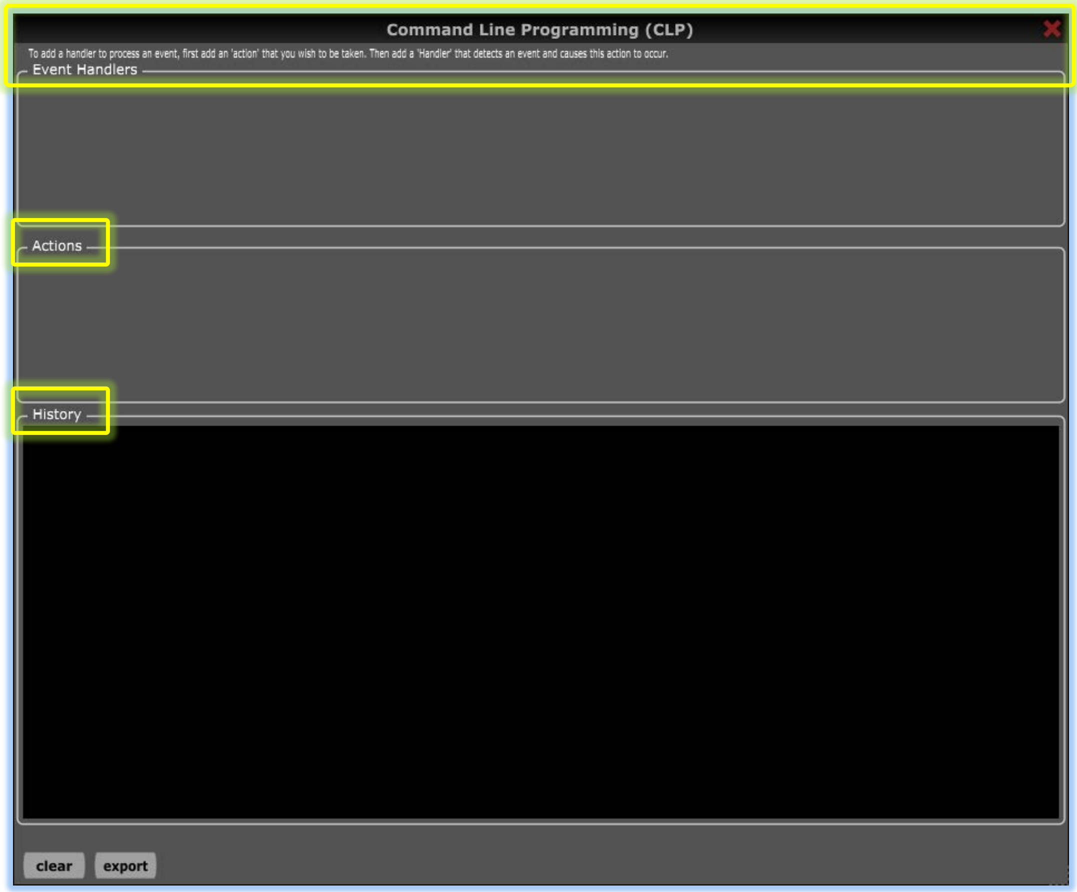
Command Line Programming (CLP) ™ is a powerful local and remote network-oriented controller that permits a wide range of | EVENT HANDLERS | and | ACTIONS | that are user defined and programmed for execution, during runtime by the technical operator.

The feature is fully integrated within the Kestrel TSCM ® Professional Software threat management capability and is fully integrated with all existing alert-based features, such as the | Dynamic Alert Annunciator (DAA) ™ | and | Minimum Detection Amplitude (MDA) ™ | threshold exceedance logging, and works well with the | Spectrum Baseline Logging (SBL) ™ | feature.

The | Automatic Export Control (AEC) ™ | OPT AEC ™ provides additional capability but does not need to be licensed on the target machine in support of the | Command Line Programming (CLP) ™ | OPT CLP ™ capability, which in turn, requires a separate Activation Security Key (ASK) ™ similar to OPT AEC ™ feature.

To access the feature, navigate to the | FILE | COMMAND LINE PROGRAMMING | DEFINE RULES | menu option to display the Command Line Programming (CLP) ™ control window.

The CLP ™ control window consists of three (3) separate elements, including | APPLICATION EVENT HANDLERS | ACTIONS | and | HISTORY | as illustrated in the following image.



Command Line Programming (CLP) TM Default Control Window | v1.40xx

Event Handlers

To add a new CLP TM | EVENT HANDLER | a right or left mouse click on the gray space within the | APPLICATION EVENT HANDLERS | display area and select the | ADD HANDLER | menu option.

A right or left mouse click on any existing operator defined | EVENT HANDLER | results in menu options | EDIT | DELETE | and | RESET | to allow programming adjustments to each existing | EVENT HANDLER |.

TIP: It is essential that the technical operator define the | ACTION | element before creating the | EVENT HANDLER | as this information will be selected from a drop-down menu list when setting up the | EVENT HANDLER |.

Actions

To add a CLP ™ | ACTION | a right or left mouse click on the gray space within the | ACTION | display area and select | ADD EMAIL ACTION | ADD SYSTEM ACTION | OR | ADD SOUND ACTION | menu option.

A right or left mouse click on any existing | ACTION | results in menu options | EDIT | and | DELETE | to allow programming adjustment to each of the existing | ACTIONS |.

To provide an < alert processing > limiting capability, the | ACTION | menu provides an operator defined | ACTION THROTTLING | between | ACTION | events, to minimize repeated nuisance < alerts > based on the | ACTION THROTTLING | settings defined.

Add Email Action
Add System Action
Add Sound Action

Action Throttling
1 Sec (between actions)
2 Sec
5 Sec
✓ 10 Sec
30 Sec
60 Sec

Action Menu | v1.40xx

The default setting is | 10 Sec |, with | 1 Sec | 2 Sec | 5 Sec | 10 Sec (Default) | 30 Sec | and | 60 Sec | options between < actions >.

History

During runtime, all events are appended and displayed within the history window in reverse order, with the most recent event displayed at the top of the history window, as a verification of each event as illustrated in the following format, as might be expected based on the following operator defined programming.

2018-05-16 | 18:32:12.280 Event DAA-exceed: LTE 2100 => Handler DAA-1 fired

2018-05-16 | 18:32:12.280 Event DAA-exceed: LTE 2100 => Handler DAA-1 fired

2018-05-16 | 18:32:12.280 Event DAA-exceed: LTE 2100 => Handler DAA-1 fired

2018-05-16 | 18:32:12.280 Event DAA-exceed: LTE 2100 => Handler DAA-1 fired

2018-05-16 | 18:32:12.280 Event DAA-exceed-file: LTE 2100

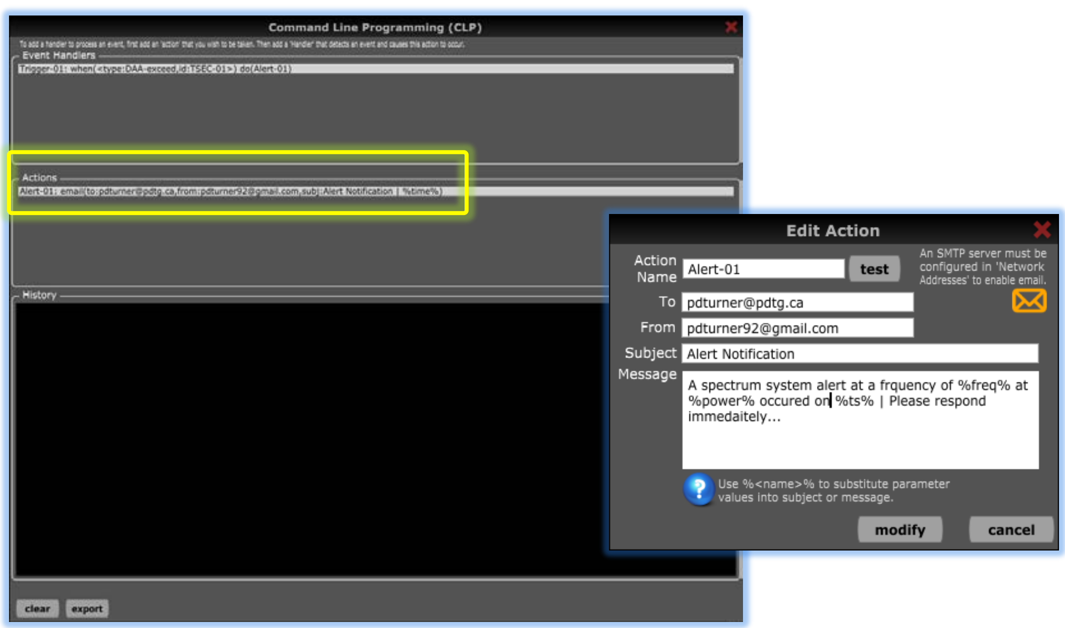
It is important to note that the history display data is not automatically saved within the application and will clear, once the | COMMAND LINE PROGRAMMING (CLP) TM | control window is closed, or the application is shut down.

The technical operator can press the < clear > button to reset the | HISTORY | window or can press the < export > button to invoke an option to save the currently existing history window content as a < CLPHistory.txt > file, appended to the current project directory.

Email Forwarding | Programming Parameters

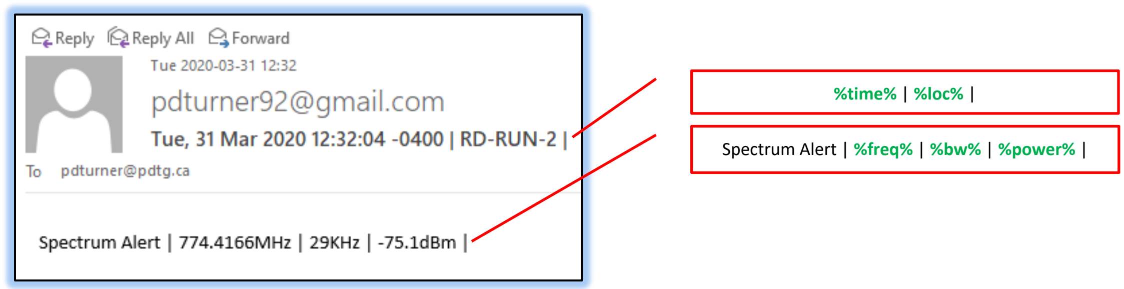
The following image illustrates | Google Mail Forwarding | for alerts using the | ADD EMAIL ACTION | and demonstrates the powerful capabilities of the feature.

The Alert-1 is an | ADD EMAIL ACTION | to send email alerts to any number of independent recipients.

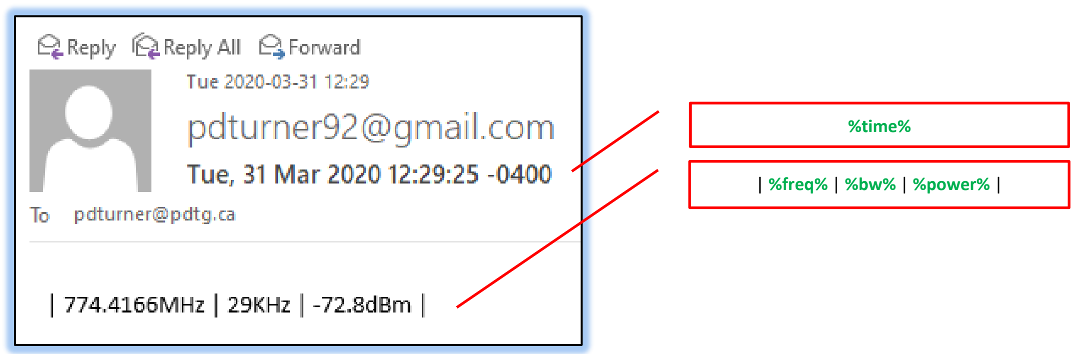


Email Forwarding | Formatting Style

The ability to produce a custom formatted email message with only the desired parameters is fully realized with a combination of simplified coding parameters and plain text descriptors.



Email Formatting Examples | v1.40xx



Email Formatting Examples | v1.40xx

In the first example above, the technical operator has programmed the | DATE | and | LOCATION | parameters into the EMAIL subject line.

The body of the EMAIL message contains a | PLAIN TEXT DESCRIPTOR | FREQUENCY | BANDWIDTH | and | AMPLITUDE | of the triggered spectrum event.

In the second example above, the technical operator programmed only the | DATE | parameter into the EMAIL message subject line.

The body of the EMAIL message contains only the | FREQUENCY | BANDWIDTH | and | AMPLITUDE | of the triggered spectrum event.

Email Formatting Examples | v1.40xx

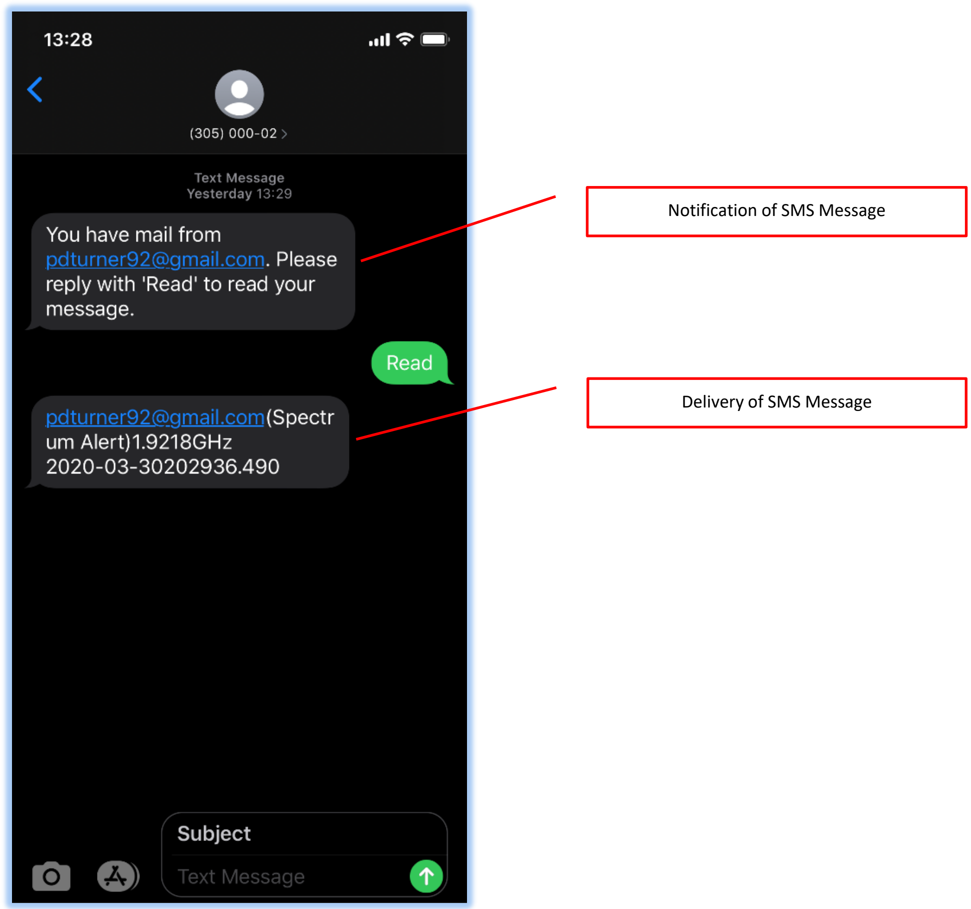
The EMAIL examples above demonstrate the ability to combine plain text and simple coding parameters to render custom operator defined output data.

The sidebar boxes separate the plain text and coded parameters that represent the generated output processed by the email forwarding mechanism.

The same process can be utilized to render an SMS output, which essentially renders the email process to the SMS service.

Depending on the carrier process handling for SMS messaging and the mobile device setup, the actual received message process may vary.

The following example is how Rogers Wireless handles the process by sending an alert message to which the receiver must respond to by texting the word < READ > back to the SMS system, at which time the original message will be delivered as authorized.



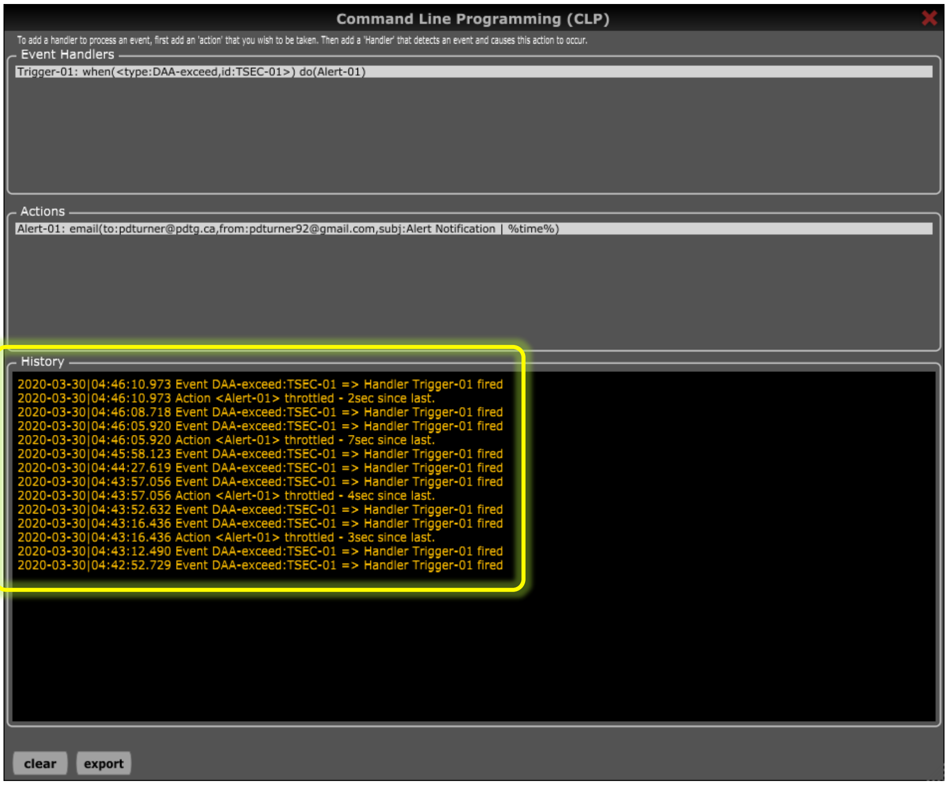
SMS Example | v1.40xx

This example contains the following formatting parameters:

Plain Text: **Spectrum Alert**

Parameters: **%freq% %ts%**

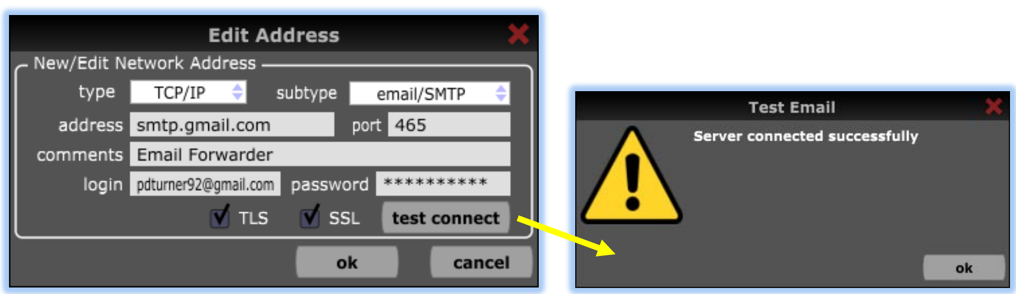
The rendered SMS delivery **< Spectrum Alert 1.9218 MHz 30-03-30 202936.490 >**



Command Line Programming (CLP) ™ | History | v1.40xx

An analysis of the above programming parameters indicates that a Dynamic Alert Annunciator (DAA) ™ alert zone has been defined by the technical operator as < TSEC-01 >, and when an exceedance trigger occurs during runtime and | EMAIL | alert will be initiated.

Email alerts require additional setup with the | NETWORK ADDRESSES | dialog window located within the | ACQUISITION | menu.



Network Addresses | Test Email Setup | v1.40xx

It may be necessary to log on to the | Google Account Profile | and select the | Allow Less Secure Applications | option, to permit the system to process third-party mail handling capability.

By default, this option is disabled in the | Google Account Profile | at the account level.

Email Forwarding | Alert Formatting Examples

The following list delineates the various legal value programming parameters that can be utilized along with standard plain text email messages to achieve customized alert specific data output.

The entire email structure including the < subject line > and < message body > can be fully customized by the technical operator.

Frequency < %freq% > | Returns the Capture Center-Frequency (CF)

Bandwidth < %bw% > | Returns the Capture Bandwidth [1]

Amplitude < %power% > | Returns the Capture Amplitude [2]

Date / Time Stamp < %time% > | Returns the Full Date, Time, and Time Zone

Time Stamp < %ts% > | Returns a Short Format Date and Time

Event Duration < %duration% > | Returns the Event Duration

Project Name < %project% > | Returns the Kestrel ® Project File (KPF) ™ Name

Alert Location < %loc% > | Returns the Defined Location

Trigger Level < %trigger% > | Returns the Trigger Level

Trigger Type < %type% > | Returns the Trigger Type

Trigger Zone ID < %id% > | Returns the Defined Trigger Zone ID

Project Directory < %projectDir% > | Returns the Full Project Directory Path

Band < %band% > | Returns the Defined Runtime Spectrum Band or Range

[1] It is essential to understand that the bandwidth returned is the instantaneous bandwidth captured during the trigger and may not be the actual bandwidth of the signal due to variations in modulation and the signal shape at the moment of capture. Multiple events may produce variations in the reported bandwidth.

[2] Modern communication signals are often power agile and are reported based on the instantaneous power level at the moment of capture. Multiple events may produce variations in the reported amplitude. A moving signal source may also produce variation in the reported amplitude within subsequent reported events.

Example 1 | Text + CLP Parameters

The following working (cut and paste) example demonstrates the structuring of the Command Line Programming (CLP) ™ | Email Forwarding of Alerts. This example makes use of all available CLP parameters and provides the full event details in a single email message.

Email Subject Line

Warning! Remote Alert | %project% | %time% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent subject line message structure. The above example illustrates an email subject line rendering, identifying the < project name > and the < date and time stamp > for the spectrum event.

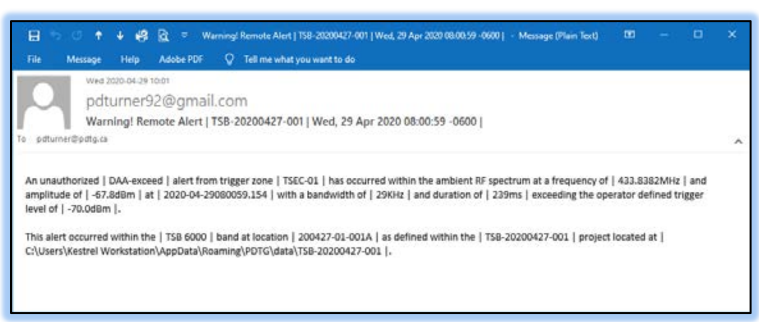
Email Message Body

An unauthorized | %type% | alert from trigger alert zone | %id% | has occurred within the ambient RF spectrum at a frequency of | %freq% | and amplitude of | %power% | at | %ts% | with a bandwidth of | %bw% | and duration of | %duration% | exceeding the operator defined trigger level of | %trigger% |.

This alert occurred within the | %band% | band at location | %loc% | as defined within the | %project% | project located at | %projectDir% |.

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent main body message structure. The above example illustrates an email message body rendering, identifying the < type of alert >, < alert zone ID >, < frequency >, < amplitude >, < time stamp >, < capture bandwidth >, < signal duration >, and < trigger level >. The < spectrum band >, < location >, < project name >, and < project directory path > will also be rendered to the alert email providing excellent detail as to the alert parameters.

The following image represents the actual email alert message received by the operator or multiple operators as defined within the Command Line Programming (CLP) ™ module.



Example 2 | Text + CLP Parameters | Variation

The following working (cut and paste) example demonstrates the structuring of the Command Line Programming (CLP) ™ | Email Forwarding of Alerts. This example makes use of all available CLP parameters and provides the full event details in a single email message with a variation of the operator defined wording.

Email Subject Line

Attention! Spectrum Alert | %freq% | %time% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent subject line message structure. The above example illustrates an email subject line rendering, identifying the alert < frequency > and the < date and time stamp > for the spectrum event.

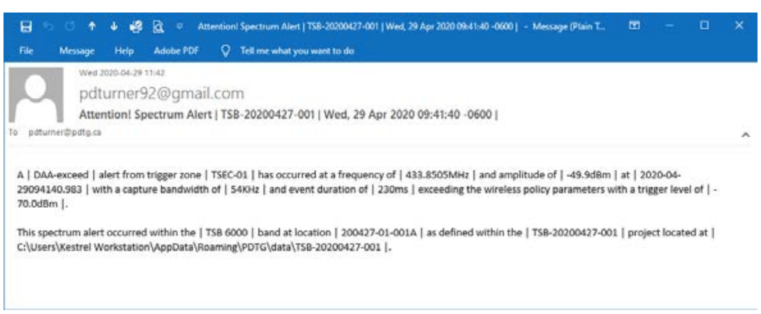
Email Message Body

A | %type% | alert from trigger alert zone | %id% | has occurred at a frequency of | %freq% | and amplitude of | %power% | at | %ts% | with a capture bandwidth of | %bw% | and event duration of | %duration% | exceeding the wireless policy parameters with a trigger level of | %trigger% |.

This spectrum alert occurred within the | %band% | band at location | %loc% | as defined within the | %project% | project located at | %projectDir% |.

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent main body message structure. The above example illustrates an email message body rendering, identifying the < type of alert >, < alert zone ID >, < frequency >, < amplitude >, < time stamp >, < capture bandwidth >, < signal duration >, and < trigger level >. The < spectrum band >, < location >, < project name >, and < project directory path > will also be rendered to the alert email providing excellent detail as to the alert parameters.

The following image represents the actual email alert message received by the operator or multiple operators as defined within the Command Line Programming (CLP) ™ module.



Example 3 | Text + CLP Alert Parameters Table

The following working (cut and paste) example demonstrates the structuring of the Command Line Programming (CLP) ™ | Email Forwarding of Alerts. This example makes use of all available CLP parameters and provides the full event details in a single email message without complex sentence structuring; utilizing simplified descriptors for each parameter.

Subject Line

Spectrum Alert | Red Deer | %time% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent subject line message structure. The above example illustrates an email subject line rendering, identifying the alert < date and time stamp > for the spectrum event.

Message Body

Type of Alert | %type% |

Alert Zone ID | %id% |

Frequency | %freq% |

Amplitude | %power% |

Time Stamp | %ts% |

Capture Bandwidth | %bw% |

Signal Duration | %duration% |

Trigger Level | %trigger% |

Spectrum Band | %band% |

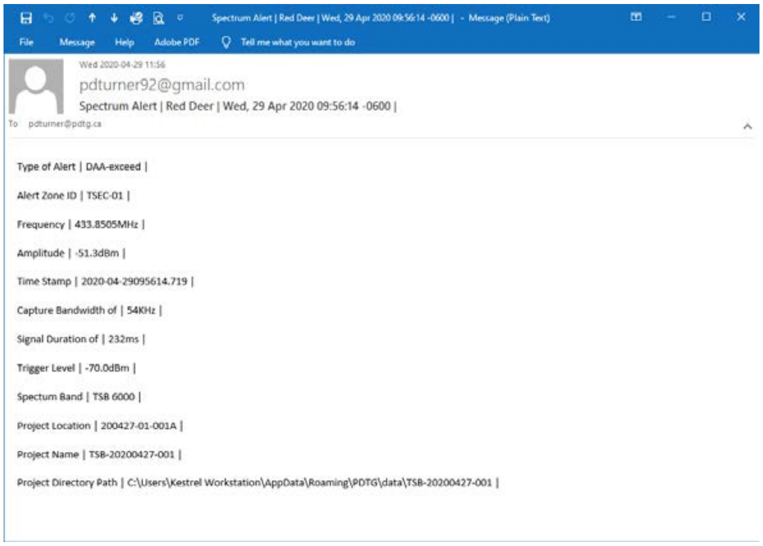
Project Location | %loc% |

Project Name | %project% |

Project Directory Path | %projectDir% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent main body message structure. The above example illustrates an email message body rendering, identifying the < type of alert >, < alert zone ID >, < frequency >, < amplitude >, < time stamp >, < capture bandwidth >, < signal duration >, < trigger level >, < spectrum band >, < project location >, < project name >, and < project directory path > will also be rendered to the alert email providing excellent detail as to the alert parameters.

The following image represents the actual email alert message received by the operator or multiple operators as defined within the Command Line Programming (CLP) ™ module.


Spectrum Alert | Red Deer | Wed, 29 Apr 2020 09:56:14 -0600 | - Message (Plain Text)

File Message Help Adobe PDF Tell me what you want to do

Wed 2020-04-29 11:56

pdturner92@gmail.com

Spectrum Alert | Red Deer | Wed, 29 Apr 2020 09:56:14 -0600 |

To pdturner@pdtg.ca

Type of Alert | DAA-exceed |

Alert Zone ID | TSEC-01 |

Frequency | 433.8505MHz |

Amplitude | -51.3dBm |

Time Stamp | 2020-04-29095614.719 |

Capture Bandwidth of | 54KHz |

Signal Duration of | 232ms |

Trigger Level | -70.0dBm |

Spectum Band | TSB 6000 |

Project Location | 200427-01-001A |

Project Name | TSB-20200427-001 |

Project Directory Path | C:\Users\Kestrel Workstation\AppData\Roaming\PDTG\data\TSB-20200427-001 |

Email Alert | v1.40xx

Example 4 | Simplified Alert Parameters Table

The following working (cut and paste) example demonstrates the structuring of the Command Line Programming (CLP) ™ | Email Forwarding of Alerts. This example makes use of minimal CLP parameters, providing only the essential details in a single email message without complex sentence structuring; utilizing simplified descriptors for each parameter. The operator can access the Kestrel ® platform remotely to review the alert event in more detail, including the actual spectrum and waterfall displays.

Subject Line

Wireless Policy Violation | Calgary | %time% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent subject line message structure. The above example illustrates an email subject line rendering, identifying the alert < date and time stamp > for the spectrum event.

Message Body

Frequency | %freq% |

Amplitude | %power% |

Signal Duration | %duration% |

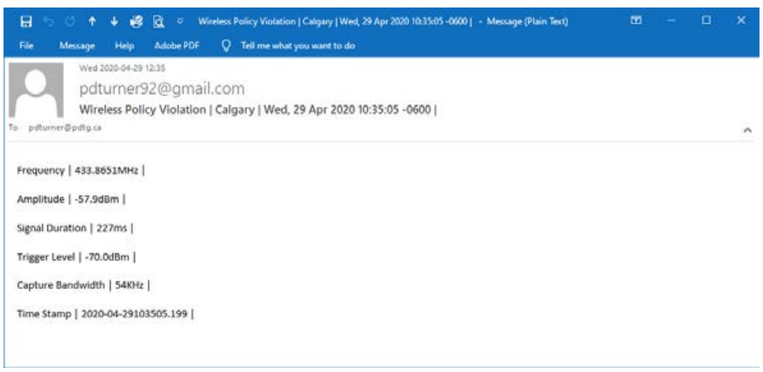
Trigger Level | %trigger% |

Capture Bandwidth | %bw% |

Time Stamp | %ts% |

Description: Plain text can be utilized around the parameter programming code to customize a meaningfully rendered and coherent main body message structure. The above example illustrates an email message body rendering, identifying the < type of alert >, < alert zone ID >, < frequency >, < amplitude >, < time stamp >, < capture bandwidth >, < signal duration >, < trigger level >, < spectrum band >, < project location >, < project name >, and < project directory path > will also be rendered to the alert email providing excellent detail as to the alert parameters.

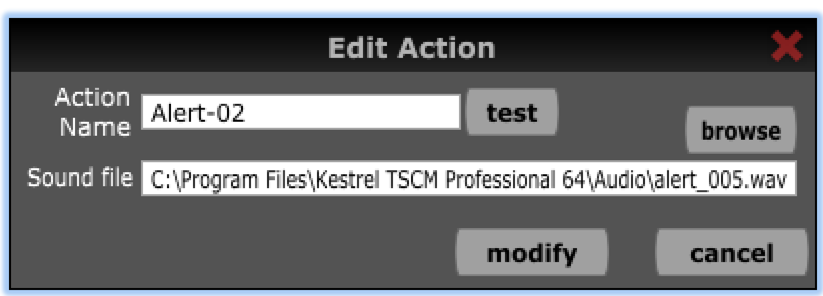
The following image represents the actual email alert message received by the operator or multiple operators as defined within the Command Line Programming (CLP) module.



Email Alert | v1.40xx

Audio Alert | Programming Parameters

| Alert-02| Initiates an audio-based alert on the local system computer platform to alert Command Post (CP) or local technical operators that a triggered alert has occurred within the | Operator Defined Target Area (ODTA) ™ |.

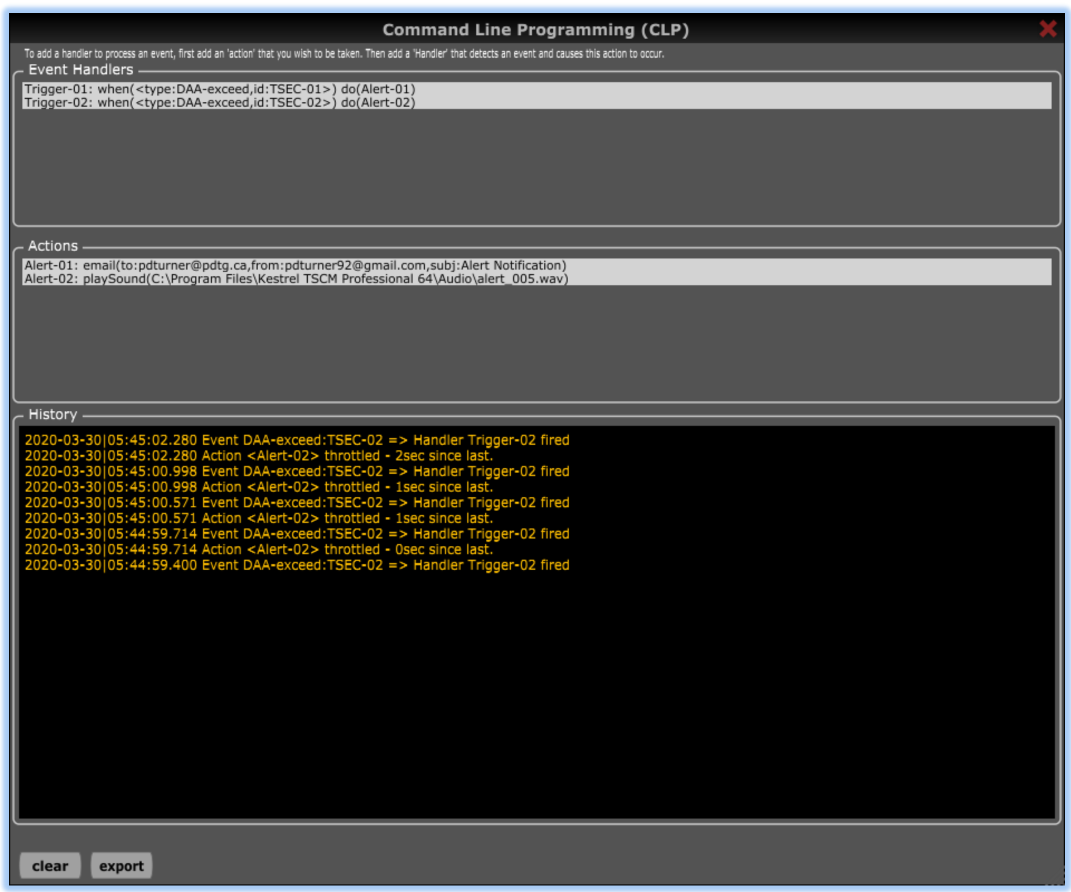


New Sound Action | v1.40xx

Any | WAV | audio file can be assigned as a local host computer audio alert during a triggered event.

There are custom audio files < Daisy > and < George > providing a powerful text-to-voice capability to enhance operator situational awareness.

New Sound Trigger | v1.40xx



New Sound Trigger Event History | v1.40xx

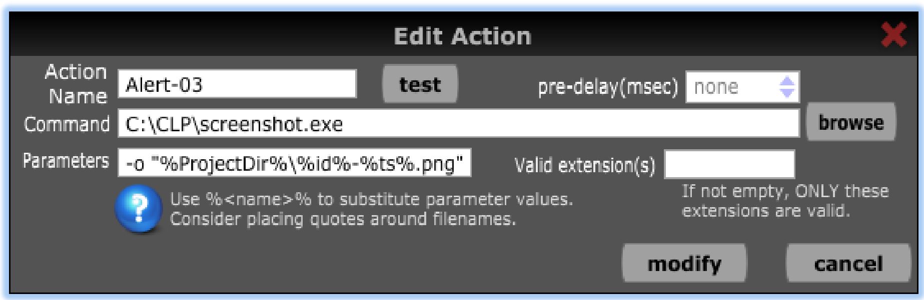
The above illustrated | Command Line Programming (CLP) ™ | window display both a separate email alert and an audio alert, each with its own | ACTION | and | TRIGGER | association.

System Action | Programming Parameters

| Alert-03 | Initiates a defined | System Action | that can be used to invoke any executable file (or application) resident on the host computer platform.

For example, support for triggering and programming smart ECM is possible, as is invoking third-party demodulation packages, screen captures and virtually any other software-controlled functionality.

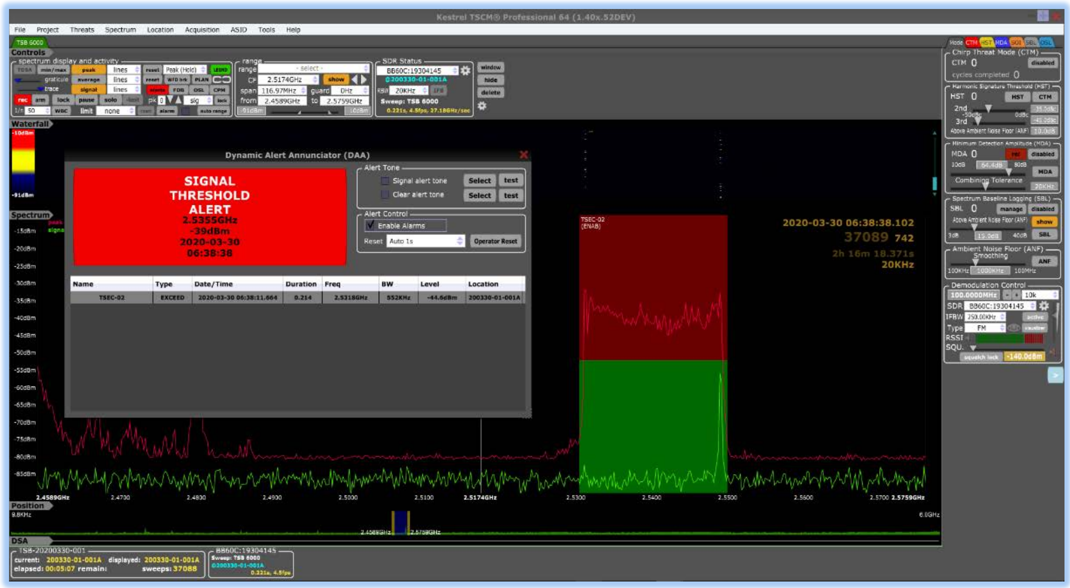
| Alert-3 | Initiates a system action, which can be any executable applications on the local system, such as a command to run (as an example), | SCREENSHOT.EXE |, or any other operator defined program.



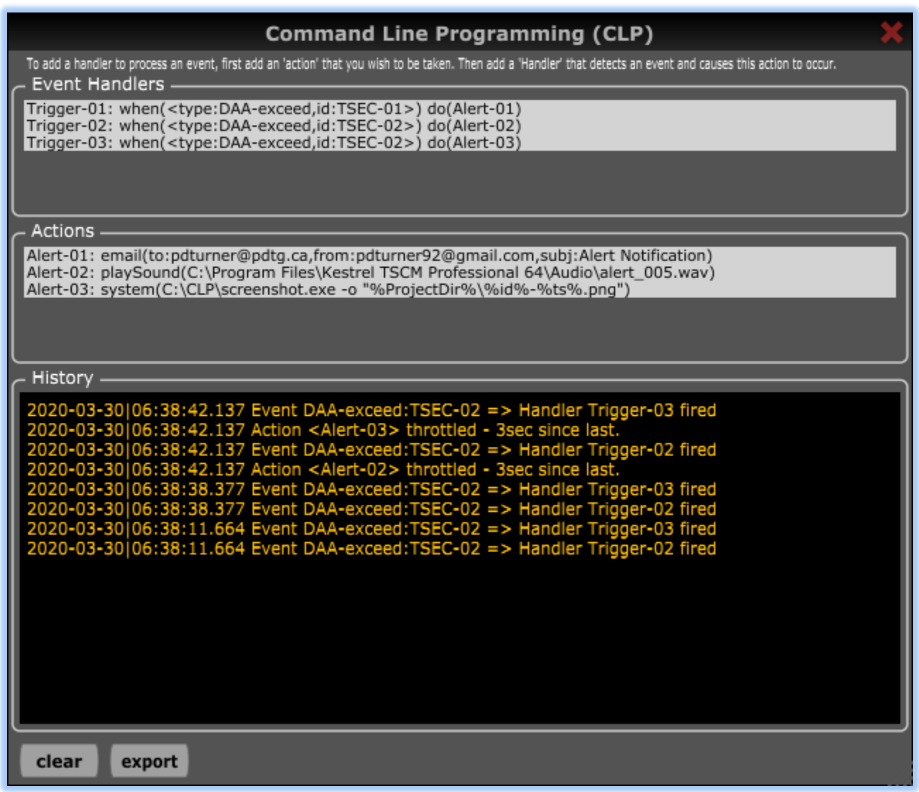
New System Action | v1.40xx

New System Event | v1.40xx

In the above example, the specified application | SCREENSHOT.EXE | will capture a screen shot of the computer screen (application window) upon a triggered event as illustrated in the image below.



Triggered Screen Shot + Audio Alert | v1.40xx



CLP TM Programming Window | v1.40xx

Programming Parameters

Command Line Programming (CLP) ™ events can contain additional parameters, which can be interpreted by the application and convert simple programming language into human readable data.

There are some parameters that are common to all event types, and some specific event types have additional unique parameters available.

Both | Actions | and | Events | may make use of such parameters, by substituting the parameter < name > for a defined < value >.

The syntax < %name% > will substitute the < value > on the parameter < name >.

There is a help dialog window within the email action programming window that displays a list of legal programming values across the Command Line | Programming (CLP) ™ | feature.


Parameter help

Application events contain parameters describing the event and providing further information. There are some parameters common to all events, and some events have additional specialized parameters.

Actions may make use of these parameters, substituting the parameter name for a value. The syntax %name% will substitute the value of the parameter 'name'.

The parameters defined for all events are:
%type% - the event type
%id% - the event ID information
%time% - human readable date/time of the event
%ts% - compact event timestamp
%project% - name of the current project
%projectDir% - Full path of the folder containing this projects' files.

Additional parameters defined for some events are:
%band% - name of band in which event was detected
%loc% - name of location at which event was detected
%freq% - frequency of event
%bw% - bandwidth of event
%power% - power associated with event
%trigger% - trigger level associated with the event
%file% - file associated with event
%modulation% - Modulation type of event
%chirp% - Chirp score of event
%count% - trace count associated with event
%duration% - duration associated with event

Additional parameters for each event type:
threat-MDA: %freq%, %bw%, %power%
threat-SBL: %freq%, %bw%, %power%
threat-CTM: %freq%, %bw%, %power%
threat-HST: %freq%, %bw%, %power%
DAA-exceed: %freq%, %bw%, %band%, %loc%, %trigger%, %power%
DAA-loss: %freq%, %bw%, %band%, %loc%, %trigger%, %power%
schedule:
DAA-exceed-file: %freq%, %bw%, %band%, %loc%, %trigger%, %power%, %file%
DAA-loss-file: %freq%, %bw%, %band%, %loc%, %trigger%, %power%, %file%
threat-MDA-file: %freq%, %bw%, %file%, %power%
threat-SBL-file: %freq%, %bw%, %file%, %power%
threat-CTM-file: %freq%, %bw%, %file%, %power%
threat-HST-file: %freq%, %bw%, %file%, %power%
REC-Limit: %count%, %duration%

dismiss

Parameter Help | v1.40xx

The following < parameter > text tables provide a detailed analysis of the existing programming parameters.

Please note that the offered < parameters > are not all inclusive, nor deployment limited.

Our Software Development Group (SDG) ™ can add new < parameters > on an as requested basis for specific deployment requirements.

If you see a limitation and have a suggestion for a new < parameters > we would be happy to add it to the list.

Command Line Programming (CLP) ™ | Defined Parameters (All Events)	
Parameter Name	**Description**
%type%	Refers to the operator defined < New Event Type >, defined as < Threat-MDA > < Threat-SBL > < Threat-CTM > < Threat-HST > < DAA-Exceed > < DAA-Loss > < Schedule > < DAA-Exceed-File > < DAA-Loss-File > < Threat-MDA-File > < Threat-SBL-File > < Threat-CTM-File > < Threat-HST-File > < Reclimit >.
%id%	Refers to the default < name > of the < alert > center frequency of the alert range, or an operator defined "friendly" name.
%time%	Outputs a human readable < date > < time > stamp consistent with the < triggered alert event >.
%ts%	Generates a < compact timestamp > for the < triggered alert event >.
%project%	Renders the < project name >.
%ProjectDir%	Renders the full < path of the project folder >.

CLP Defined Parameters (All Events) | v1.40xx

Command Line Programming (CLP) ™ | Defined Parameters (Some Events)	
Parameter Name	**Description**
%band%	Renders the < name of the band > in which the < triggered alert event > occurred.
%loc%	Provides the < name of the location > in which the < triggered alert event > occurred.
%freq%	Reports the < frequency > of the < triggered alert event >.
%bw%	Reports the < instantaneous bandwidth > of the < triggered alert event > at the moment of capture.
%power%	Renders the <detected power level > of the exceeding signal event.
%trigger%	Outputs the operator defined < trigger level > for which the signal exceeded.
%file%	Invokes a < triggered event > < write to file > command.
%modulation%	Defines the < modulation > type of the < triggered event >.
%chirp%	Provides the < chirp > score of the <triggered event >.
%count%	Outputs the < trace count > associated with the < triggered event >.
%duration%	Provides the < event duration > of the < triggered event >.

CLP Defined Parameters (Some Events) | v1.40xx

Command Line Programming (CLP) ™ | Event Type Parameters	
Event Type	**Parameter (Availability) Description**
Threat-MDA	%freq% | %bw% | %power%
Threat-SBL	%freq% | %bw% | %power%
Threat-CTM	%freq% | %bw% | %power%
Threat-HST	%freq% | %bw% | %power%
DAA-Exceed	%freq% | %bw% | %band% | %loc% | %trigger% | %power%
DAA-Loss	%freq% | %bw% | %band% | %loc% | %trigger% | %power%
Schedule	Pending Implementation
DAA-Exceed-File	%freq% | %bw% | %band% | %loc% | %trigger% | %power% | %file%
DAA-Loss-File	%freq% | %bw% | %band% | %loc% | %trigger% | %power% | %file%
Threat-MDA-File	%freq% | %bw% | %file% | %power%
Threat-SBL-File	%freq% | %bw% | %file% | %power%
Threat-CTM-File	%freq% | %bw% | %file% | %power%
Threat-HST-File	%freq% | %bw% | %file% | %power%
Reclimit	%count% | %duration%

CLP Defined Parameters (Event Type Parameters) | v1.40xx

The use an < * > after a value allows flexibility in the CLP ™ activity process.

For example, with the < id > < parameter> DAA Alert Zones < LTE 700 > and < LTE 2100 > present, using < LTE* > will invoke an < action > for either of the two (2) defined alert zones.

Programming | Defining Triggers

The technical operator should program one (1) or more actionable event triggers within the Kestrel TSCM ® Professional Software prior to defining | ACTIONS | and | EVENT HANDLERS |, such as a DAA Alert Zone or MDA Exceedance, for example.

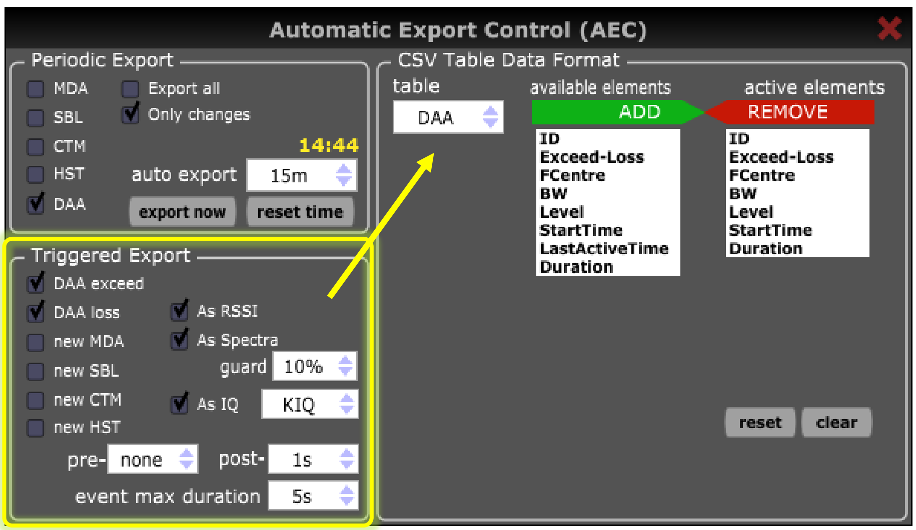
Any of the existing mission specific | TRIGGER | and | ALERTING | mechanisms may be defined for use with the | Command Line Programming (CLP) ™ | feature.

The most versatile of these options is the | Dynamic Alert Annunciator (DAA) ™ | that allows the technical operator to custom define any number of independent | DAA ALERT ZONES | for signal detection of < signal exceedance > and < signal loss > within the same alert zone logic.

Once the operator has set one (1) or more alert types, additional capability exists within the | Automatic Export Control (AEC) ™ | OPT AEC providing the operator the ability to define additional mission specific parameters.

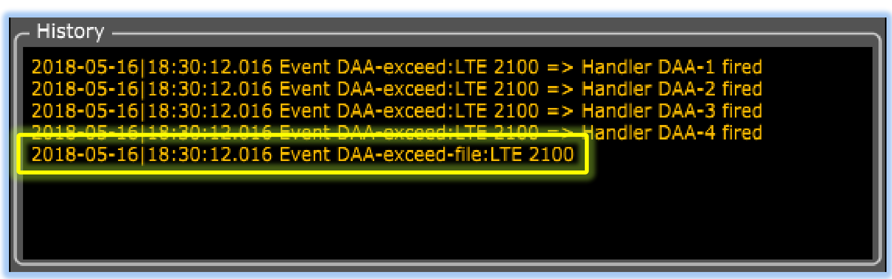
An example of the AEC ™ programming is illustrated in the following image, as | DAA EXCEED | export as | SPECTRA | to file.

This can be verified within the CLP ™ | HISTORY | window example below.



Automatic Export Control (AEC) ™ | OPT AEC | v1.40xx

During the defined DAA triggered event, the spectra data is captured and appended to a CSV file based on the operator selected parameters.



Command Line Programming (CLP) ™ | OPT CLP | v1.40xx

A single | DAA Alert Zone | event can produce single or multiple | ACTION | depending on the configuration of the | TRIGGER | ACTION | programming relationship.

The following | CSV | file content and file naming convention highlight this capability to capture and utilize third-party productivity software to build graphs and charts.

The technical operator can define the file directory location by accessing the | FILE | AUTOMATIC EXPORT CONTROL (AEC) ™ | OPT AEC | AEC DIRECTORY | giving the technical operator absolute control over file management and file storage requirements.

By default, all AEC files are appended to the | AEC DIRECTORY | located on the desktop as part of the installation process.

CSV files exhibit a relatively small storage footprint and provide excellent post analytical data for manipulation, exploitation and big data analytics.

It is recommended that the operator confirm all destination file directory after installing the Kestrel TSCM ® Professional Software on the target machine.

Decoding the automatically appended file naming convention, provides the technical operator with significant information about the contents of the exported file.

(DAA-exceed-(LTE 2100))-20180516-165459-BB60C-16319081-180515-01-01A-spectra

TYPE: DAA Exceedance

ALERT ZONE: LTE 2100

DATE: 2018-05-16

TIME: 16:54:59

HARDWARE: BB60C

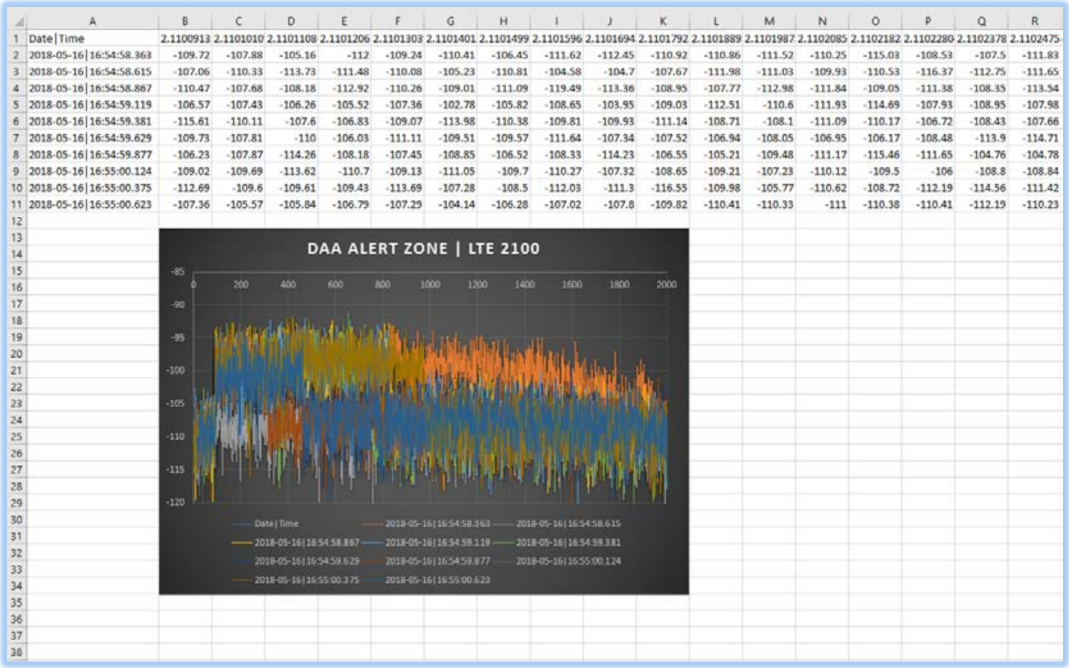
RX SN: 16319081

LOCATION: 2018-05-15-01A

EXPORT: SPECTRA

The following Microsoft Excel spreadsheet illustrates the potential benefits of exporting | SPECTRA | and / or | RSSI | as part of the signal capture process.

The raw CSV data can be opened directly in Microsoft Excel and other productivity applications.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Date|Time	2.1100913	2.1101010	2.1101108	2.1101206	2.1101303	2.1101401	2.1101499	2.1101596	2.1101694	2.1101792	2.1101889	2.1101987	2.1102085	2.1102182	2.1102280	2.1102378	2.1102475
2	2018-05-16|16:54:58.363	-109.72	-107.88	-105.16	-112	-109.24	-110.41	-106.45	-111.62	-112.45	-110.92	-110.86	-111.52	-110.25	-115.03	-108.53	-107.5	-111.83
3	2018-05-16|16:54:58.615	-107.06	-110.33	-113.73	-111.48	-110.08	-105.23	-110.81	-104.58	-104.7	-107.67	-111.98	-111.03	-109.93	-110.53	-116.37	-112.75	-111.65
4	2018-05-16|16:54:58.867	-110.47	-107.68	-108.18	-112.92	-110.26	-109.01	-111.09	-119.49	-113.36	-108.95	-107.77	-112.98	-111.84	-109.05	-111.38	-108.35	-113.54
5	2018-05-16|16:54:59.119	-106.57	-107.43	-106.26	-105.52	-107.36	-102.78	-105.82	-108.65	-103.95	-109.03	-112.51	-110.6	-111.93	-114.69	-107.93	-108.95	-107.98
6	2018-05-16|16:54:59.381	-115.61	-110.11	-107.6	-106.83	-109.07	-113.98	-110.38	-109.81	-109.93	-111.14	-108.71	-108.1	-111.09	-110.17	-106.72	-108.43	-107.66
7	2018-05-16|16:54:59.629	-109.73	-107.81	-110	-106.03	-111.11	-109.51	-109.57	-111.64	-107.34	-107.52	-106.94	-108.05	-106.95	-106.17	-108.48	-113.9	-114.71
8	2018-05-16|16:54:59.877	-106.23	-107.87	-114.26	-108.18	-107.45	-108.85	-106.52	-108.33	-114.23	-106.55	-105.21	-109.48	-111.17	-115.46	-111.65	-104.76	-104.78
9	2018-05-16|16:55:00.124	-109.02	-109.69	-113.62	-110.7	-109.13	-111.05	-109.7	-110.27	-107.32	-108.65	-109.21	-107.23	-110.12	-109.5	-106	-108.8	-108.84
10	2018-05-16|16:55:00.375	-112.69	-109.6	-109.61	-109.43	-113.69	-107.28	-108.5	-112.03	-111.3	-116.55	-109.98	-105.77	-110.62	-108.72	-112.19	-114.56	-111.42
11	2018-05-16|16:55:00.623	-107.36	-105.57	-105.84	-106.79	-107.29	-104.14	-106.28	-107.02	-107.8	-109.82	-110.41	-110.33	-111	-110.38	-110.41	-112.19	-110.23

Third-Party Productivity Software | v1.40xx

Please review the set-up and programming information regarding the | Dynamic Alert Annunciator (DAA) ™ | for detailed export control of the | SPECTRA | and | RSSI | data.

Actions | Programming Parameters

It is recommended that the operator define the desired < actions > before the < event handler >, so that the < actions > appear in the < new event handler > < new action > selection box.

There are currently three (3) operator defined actions available, to trigger < sound > < system actions > and < email alerts >, each with unique programming parameters specific to the intended functionality.

The process of initiating an email alert, assumes the host computer is connected to a network.

The same programming window is utilized to initiate and SMS alert, where this service is available.

It will be necessary to locate the gateway email address for your wireless carrier and use your mobile number in the following format;

The 10-digit mobile number, is followed by the email gateway for the specific wireless carrier | 0000000000@pcs.rogers.com | for the wireless device you wish to include in the alert notification.

The above example assumes that the wireless carrier is Rogers Wireless and that the email gateway is | pcs.rogers.com |.

The process begins by defining an < action name >, for example < Alert-4 > might be utilized, consistent with earlier examples.

A properly formatted SMS address is appended to the < To > text input box, and another the | Google Mail | address in the <From > text input box.

In is important to note that various authentication and spam filters may limit the < To > and < From > options, so it is highly recommended that the technical operator test and confirm that the < alert > mechanism is actually working as intended.

As mentioned previously, it might be necessary to change the | Google Account Profile | to permit the use of | Less Secure Applications |.

The < Subject > line information can be a plain text message or supplemented with various | CLP | < parameters > to create a unique < alert > message subject line for each DAA Triggered < Alert Zone > scheduled to send | EMAIL | and / or | SMS | messages to the same recipient.

For example, to configure the following < alert > the technical operator can type the following into the < Subject > text box.

SPECTRUM ALERT %id% RED DEER ALBERTA

The resulting output in the received < email > or < SMS > message will display as

SPECTRUM ALERT LTE 2100 RED DEER ALBERTA

The < message > text input box contains a plain text message supplemented with various CLP < parameters > to create a unique < alert > message for each Triggered event < Alert Zone > scheduled to send | EMAIL | and / or | SMS | messages to the same recipient.

For example, the following < text > and < parameters > will result in a formalized < email > or < SMS > message, as illustrated below.

A Wireless Policy Violation %type% %id% %freq% has Occurred on %time%. Please Respond...

A Wireless Policy Violation DAA-exceed LTE 2100 2.1128GHz has Occurred on Wed, 16 May 2018 18:57:04 -0600. Please Respond...

Once the < new email action > or < SMS > window is properly formatted, the < test > button will become active, allowing the operator to confirm the messages are being sent successfully.

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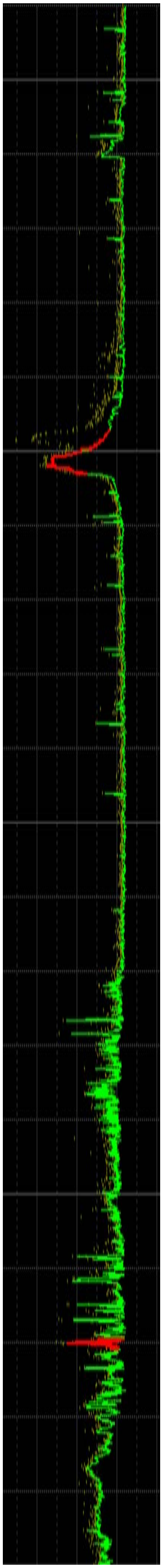
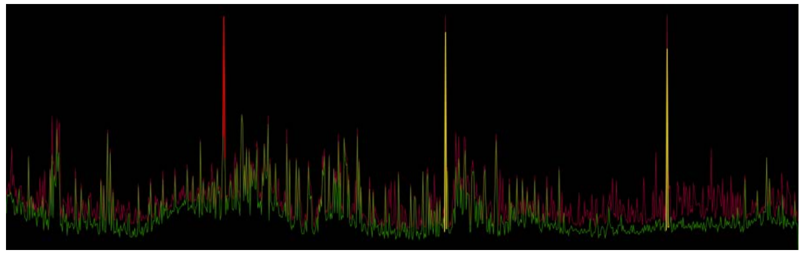
Intentionally Left Blank



Chapter 16



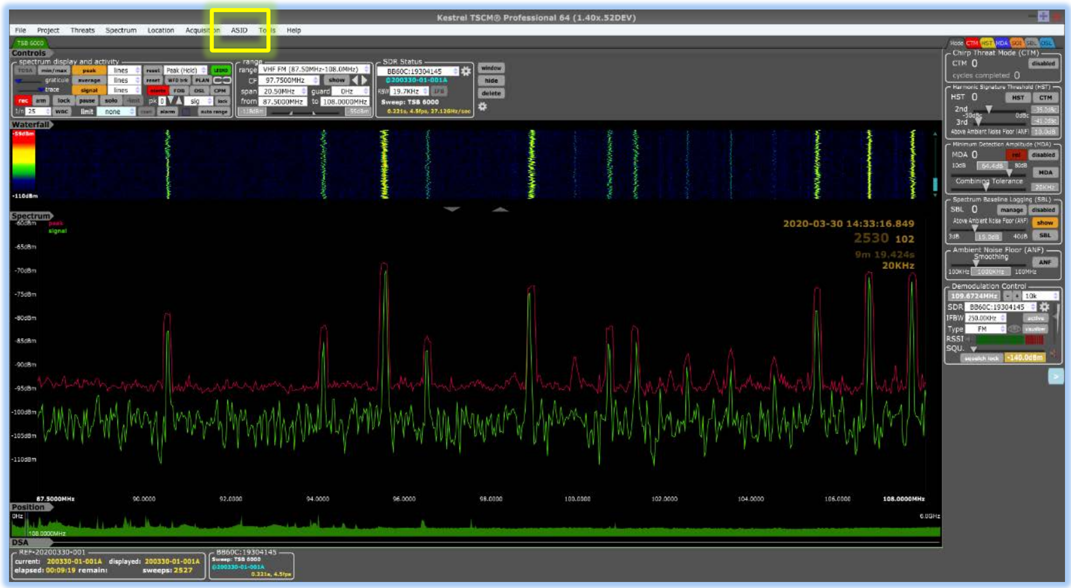
Advanced Signals Intelligence Database (ASID) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Advanced Signals Intelligence Database (ASID)

The Kestrel TSCM ® Professional Software includes sophisticated (official source) frequency licencing database functionality as a standard included feature within the application.



Main Application Window | v1.40xx

The spectrum above displays the | Region 2 FM Commercial Broadcast Band | within a runtime environment.

The technical operator can access the | ASID | menu and select | LOAD FDB | to initiate the process.

This step assumes that the technical operator has already downloaded the appropriate FDB files from the Technical Support Group (TSG) Website.

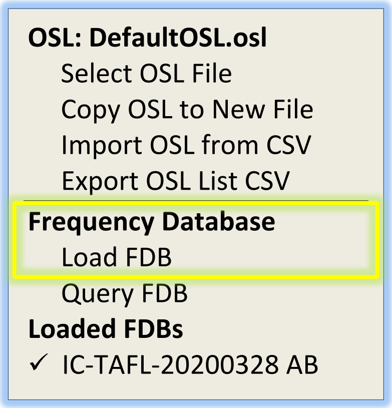
The files are always available free of charge and can be downloaded for both Canada and the United States of America.

Additional FDB databases for other countries are currently under development and will be made available along with the existing FDB database files.

The first step is to access the | ASID | menu option located on the main menu and select the | LOAD FDB | as illustrated in the image below.

Next navigate to the desired FDB file for the intended purpose.

Any number of FDB files can be loaded to accommodate provincial, state or international border regions.



ASID Menu | v1.40xx

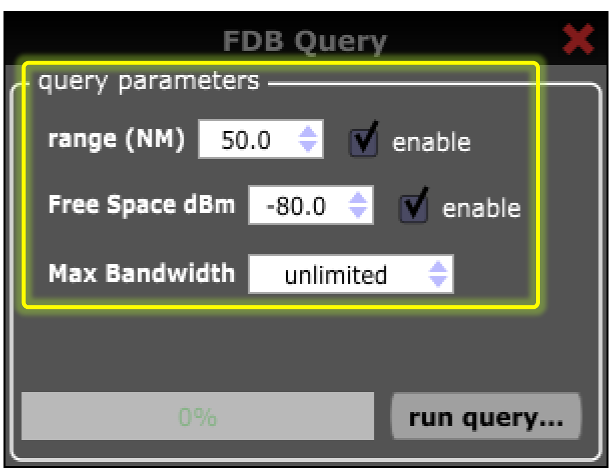
Once the desired FDB database files are loaded, the next step in the process is to run a database | QUERY |.

The image below delineates query process and the operator can define the various query parameters as follows:

Enable Range (NM) | 1 | 2 | 5 | 10 | 20 | 50 | 100 | Custom |

Enable Free Space (dBm) | -20 | -30 | - 40 | -50 | -60 | -70 | -80 | - 90 |

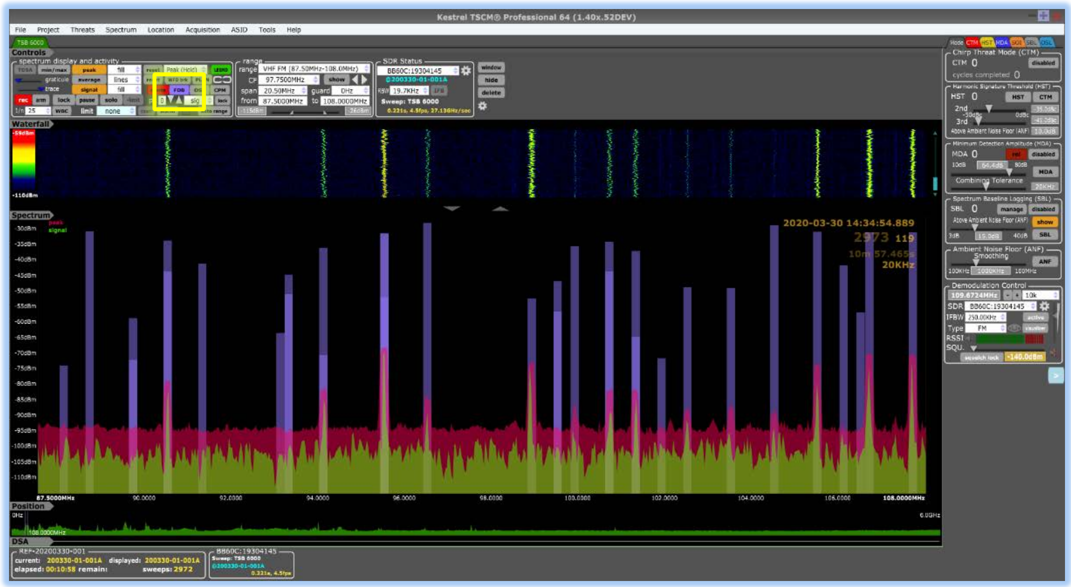
Max Bandwidth | Unlimited | 100 kHz | 200 kHz | 500 kHz | 1 MHz | 2 MHz | 5 MHz | 10 MHz | 20 MHz | 50 MHz | 100 MHz



ASID Menu | v1.40xx

The | Enable Range (NM) | defines the radius of the query based on the current GPS coordinates.

The | Enable Free Space (dBm) | query defines the minimum power level that the expected | Free Space Power Level | must attain to display on the FDB overlay.



FDB Overlay | v1.40xx

The image above displays the FDB overlay indicating bandwidth, free space power, and the center-frequency of each of the FDB licensing within the official licensing database.

Our Advanced Signals Intelligence Database (ASID) ™ permits the technical operator to effectively manage complex collection, storage and reporting requirements during active deployment and provides a significant comparative spectrum intelligence capability.

The ASID ™ is an advanced technical operator centric, work-flow oriented and powerful, TSCM specific database feature that allows the technical operator to search multiple available reference databases from the same or different geographical areas and bring clarity to the many unknown but often important friendly signal events commonly observed during active deployment and during post event analysis.

GPS Receiver Support (Generic USB)

With a generic USB, third-party GPS receiver module connected to the host computer, the technical operator is able to capture the precise geographical coordinates for each operator defined | Antenna Location | whenever actual GPS satellite data is available.

Many of the modern tablet computers and laptops now have the availability or option of a GPS module, however, the addition of an externally connected GPS receiver can be added to the system.

The technical operator can also manually enter specific Latitude and Longitude coordinates, should an actual GPS signal <u>not</u> be available, which might occur when the software is deployed within a building or RF shielded facility, or structure.

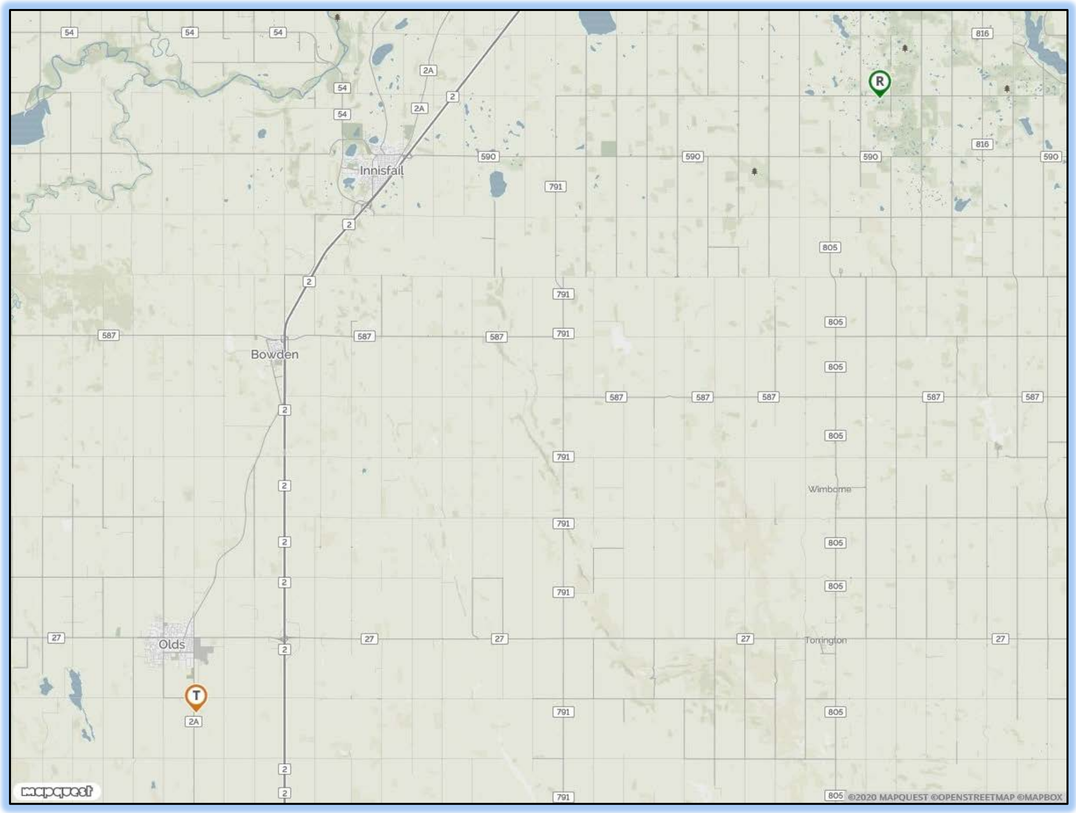
Kestrel GPS Rx Module | v1.40xx

Our Advanced Signals Intelligence Database (ASID) ™ and the Frequency Database (FDB) utilizes either an active GPS signal or technical operator provided static geographical coordinates, to display the relative expected (line-of-sight) free-space power levels of known FDB signal entries, and allows the technical operator to plot this data directly on Google Maps, or in Satellite view, with the assistance of an active network connection.

When GPS data is <u>not</u> available or is <u>not</u> manually entered by the technical operator for the current Antenna Location, the software will not be able to calculate the distance, bearing and expected Free Space Power (FSP) ™ related information and will be limited to FDB licensing data only as an overlay.

The technical operator is also able to plot a relative static overview map plot of the current collection | Antenna Location | against any Signal of Interest (SOI) within the Frequency Database (FDB), giving perspective to the Line-of-Sight (LOS) distance and bearing between two (2) known sets of coordinates, which displays on a high resolution static | JPG | map image.

This ability also provides the technical operator with a better appreciation of the terrain and propagation factors between the collection | Antenna Location | and the emitter location as illustrated in the map image below.



Static Overview Map | v1.40xx

How a GPS Receiver Works

A GPS receiver receives data from a constellation satellites orbiting the earth and provides very accurate geographical location data based on a number of different satellite navigation system worldwide.

GPS satellites are arranged so that a useable number are always visible in the sky (or on the horizon) from anywhere on earth.

A GPS receiver requires the acquisition lock of signals from at least three (3) GPS satellites for a position fix, but four (4) or more satellites are preferable in practice, to determine your Latitude, Longitude, altitude or elevation, speed and direction anywhere on or above the planet.

Since a GPS receiver must receive and track data from at least three (3) satellites at the same time, there must be a direct Line-of-Sight (LOS) to the sky when you use a GPS receiver.

This generally will pose a problem for indoor use or in any location where GPS signals might be blocked by terrain.

The following are a sample of some of the satellite navigation system worldwide.

A number of GPS receivers support more than one system, extending the accuracy by way of additional satellite visibility.

United States of America | Navistar GPS L1 | 1.575 GHz

European Union | Galileo E1 | 1.575GHz

Russia | GLONASS G1 | 1.602 GHz

China | Beidou B1 | 1.5611 GHz

Japan | Quasi-Zenith QZSS

India | IRNSS / NAVIC

Kestrel TSCM ® Professional Software also supports the entry of an operator defined, static | Latitude | and | Longitude | set of coordinates that can be manually entered as a known receiver | Antenna Location | for collection purposes.

The technical operator might also be able to locate the actual GPS receiver or antenna near a window even when working indoors to achieve signal lock or obtain this information from any number of other sources during deployment.

GPS location information is calculated through a process called three (3) dimensional trilateration, a complex mathematical formula that uses the positions of the satellites and their very precise (known) distance from the earth (based on the amount of time it takes the signal to reach the receiver) to determine the point at which the satellite signals and the surface of the earth intersect.

After the GPS receiver acquires the satellite signals, the receiver continually recalculates your position as you travel and provides data to compatible mapping software, as a series of Latitude and Longitude pairs that can be displayed on a map or other image supported by the Kestrel TSCM ® Professional Software.

GPS Receiver Support (SDR Hardware)

Radios such as the Signal Hound SM200A/B/C include embedded GPS capability via external antenna connectivity included with the hardware as does the ThinkRF R5750 SDR receiver.

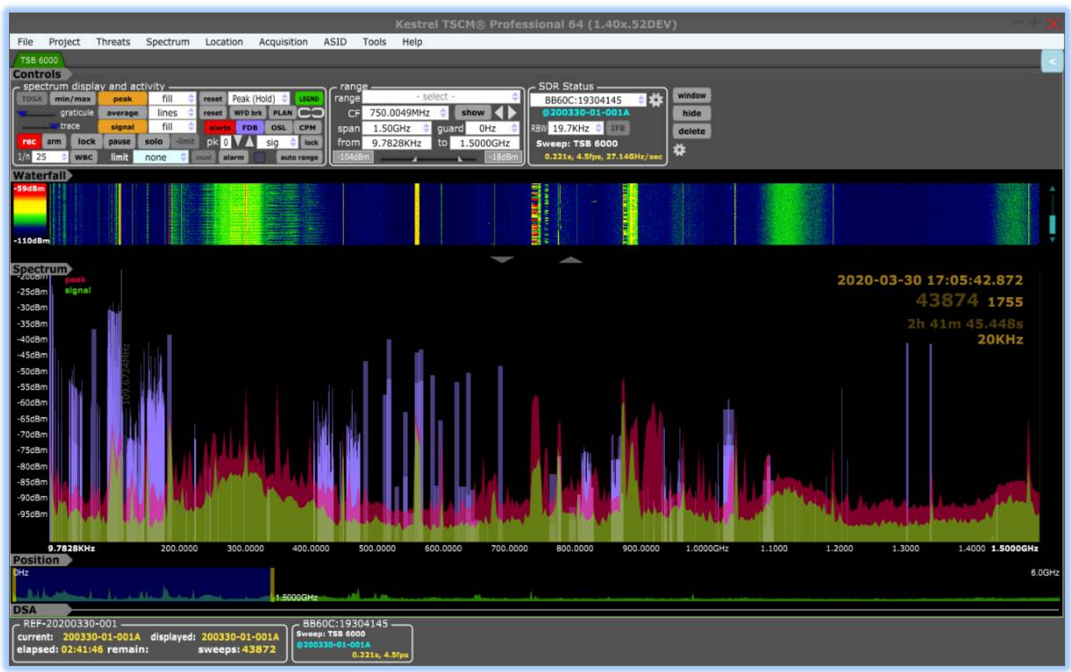
The GPS signal (when available) is processed on the SDR hardware and the data is ported through the API to the Kestrel TSCM ® Professional Software for location-based operation.

Another advantage is realized by utilizing the on-board GPS capability via an externally connected GPS antenna is the availability of GPS based time stamping via the GPS time clock reference signal for greater accuracy.

A number of 4G | LTE modem technology also will have GPS capability as an option that may need to be enabled at the account level.

Frequency Database (FDB)

There are a number of scalable, highly integrated component database modules associated with the | Advanced Signal Intelligence Database (ASID) ™ | feature that work together or independently to provide unprecedented TSCM specific collection, analysis and project management capability during deployment.

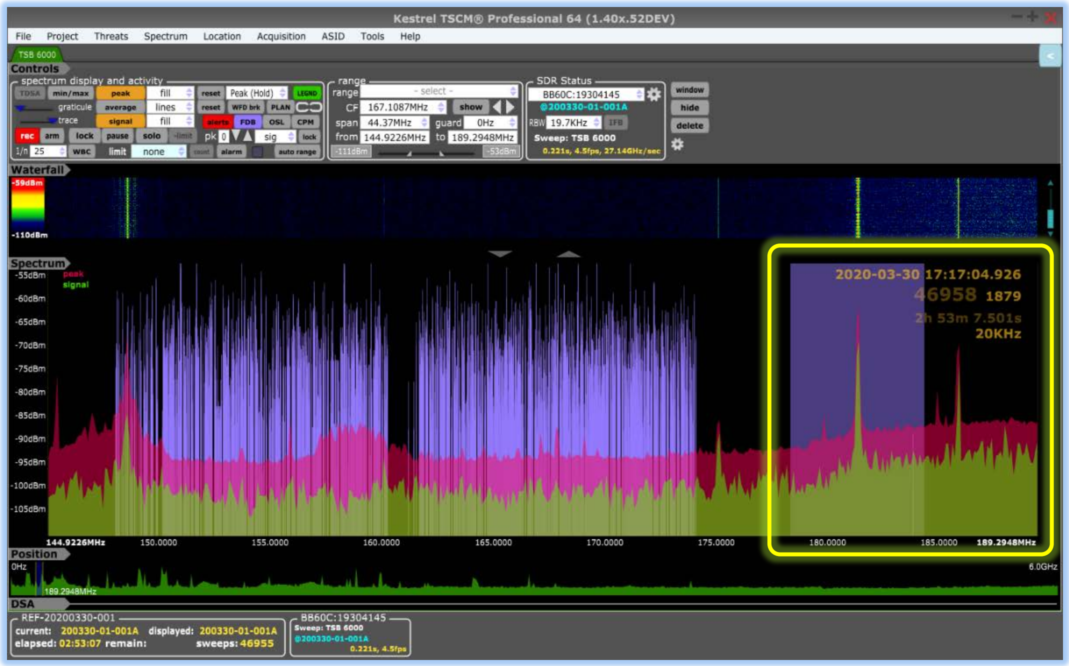


FDB Marker Overlay | v1.40xx

The above example illustrates a (9 kHz to 1500 MHz) span and is currently displaying FDB Marker Overlay data for the active query based on the Canadian (non-protected spectrum data) contained within the Technical and Administrative Frequency List (TAFL).

Full support for the United States of America – FCC Spectrum Frequency Licensing Database is also a standard included feature with a monthly FDB update service available to licensed technical operators free of charge.

The technical operator can utilize the Positional Zoom Control (PZC) ™ to display individual FDB frequency markers as illustrated in the following example plot.



FDB Marker Overlay (Zoom) | v1.40xx

The Kestrel TSCM ® Professional Software is utilizing the current | Antenna Location | based-GPS coordinates and our Free Space Propagation (FSP) ™ algorithm to display the relative power levels for all FDB data displayed within the current Range of Interest (ROI).

The operator has noted a signal event in the area of 180 MHz and invokes the FDB dialog window to display the following pop-up menu.

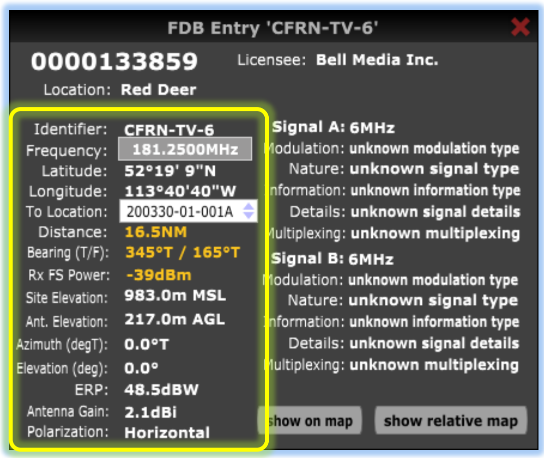
Zoom to Peak

Frequency Database

Bell Media In., BW 6 MHz, 16.5 NM, -39dBm

FDB Marker (Pop-Up Menu) | v1.40xx

In the above example, only a single licensing entry is present based on the operator defined query parameters.



FDB Marker (Pop-Up Menu) | v1.40xx

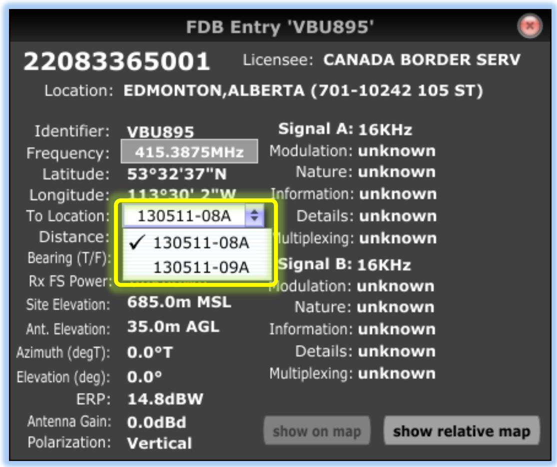
The FDB Entry dialog window provides the metrics extracted from the licensing database and provides essential analytical information and provides a location-based triangulation capability by providing the distance bearing and free space power elements.

The ability to select any available Kestrel ® project location provides a number of manual triangulation metrics that can be plotted for analytical geo-location purposes and propagation modeling.

The | FDB Entry | dialog window provides considerable information relating to the Signal of Interest (SOI) which can be very useful in determining the source of unknown signal events that have been identified during the collection process and need to be resolved as friendly signal events before being dismissed by the technical operator.

Depending on the number of | Location Differential Signal Analysis (LDSA) ™ | Antenna Locations | available; the technical operator can directly select any | To Location | for Distance, Bearing, and Rx Free Space Propagation (FSP) ™ information for the | FDB Entry | and the selected | Antenna Location |.

The following example illustrates two (2) LDSA ™ Antenna Locations within the current Kestrel Project File (KPF) ™ and are available for comparative analysis.



FDB Entry | v1.40xx

The Frequency Database (FDB) ™ is a dedicated support module that resides within the Advanced Signals Intelligence Database (ASID) ™ structure and is built and maintained by our Technical Research and Standards Group (TSRG) ™.

The FDB contains (non-protected) frequency data and is provided to licensed technical operators as periodic FDB updates downloaded from the Technical Support Group (TSG) website.

A unique feature of the Kestrel TSCM ® Professional Software; Signals Intelligence Support System (SISS) ™ is the ability to load and run multiple Frequency Database (FDB) files at the same time and run query based searches of many thousands of known frequencies in a matter of seconds with the ability to drill down to only a small number of entries for analysis.

FDB Frequency Entry | "Drag-and-Drop"

The frequency entry, as displayed within the | FDB Entry | dialog window is fully supported by our | Drag-and-Drop | technology.

For example, it is possible to | Drag-and-Drop | the actual displayed frequency value from the | FDB Entry | dialog window, directly to the sidebar Demodulation Control Group or Graticule to focus a 20x zoom factor centered on the actual displayed FDB frequency value.

All | Drag-and-Drop | features are standardized throughout the application.

Any given FDB file may represent a single geographical area that can be the actual target area, city, region, or even an entire country.

The technical operator <u>cannot</u> edit, add or delete any information to the data contained within the FDB file structure.

The ability to add, delete and edit is the function of the | Operator Signal List (OSL) ™ | which is a separate operational component of the Advanced Signal Intelligence Database (ASID) structure.

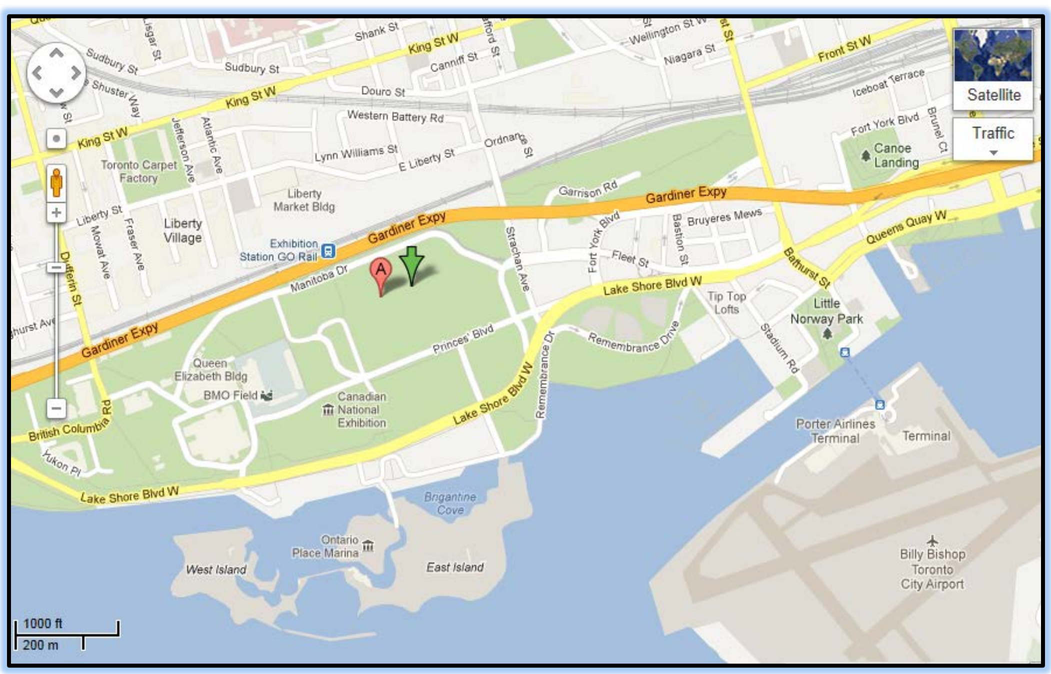
Custom FDB database files can be developed and integrated by our Software Development Group (SDG) ™ for special applications or technical operator requirements.

A powerful search utility permits the technical operator to search based on geographical parameters, such as GPS and fixed static coordinates, with the ability to search based on both | Distance | and the projected |Free Space | signal strength propagation characteristics.

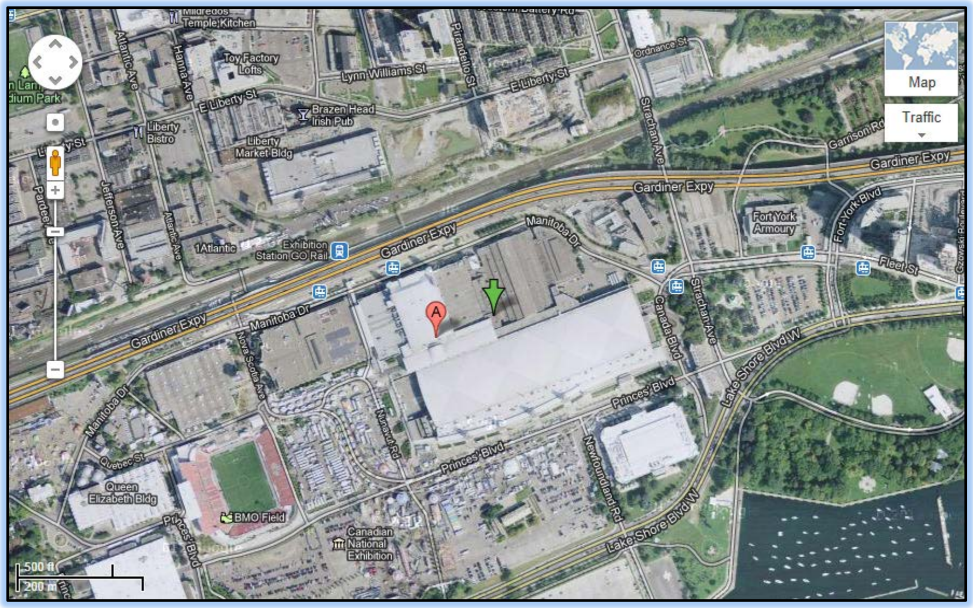
During runtime, the technical operator maintains the ability to display FDB signal information on the Graticule as a separate layer containing a display marker overlay.

The technical operator can display or hide the FDB marker overlay utilizing the | FDB Button | located in the Spectrum Display and Activity Control Group.

The technical operator can press the | Show on Map | button to plot the | FDB Entry | on Google Maps to gain significant situational awareness has to the orientation of the emitter location.



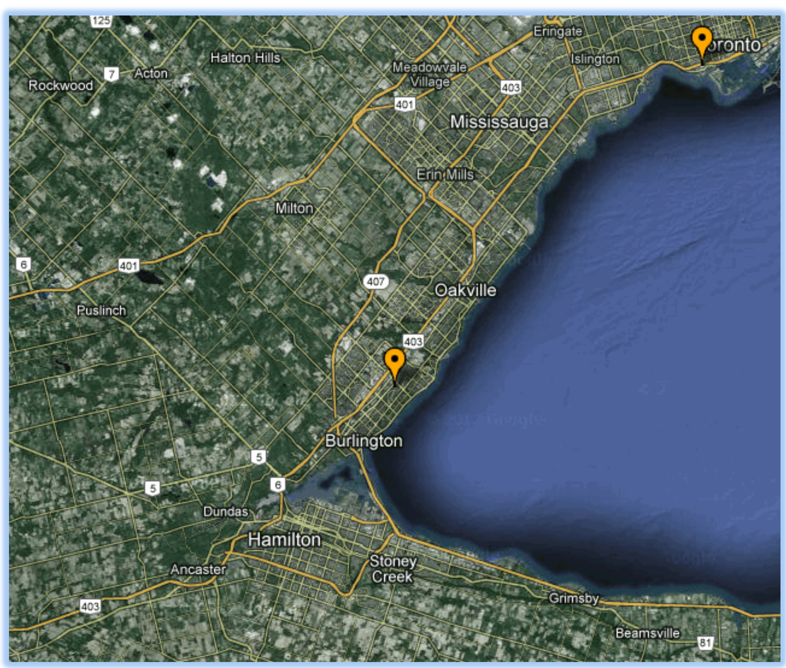
Google Maps (Map View) | v1.40xx



Google Maps (Satellite View) | v1.40xx

Another useful tool is the | Show Relative Map | feature that generates a static satellite map view image of the DSA Antenna Location and | FDB Entry | currently displayed.

This image may be viewed directly by the technical operator or saved for inclusion within reports or for post analysis review.



Google Maps (Satellite View) | v1.40xx

Frequency Database (FDB) Updates

The Kestrel ® Frequency Database (FDB) is derived from specific data elements that are contained within the official Industry Canada – Spectrum Management Technical and Administrative Frequency List (TAFL), which in-turn contain technical data on radio system frequencies in use across Canada.

The Technical and Administrative Frequency List (TAFL) information is generally updated on a monthly basis.

The software also fully supports the United States of America – FCC Licensing Database.

TIP: Specific information on the frequency assignments to the Department of National Defence (DND) and a number of other various national security entities are not included within the Kestrel FDB database. As a reference; protected frequency allocations and exclusions represent approximately 6 percent (%) of the database contents.

TAFL utilizes the metric system and therefore all linear measurements are expressed in metres and geographical coordinates are of the NAD-83 standard.

Technical operators can download the Frequency Database (FDB) directly from the Technical Support Group (TSG) Resource Centre website.

The TSG website is password protected.

Frequency Database (FDB) regional files are individually available for download or the technical operator may download a compressed file containing all of the individual files.

The following table provides the provincial boundary related licensing data specific to the FDB database file structure.

Industry Canada | Frequency Database (FDB) | Province | Territory		
Province | Territory	**File Name Format**	**File Type**
Alberta	IC-TAFL-20200328_AB	FDB
British Columbia	IC-TAFL-20200328_BC	FDB
Manitoba	IC-TAFL-20200328_MB	FDB
New Brunswick	IC-TAFL-20200328_NB	FDB
Newfoundland | Labrador	IC-TAFL-20200328_NL	FDB
Nova Scotia	IC-TAFL-20200328_NS	FDB
North West Territories	IC-TAFL-20200328_NT	FDB
Nunavik	IC-TAFL-20200328_NU	FDB
Ontario	IC-TAFL-20200328_ON	FDB
Prince Edward Island	IC-TAFL-20200328_PE	FDB
Quebec	IC-TAFL-20200328_QC	FDB
Saskatchewan	IC-TAFL-20200328_SK	FDB
Yukon	IC-TAFL-20200328_YT	FDB

Canada FDB Data Files | v1.40xx

The frequency related geographical and licensing data is derived from the (non-protected) Industry Canada, Technical Frequency and Administrative List (TAFL) and is made available for download at no charge for use with the Kestrel TSCM ® Professional Software by licensed technical operators.

The information contained within our Frequency Database (FDB) ™ is protected under the End User License Agreement (EULA) and may not be utilized for any other purpose and may not be distributed to any third party.

The FDB file structure of the database is specifically formatted for use with the Kestrel TSCM ® Professional Software and coded as | Frequency Database (FDB) | files that are compatible for import and overlay within the application only.

Federal Commination Commission (FCC) | Frequency Database (FDB) | State		
State | Territory	**File Name Format**	**File Type**
Alaska | AK	FCCLicenseDB_AK	FDB
Alabama | AL	FCCLicenseDB_AL	FDB
Arkansas | AR	FCCLicenseDB_AR	FDB
American Samoa | AS	FCCLicenseDB_AS	FDB
Arizona | AZ	FCCLicenseDB_AZ	FDB
California | CA	FCCLicenseDB_CA	FDB
Commonwealth of Northern Mariana Islands | CM	FCCLicenseDB_CM	FDB
Colorado | CO	FCCLicenseDB_CO	FDB
Connecticut | CT	FCCLicenseDB_CT	FDB
District of Columbia | DC	FCCLicenseDB_DC	FDB
Delaware | DE	FCCLicenseDB_DE	FDB
Florida | FL	FCCLicenseDB_FL	FDB
Georgia | GA	FCCLicenseDB_GA	FDB
Guam | GU	FCCLicenseDB_GU	FDB
Hawaii | HI	FCCLicenseDB_HI	FDB
Iowa | IA	FCCLicenseDB_IA	FDB
Idaho | ID	FCCLicenseDB_ID	FDB
Illinois | IL	FCCLicenseDB_IL	FDB
Indiana | IN	FCCLicenseDB_IN	FDB
Kansas | KS	FCCLicenseDB_KS	FDB
Kentucky | KY	FCCLicenseDB_KY	FDB
Louisiana | LA	FCCLicenseDB_LA	FDB
Massachusetts | MA	FCCLicenseDB_MA	FDB

Federal Commination Commission (FCC) | Frequency Database (FDB) | State		
State | Territory	**File Name Format**	**File Type**
Maryland | MD	FCCLicenseDB_MD	FDB
Maine | ME	FCCLicenseDB_ME	FDB
Marshall Islands | MH	FCCLicenseDB_MH	FDB
Michigan | MI	FCCLicenseDB_MI	FDB
Minnesota | MN	FCCLicenseDB_MN	FDB
Missouri | MO	FCCLicenseDB_MO	FDB
Northern Marianas | MP	FCCLicenseDB_MP	FDB
Mississippi | MS	FCCLicenseDB_MS	FDB
Montana | MT	FCCLicenseDB_MT	FDB
North Carolina | NC	FCCLicenseDB_NC	FDB
North Dakota | ND	FCCLicenseDB_ND	FDB
Nebraska | NE	FCCLicenseDB_NE	FDB
New Hampshire | NH	FCCLicenseDB_NH	FDB
New Jersey | NJ	FCCLicenseDB_NJ	FDB
New Mexico | NM	FCCLicenseDB_NM	FDB
Nevada | NV	FCCLicenseDB_NV	FDB
New York | NY	FCCLicenseDB_NY	FDB
Ohio | OH	FCCLicenseDB_OH	FDB
Oklahoma | OK	FCCLicenseDB_OK	FDB
Oregon | OR	FCCLicenseDB_OR	FDB
Pennsylvania | PA	FCCLicenseDB_PA	FDB
Puerto Rico | PR	FCCLicenseDB_PR	FDB
Rhode Island | RI	FCCLicenseDB_RI	FDB

Federal Commination Commission (FCC) | Frequency Database (FDB) | State		
State | Territory	**File Name Format**	**File Type**
South Carolina | SC	FCCLicenseDB_SC	FDB
South Dakota | SD	FCCLicenseDB_SD	FDB
Tennessee | TN	FCCLicenseDB_TN	FDB
Texas | TX	FCCLicenseDB_TX	FDB
US Minor Outlying Islands | UM	FCCLicenseDB_UM	FDB
Utah | UT	FCCLicenseDB_UT	FDB
Virginia | VA	FCCLicenseDB_VA	FDB
Virgin Islands | VI	FCCLicenseDB_VI	FDB
Vermont | VT	FCCLicenseDB_VT	FDB
Washington WA	FCCLicenseDB_WA	FDB
Wisconsin | WI	FCCLicenseDB_WI	FDB
West Virginia | WV	FCCLicenseDB_WV	FDB
Wyoming | WY	FCCLicenseDB_WY	FDB
Micronesia | FM	--- Not Available ---	FDB
Palau | PW	--- Not Available ---	FDB

United States of America | FDB Data Files | v1.40xx

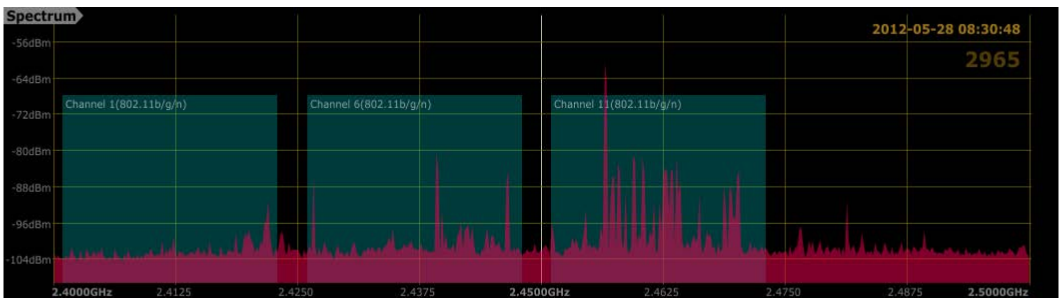
Channel Profile Masks (CPM) ™

The Kestrel TSCM ® Professional Software fully supports any number of technical operator defined | Channel Profile Masks (CPM) ™ | that are stored in a | ChannelProfiles.cpm | database file that resides within the | Settings Directory | or other technical operator assigned location.

Multiple CPM files are supported and the technical operator can edit, create, import from CSV and select the current CPM file.

Channel Profile Masks (CPM) ™, are utilized to create a visual display reference overlay on the Graticule as a background layer.

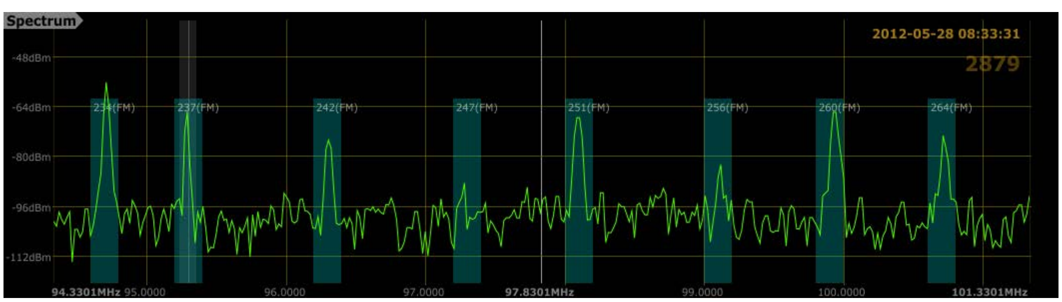
The | Channel Profile Mask (CPM) ™ | feature provides a reference overlay that is based on a known (official) channel allocation, such as the channel Centre Frequency (CF) and Bandwidth.



CPM ISM 2400 | v1.35xx

The above example illustrates the typical 2.4 GHz ISM (WI-FI) band allocations for Channel 1 (802.11 b/g/n), Channel 6 (802.11 b/g/n), and Channel 11 (802.11 b/g/n) as Channel Profile Masks (CPM), along with the Peak Envelope Capture (PEC) trace visible on the Graticule.

The technical operator can quickly identify specific channel activity during deployment.



CPM FM Band | v1.35xx

The spectrum plot above, illustrates of operator defined Channel Profile Masks (CPM) ™ within the commercial FM broadcast band, for each displayed signal event.

The text annotation includes the official International Telecommunication Union (ITU) channel number designation as a reference and is useful for spectrum management and interference analysis related field deployment.

Channel Profile Editor (CPE) ™

The Kestrel TSCM ® Professional Software, includes a Channel Profile Editor (CPE) ™ that is accessed from the | SPECTRUM | CHANNEL PROFILE EDITOR | menu options on the main tool bar.

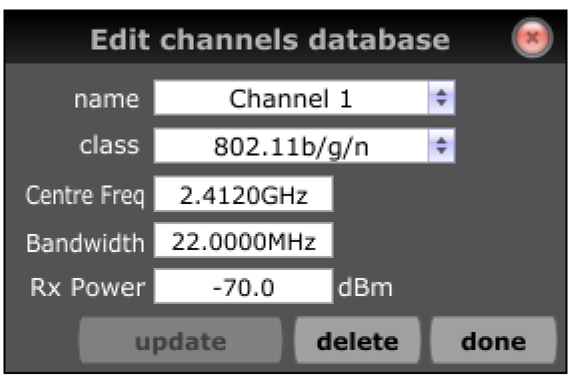
The CPE provides the necessary user interface to create, edit and delete profiles from the Channels Database.

The technical operator can create or update Channel Profile Masks (CPM) ™ by providing a channel name or designation, class or category, centre frequency and the channel bandwidth.

The Channel Profile Masks (CPM) ™ are by default hidden and may be displayed by pressing the | CPM | button located on the Spectrum Display and Activity control group.

The CPM display functionality is independent for each spectrum band and is not a global feature; the technical operator must display or hide the CPM reference overlays for each active spectrum band.

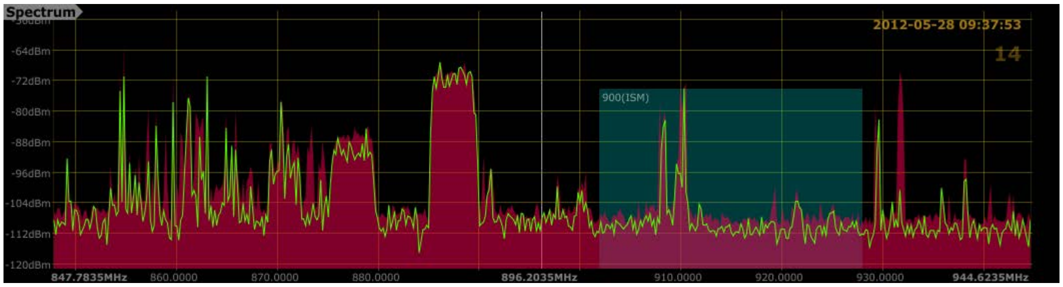
Rather that utilizing the Channel Profile Editor (CPE) ™, advanced operators may find that building a master CPM profiles directly in third-party productivity software such as Microsoft Excel and saving as a CSV formatted file.



CPM Editor | v1.35xx

The ability of the technical operator to create channel specific profiles or entire band allocations is fully supported.

The following example demonstrates the ability or the technical operator to create a mask that represents the entire ISM 900 band (902 MHz to 928 MHz) when working with a much larger Range of Interest (ROI).



CPM Full Band Allocation ISM 900 | v1.35xx

The above spectrum plot illustrates a confirmed hostile signal event that is associated with a (910.0000 MHz) wireless video camera located within the target area.

Operator Signal List (OSL) ™

The Operator Signal List (OSL) ™ is an important component of the Advanced Signals Intelligence Database (ASID) ™ and provides yet another level of sophistication within the project management structure bringing clarity to complex spectrum relationships.

The | Operator Signal List (OSL) ™ | is an operator definable signal database that spans multiple, Kestrel Project Files (KPF) ™ and is therefore independent of any particular runtime or historical project.

The current OSL database file in use is selectable by the technical operator from the | ASID | SELECT OSL FILE | menu structure.

Select OSL File | v1.40xx

Any number of defined | Operator Signal List (OSL) ™ | database files are maintainable by the technical operator for any specific client location, site, geographical region, and for friendly, hostile, or other Signals of Interest (SOI) by the operator for overlay onto the current Real-Time Event (RTE) ™ trace display.

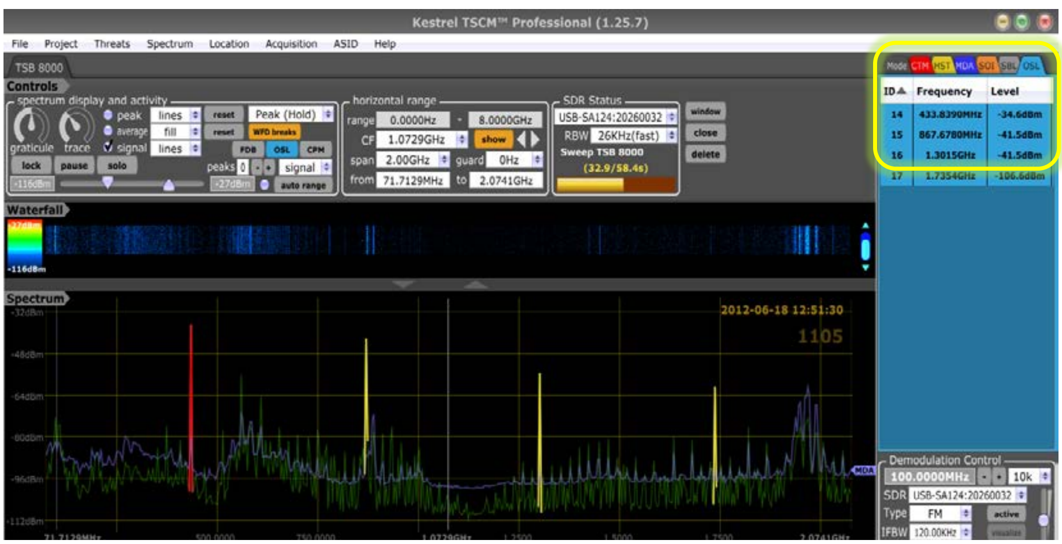
There are several OSL menu options available to assist the technical operator in creating, editing and managing multiple, fully transportable Operator Signal List (OSL) ™ database files.

Menu options include a | Copy OSL to New File | command | Import OSL from CSV | file, and | Export OSL List CSV | file format.

Understanding OSL Operation

An entry on the OSL ™ signal list is promoted from an existing displayed designated threat event such as an MDA, SBL or operator SOI signal, for direct manual entry by the technical operator utilizing a right mouse click on any currently displayed | Spectral Marker Flag | by selecting the | Generate OSL Entry | menu option.

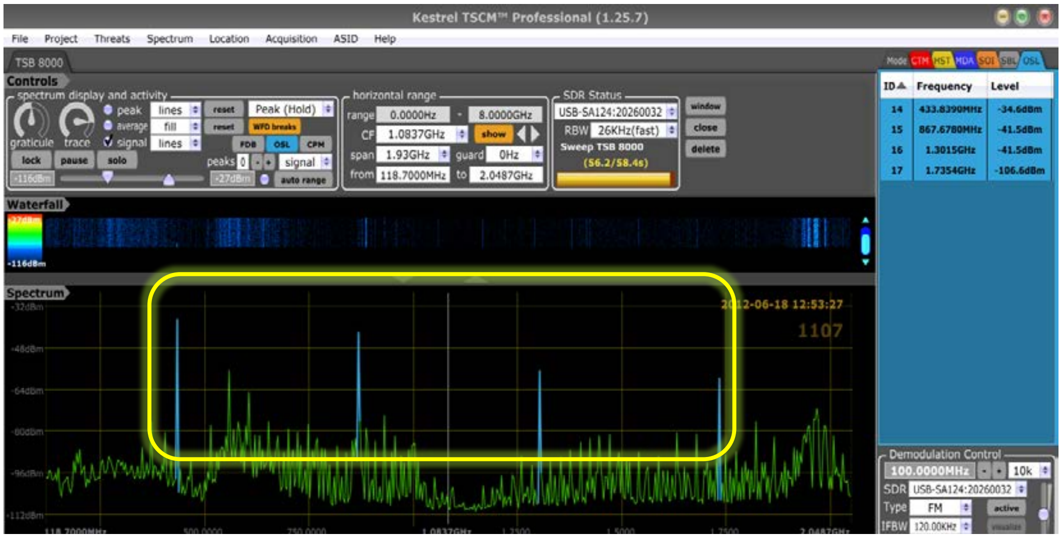
The OSL ™ feature utilizes the familiar | Spectral Marker Flag | to display signal events directly on the RF Spectrum Display (RSD) and utilizes the same data display structure, by including signal events on the OSL ™ sidebar menu structure to reveal the frequency and signal amplitude and additional signal level detail on the Master Automatic Threat List (ATL) ™.



CTM HST Spectral Marker Flags | v1.35xx

The technical operator can promote any existing active signal event or threat to the Operator Signal List (OSL) ™.

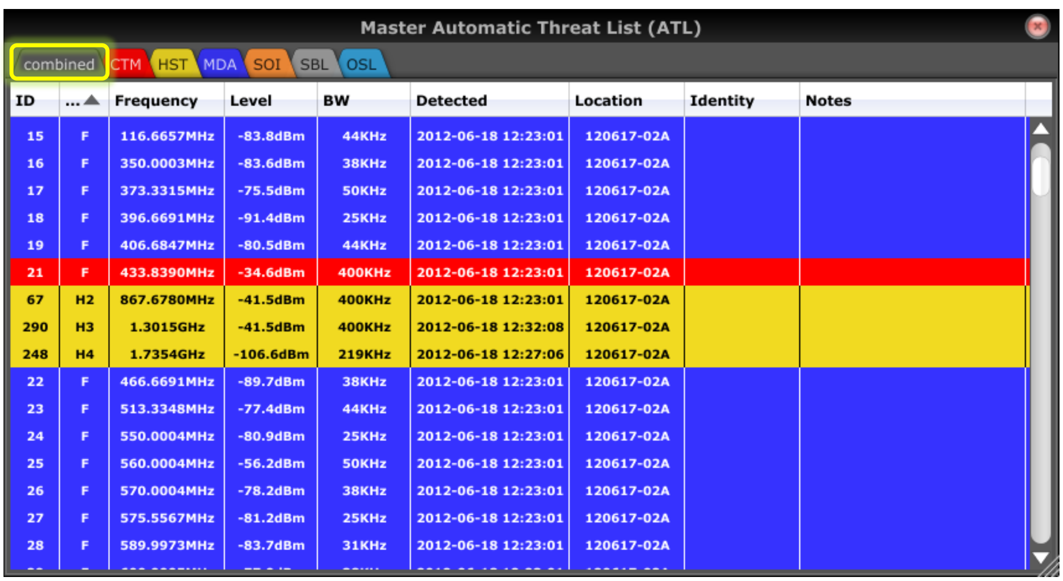
The OSL ™ is an operator defined database that can be used for flagging any SOI in an application resident database.



OSL Spectral Marker Flags | v1.35xx

OSL ™ signals are not displayed on the combined Master Automatic Threat List (ATL) ™ and are maintained is an independent OSL ™ database file that can be utilized across multiple project files or locations.

The following Master ATL ™ displays the combined project level threat and signal lists independently of the application based OSL ™ tab.

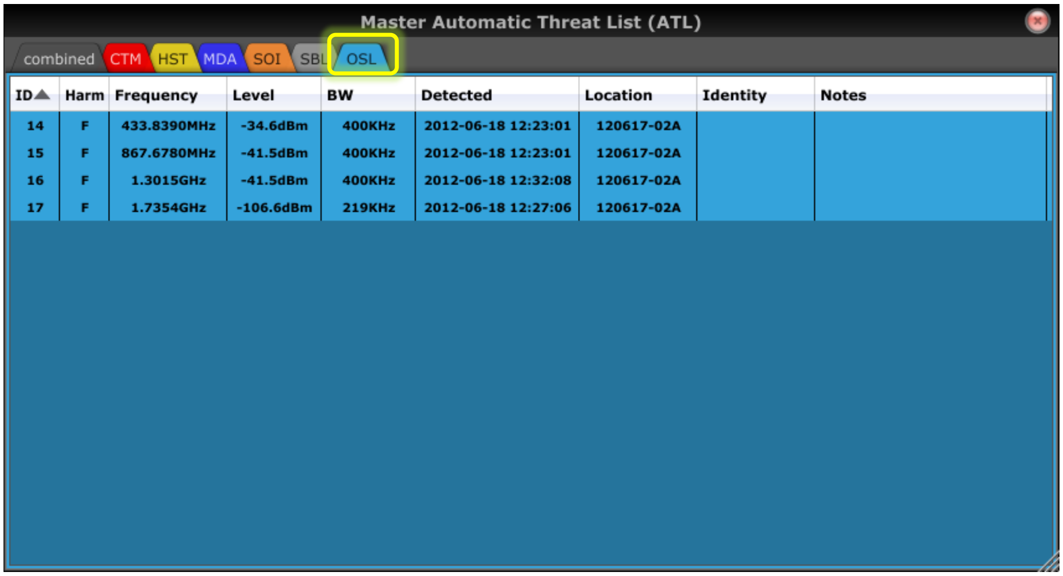

Master Automatic Threat List (ATL)

combined | CTM | HST | MDA | SOI | SBL | OSL

ID	...	Frequency	Level	BW	Detected	Location	Identity	Notes
15	F	116.6657MHz	-83.8dBm	44KHz	2012-06-18 12:23:01	120617-02A		
16	F	350.0003MHz	-83.6dBm	38KHz	2012-06-18 12:23:01	120617-02A		
17	F	373.3315MHz	-75.5dBm	50KHz	2012-06-18 12:23:01	120617-02A		
18	F	396.6691MHz	-91.4dBm	25KHz	2012-06-18 12:23:01	120617-02A		
19	F	406.6847MHz	-80.5dBm	44KHz	2012-06-18 12:23:01	120617-02A		
21	F	433.8390MHz	-34.6dBm	400KHz	2012-06-18 12:23:01	120617-02A		
67	H2	867.6780MHz	-41.5dBm	400KHz	2012-06-18 12:23:01	120617-02A		
290	H3	1.3015GHz	-41.5dBm	400KHz	2012-06-18 12:32:08	120617-02A		
248	H4	1.7354GHz	-106.6dBm	219KHz	2012-06-18 12:27:06	120617-02A		
22	F	466.6691MHz	-89.7dBm	38KHz	2012-06-18 12:23:01	120617-02A		
23	F	513.3348MHz	-77.4dBm	44KHz	2012-06-18 12:23:01	120617-02A		
24	F	550.0004MHz	-80.9dBm	25KHz	2012-06-18 12:23:01	120617-02A		
25	F	560.0004MHz	-56.2dBm	50KHz	2012-06-18 12:23:01	120617-02A		
26	F	570.0004MHz	-78.2dBm	38KHz	2012-06-18 12:23:01	120617-02A		
27	F	575.5567MHz	-81.2dBm	25KHz	2012-06-18 12:23:01	120617-02A		
28	F	589.9973MHz	-83.7dBm	31KHz	2012-06-18 12:23:01	120617-02A		

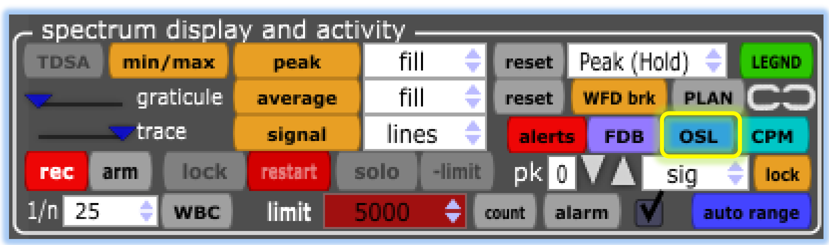
Master Automatic Threat List (ATL) | v1.35xx

The following illustrates the manually entered signal events within the current OSL ™ database file.



CTM HST Spectral Marker Flags | v1.35xx

OSL ™ signal event data can be selected to overlay on the current RF Spectrum Display (RSD) as spectral marker flags that indicate where the signal is expected to be, even when the signal is not currently active in the ambient spectrum.



OSL Button | v1.40xx

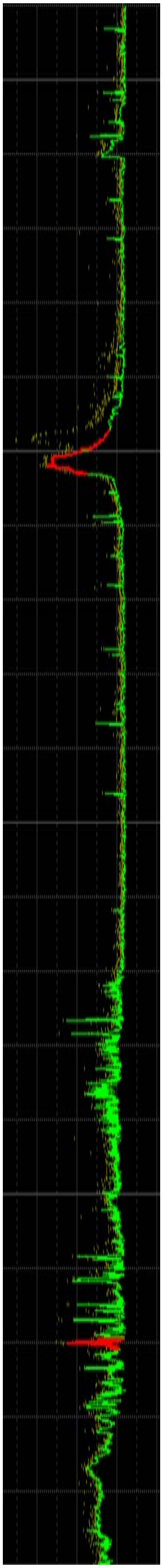
Just like the CTM, HST, MDA, SOI and SBL, the OSL ™ maintains access to the Signal Profile database to view additional signal parameters.

The technical operator can mouse-over the spectral marker flags and display the OSL Signal ID, Frequency (MHz) and Level (dBm).

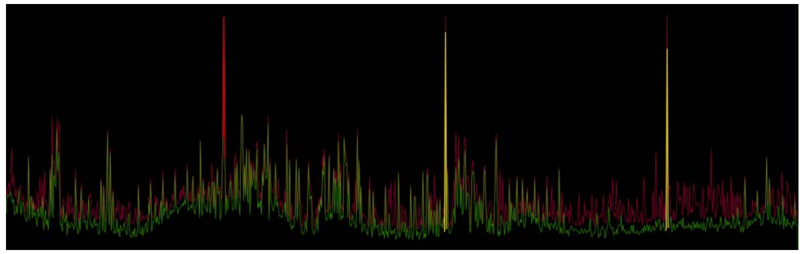
A right mouse-click displays a menu list that allows the technical operator to display the signal profile dialog window and / or demodulate the OSL signal.

Intentionally Left Blank

Intentionally Left Blank



Chapter 17



Session Report Generator (SRG) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Session Report Generator (SRG) ™

The ability to generate a custom, professionally formatted technical inspection report at any time during active runtime deployment, or during post analysis review is an essential capability not found on any other TSCM specific software application.

Our Session Report Generator (SRG) ™ was specifically developed by our Technical Research and Standards Group (TRSG) ™ and designed by an experienced technical operator, for implementation within the Kestrel TSCM ® Professional Software, as an essential component of our operator centric and workflow-based project management concept.

Generating an inspection related technical report is oftentimes one of the most time-consuming elements faced by the technical operator, aside from conducting the actual inspection.

In-fact, it typically takes an hour of report development time, equal to every hour considered as "time-on-task" by the technical operator.

The ability to generate a detailed technical report quickly during runtime is original and ground breaking new technology, included as a standard feature of the Kestrel TSCM ® Professional Software.

Our advanced Session Report Generator (SRG) ™ capability to customize essential reporting elements is operator centric and TSCM specific.

The SRG is interactive and includes dynamically automated functionality that fully supports “on-the-fly” report generation during runtime, or post event analysis.

Waterfall Rendering

Interim “on-the-fly” session reports may be dynamically generated during runtime to represent the spectrum trace and waterfall level data with reference to the last spectrum trace, backwards to fill the WFD plot (rendering) space available.

The operator has the option of selecting the WFD summation check box to produce a compressed WFD, representing all WFD data from the first trace to the last trace, as defined by the WFD (rendering) space available.

Report Generator Tools

There are three (3) operational components available to the technical operator for the purpose of report generation.

Each of the features are essential reporting elements that may be utilized independently to document the various aspects of collected data during active deployment, and utilized to include specific spectrum and waterfall data in supplementary report documents, utilizing third party productivity software.

Image Capture Tool (ICT) ™

The technical operator has the ability to capture a high resolution graphic image of the | RF Spectral Display (RSD) |, | Waterfall Display (WFD) |, | Differential Signal Analysis (DSA) | window and the | Demodulation Visualizer | window, independently, based on the current view options selected by the technical operator, as defined by the default File Naming Convention (FNC).

The ICT feature can also capture the entire application window to document the settings and all spectrum and waterfall trace details present on the Graphical User-Interface (GUI).

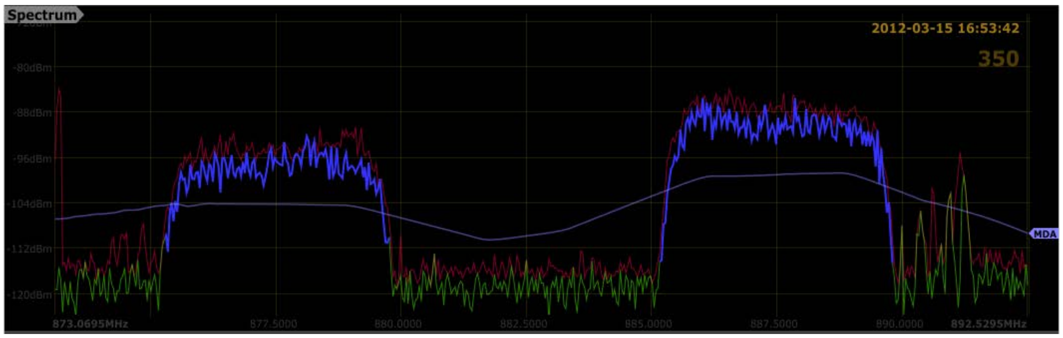
Image Capture Tool (ICT) | File Naming Convention (FNC)		
ICT Capture	**File Naming Convention**	**Example**
RF Spectrum Display (RSD)	spectrum_band_location.png	spectrum_VHF_FM_NT12.png
Waterfall Display (WFD)	waterfall_band_location.png	waterfall_TSB_1000_NT19.png
Differential Signal Analysis (DSA)	dsa_band_location.png	dsa_ROI_6000_NT32.png
Demodulation Visualizer	demodulation_frequency.png	demodulation_98.1000MHz.png
NTSC Video Image	ImageFromVideo.png	ImageFromVideo.png
Application Window	screen_band_location.png	Screen_TSB_6000_020.png

Image Capture Tool (ICT) | v1.40xx

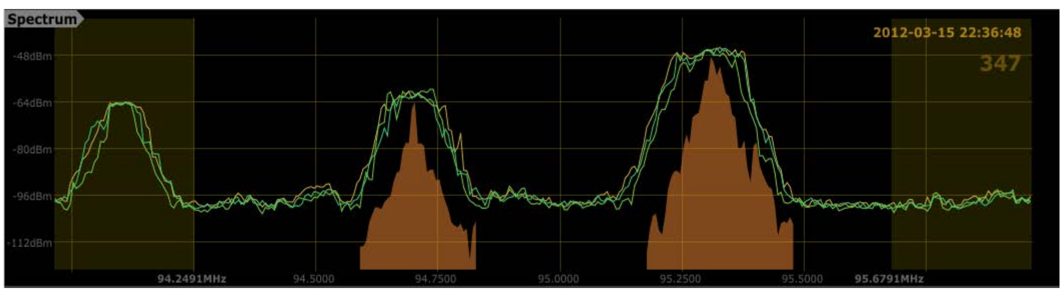
Utilizing a right mouse click on the WFD, RSD, DSA or DEMODULATION VISUALIZER window, results in the display of the | SAVE IMAGE | menu option.

High resolution image capture is accomplished by a single Right mouse click on the RSD, WFD, or DSA window to expose the | SAVE IMAGE | menu option.

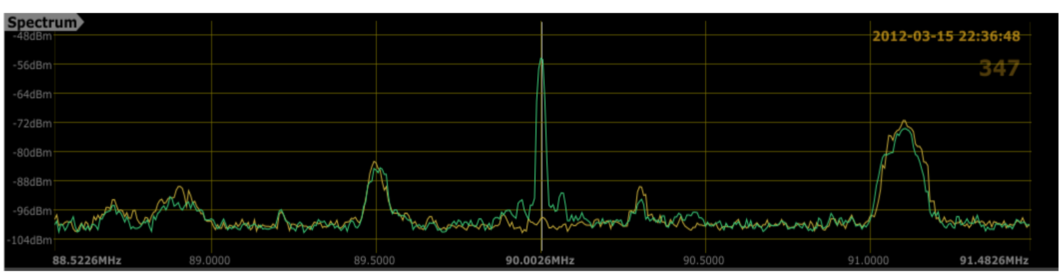
Selecting the | SAVE IMAGE | menu option results in the display of the windows file save dialog, and prompts the technical operator to enter, accept or alter the default file name and file save location on the host computer.



Example - RSD Image Capture Tool (ICT) | (.PNG) | v1.35xx



Example - DSA Image Capture Tool (ICT) | (.PNG) | v1.35xx



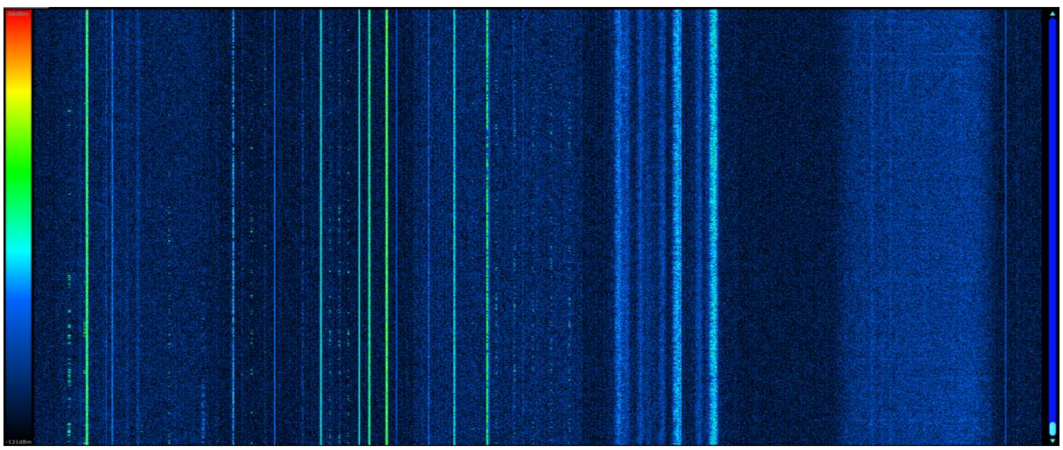
Example - DSA Image Capture Tool (ICT) | (.PNG) | v1.35xx

It is also possible to capture the entire application window utilizing the | SAVE APPLICATION WINDOW | menu option.

The | Image Capture Tool (ICT) ™ | feature will capture the RSD, WFD or DSA trace as displayed on the Graticule at the moment of capture and may be utilized repeatedly to capture a series of images, as may be required by the technical operator for inclusion in supplementary report documentation.

TIP: As illustrated in the example image captures above, it is essential that the technical operator adjust the Graticule size as desired for the intended purpose prior to utilizing the Image Capture Tool (ICT). For example, if the RSD display is adjusted full screen by closing the WFD display, the captured image will be larger and contain more data.

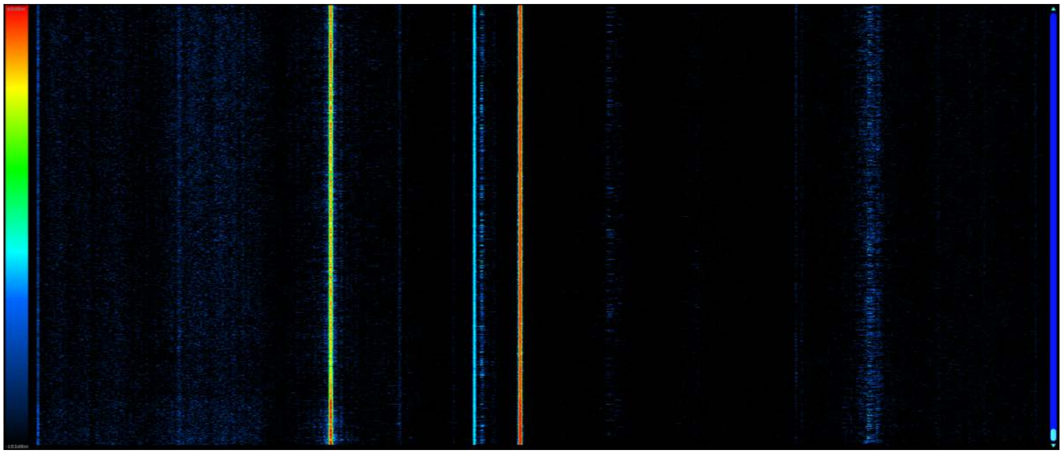
The technical operator can adjust the current view as desired prior to utilizing the | Image Capture Tool (ICT) | to best display the data for the technical operators intended purpose.



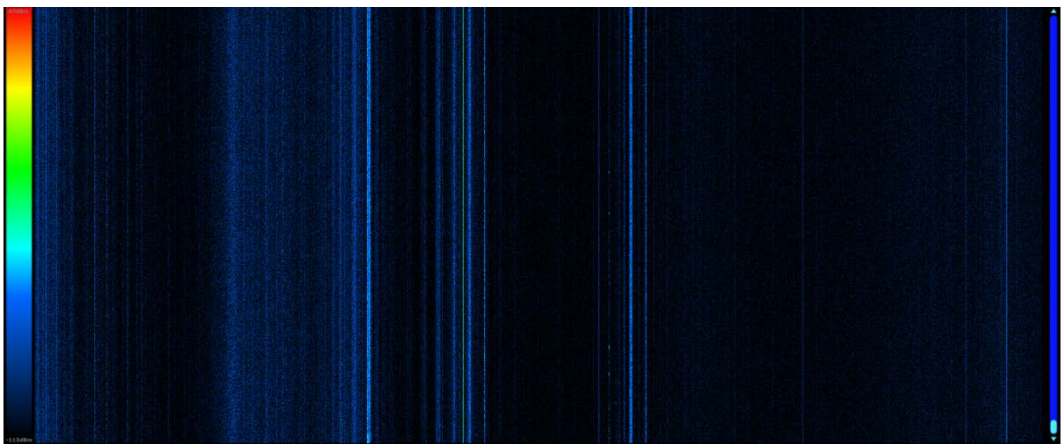
Example - WFD Image Capture Tool (ICT) | (PNG) | v1.35xx

This ability allows the technical operator to capture images at a variety of sizes for direct insertion within third party productivity software.

TIP: There is another excellent third-party image capture tool available within the Windows Operating System (OS). The “Snipping Tool” provides a means of capturing the desktop, or a user defined custom region or window. Once captured, the image can be edited or saved as a (.PNG) image file. These images can also be imported and attached to the Session Report Generator (SRG) output adding yet another dimension to the RSG capability. This tool is located in the | START | ALL PROGRAMS | ACCESSORIES | directory.



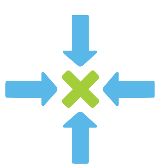
Example - WFD Image Capture Tool (ICT) | (PNG) | v1.35xx



Example - WFD Image Capture Tool (ICT) | (PNG) | v1.35xx

Selecting the | SAVE IMAGE | menu option causes the immediate capture of the screen image and prompts the technical operator to save the captured image.

It is recommended that the default file location within the Kestrel Project File (KPF) ™ directory be utilized to store all captured images.



TIP: The ability to capture screen images at any time during active deployment and / or during Post Analysis and Review, utilizing Live View Analysis (LVA) is fully supported by the Kestrel TSCM ® Professional Software.

The file save dialog window opens allowing the technical operator to select the default File Naming Convention (FNC) and file save location or adjust either setting as might be required.

The default file save location will be the "Project File Directory" and based on the default installation directory, or alternatively, the operator specified "Project Root Directory".

As an example, consider the following default file naming convention;

"waterfall_TSB 1500_Meeting Room.png".

The operator can easily determine that the captured image is a "WFD" plot within the spectral band profile "TSB 1500" and that the image was captured in the "Meeting Room" location.

As another example, consider the following default file naming convention; "spectrum_TSB 1500_Meeting Room.png".

The operator can easily determine that the captured image is an "RSD" plot within the spectral band profile "TSB 1500" and that the image was captured in the "Meeting Room" location.

The | Image Capture Tool (ICT) | may be utilized to capture as many screen captures, as desired, however, as the default File Naming Convention (FNC) will be the same for each successive plot from a band and location standpoint, it is recommended that the technical operator add a prefix such as “001_”, “002_”, “003_” for each successive screen capture.

The addition of the numeric prefix helps establish the sequence of capture and creates a more structured file list within the Kestrel Project File (KPF) directory.

Export Signal | Threat Lists (.CSV)

The technical operator can generate and export any of the various signal and threat list contents directly to a (CSV) file format for analysis or review in third party productivity software.

The following chart indicates the signal and threat lists that are available for export directly to (CSV) file format.

The ability to export the signal and threat lists to a standard "Comma-Separated Values" or (CSV) file format allows the technical operator to further analyze, organize and disseminate deployment related data, utilizing third party applications such as Microsoft Office Excel ™ as well as other similar productivity programs.

The export (CSV) feature is located by accessing the | FILE | EXPORT CTM LIST | EXPORT HST LIST | EXPORT MDA LIST | EXPORT SOI LIST | EXPORT SBL LIST | EXPORT DAA | menu options.

<table>
<tr><th colspan="2">Export Signal | Threat List (.CSV)</th></tr>
<tr><td>Export ALL Signals (CSV)</td><td>Export ALL Signals | Single CSV</td></tr>
<tr><td>Export CTM List (CSV)</td><td>Chirp Threat Mode (CTM)</td></tr>
<tr><td>Export HST List (CSV)</td><td>Harmonic Signature Threshold (HST)</td></tr>
<tr><td>Export MDA List (CSV)</td><td>Minimum Detection Amplitude MDA)</td></tr>
<tr><td>Export SOI List (CSV)</td><td>Signal of Interest (SOI)</td></tr>
<tr><td>Export SBL List (CSV)</td><td>Spectrum Baseline Logging (SBL)</td></tr>
<tr><td>Export DAA List (CSV)</td><td>Dynamic Alert Annunciator (DAA)</td></tr>
</table>

Export (.CSV) | v1.40xx

In the event that the selected list for export does not have any signal content for export, a warning dialog box will appear displaying the message "List is Empty".

When the technical operator selects a signal or threat list that contains one or more captured signals, the file save dialog window will open and allow the technical operator to accept the default File Naming Convention (FNC) and save the file to the current location.

The default File Naming Convention (FNC) is dynamically generated based on the selected list for export to (CSV) file format.

As an example, when the technical operator selects the "Export MDA List" option, the file save dialog window opens and the default file name will display as "MinimumDetectionAmplitude.csv" and will display the default file save location "Project File Directory" based on the default installation directory or the custom operator specified "Project Root Directory".

The export (CSV) feature may be utilized to capture as many signal or threat lists as desired, however, as the default File Naming Convention (FNC) will be the same for each export command of the same type, it is recommended that the technical operator add a prefix such as "001_", "002_", "003_" for each successive capture.

The addition of the prefix helps establish the sequence of capture and creates a more structured file list within the "Project File Directory".

The ability to export signal and threat list data allows the technical operator to utilize third party productivity software for detailed analysis and advanced report generation.

To better illustrate the ability to utilize third party productivity software to analyze and display exported threat, or signal list data, consider the following charts and graphs created utilizing Microsoft Excel ™ software.

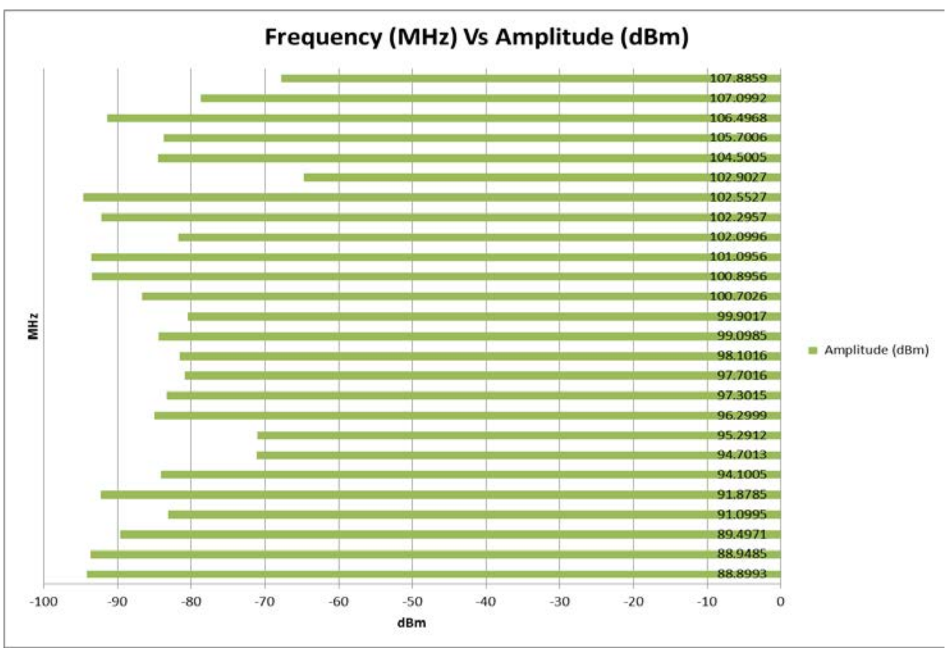
	A	B	C	D	E	F	G	H	I	J	K
1	Threat ID	Identity	Frequency(MHz)	Bandwidth(KHz)	Amplitude(dBm)	Location	Date	Time	Modulation	Chirp	Harmonic
2	1		89.5002	59	-85.4	Level 3	2012-03-13	09:25:45		0%	-
3	2		91.1026	117	-78.8	Level 3	2012-03-13	09:25:45		0%	-
4	3		94.7005	225	-72.4	Level 3	2012-03-13	09:25:45		0%	-
5	4		95.2975	234	-62.3	Level 3	2012-03-13	09:25:45		0%	-
6	5		96.2991	100	-80.4	Level 3	2012-03-13	09:25:45		0%	-
7	6		97.3007	144	-85.7	Level 3	2012-03-13	09:25:45		0%	-
8	12		97.7	127	-85.2	Level 3	2012-03-13	09:25:46		0%	-
9	13		98.1008	141	-80.9	Level 3	2012-03-13	09:25:46		0%	-
10	7		99.097	77	-84.4	Level 3	2012-03-13	09:25:45		0%	-
11	16		99.9017	148	-84.8	Level 3	2012-03-13	09:25:46		0%	-
12	14		100.6979	69	-85.6	Level 3	2012-03-13	09:25:46		0%	-
13	8		102.9043	241	-66.8	Level 3	2012-03-13	09:25:45		0%	-
14	9		104.5029	159	-82.3	Level 3	2012-03-13	09:25:45		0%	-
15	10		105.6998	166	-81.9	Level 3	2012-03-13	09:25:45		0%	-
16	15		107.1015	147	-79.9	Level 3	2012-03-13	09:25:46		0%	-
17	11		107.8984	203	-60.9	Level 3	2012-03-13	09:25:45		0%	-

Microsoft Excel | v1.35xx

The above example illustrates the ability of the technical operator to open and display the Minimum Detection Amplitude (MDA) signal list utilizing Microsoft Excel ™ as part of the Microsoft Office Professional ™ productivity software.

The following are working examples that illustrate the potential benefits of exporting signal list data to third party applications for processing and analysis.

The Kestrel TSCM ® Professional Software was specifically designed to work with and take full advantage of third-party productivity software applications. This essential functionality significantly enhances the technical operator’s ability to analyze and report critical collection data during deployment.

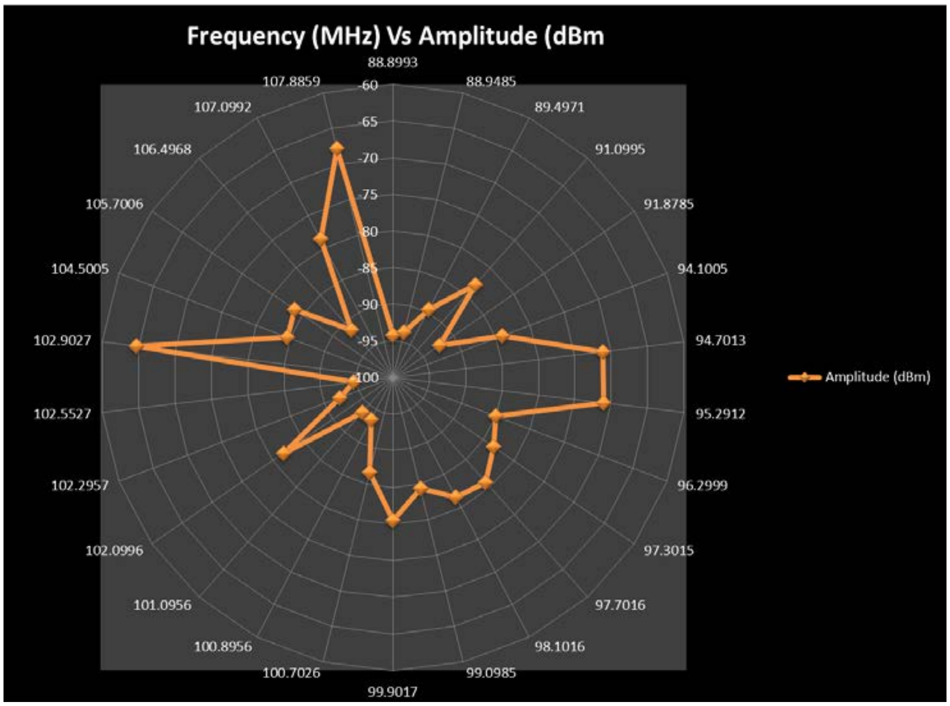


Microsoft Excel | v1.35xx

The above chart represents spectral data exported from the Minimum Detection Amplitude (MDA) signal list as a (CSV) file format.

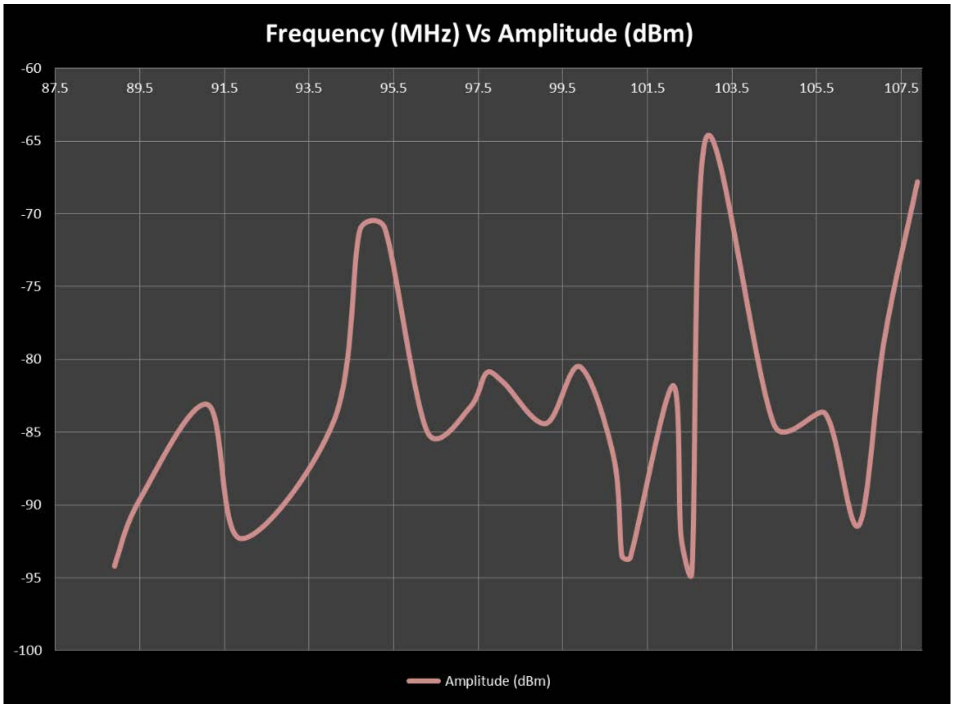
As an example, creating a graph of Frequency Vs RSSI values turns a simple signal list into a very easy to understand visual masterpiece.

Utilizing the chart and graph functionality of Microsoft Excel ™ as part of the Microsoft Office Professional ™ productivity software, the technical operator can create a wide range of charts and graphs that significantly enhance all aspects of analysis and report generation.



Microsoft Excel | v1.35xx

The above graph represents the captured spectral data exported from the Minimum Detection Amplitude (MDA) signal list as a (CSV) file format.



Microsoft Excel ™ | v1.35xx

The above graph represents the captured spectral data exported from the Minimum Detection Amplitude (MDA) signal list as a (CSV) file format.

Create Report

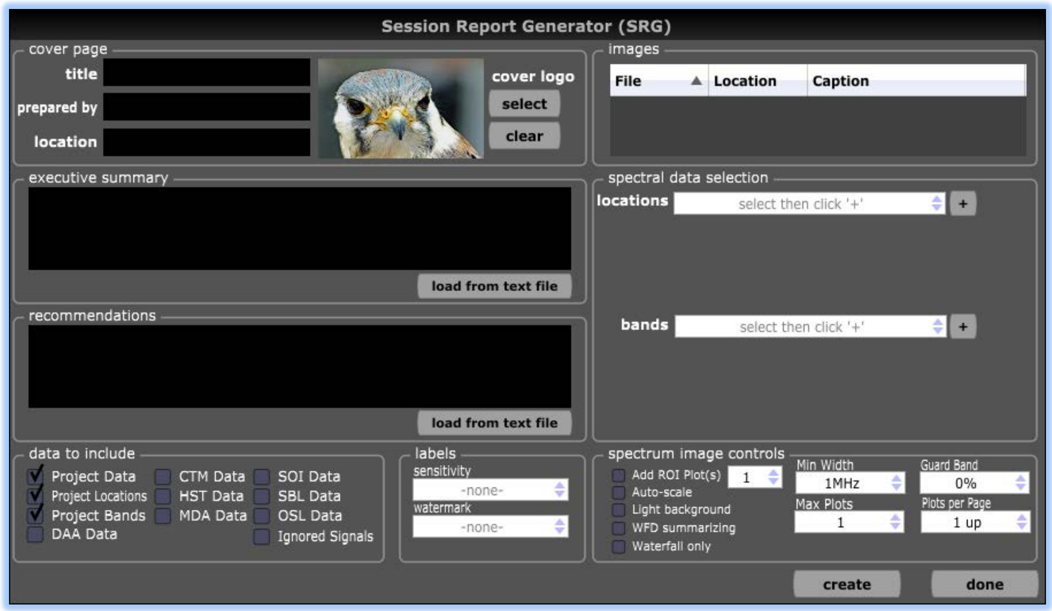
The ability to generate interim runtime and post analysis review-based session reports is fully supported within the Kestrel TSCM ® Professional Software.

The report generator is accessed from the | FILE | CREATE REPORT | menu option.

Selecting the "Create Report" menu option results in the "Session Report Generator (SRG)" dialog input window being displayed.

The following options and customizations are fully supported and allow considerable flexibility as to what active elements are to be included and how various reporting elements are displayed within the generated session report.

The Kestrel TSCM ® Professional Software fully supports the ability to generate formatted Portable Document File (PDF) without the requirement for a third-party PDF writer application.



Default | Session Report Generator (SRG) | v1.38xx

The default Session Report Generator (SRG) dialog window will be displayed and allow the technical operator to accept a number of default values and / or customize essential reporting elements.

The SRG dialog holds the report values if opened and closed in-session and can be opened again with all recent data and settings intact.

This is useful, when periodic runtime reports are required, without the need to select all of the desired setting for additional report generation.

Cover Page (Report)

The cover page section of the report generator dialog box dynamically displays the Project File Name, Technical Operator Name, and Location related details as entered by the technical operator as captured from the Setup Wizard during the initialization process.

Session Report Generator (SRG) | v1.38xx

The above project parameters are automatically generated within the report output structure.

TIP: It is essential that the technical operator utilize an appropriate and consistent "File Management" structure when initializing the software to avoid unexpected and undesirable results in report generation process based on the concept of “garbage in”, “garbage out”.

Cover Page | Edit

The ability to edit and replace the “document title”, “prepared by” and “location details”, is fully supported.

Making changes to these reporting elements will not affect the project or file system and will only change the Session Report Generator (SRG) output.

This might be required when a typo is observed in the Setup Wizard data and for security reasons if reports are being disseminated to a third party.

The technical operator can include an optional logo (PNG) file format on the cover page of the report.

Session Report Generator (SRG) | v1.38xx

The technical operator will need to create or supply an appropriate graphic image in a (PNG) file format.

Any suitable graphic image may be selected by browsing the host computer.

The Kestrel TSCM ® logo graphic image “ReportLogo.png” has been included and will appear as the default value when the report generator is active.

TIP: Please note that this graphic image is a copyrighted original work photograph and may not be utilized, posted or distributed electronically or otherwise outside of the Kestrel TSCM ® Professional Software, Session Report Generator (SRG) without the express written permission of the copyright holder.

If the technical operator does not want a cover page graphic image appears within the session report, pressing the | CLEAR | button will remove the default logo for the current report.

Should the technical operator wish to utilize a custom (PNG) logo or other graphic image, utilizing the | SELECT | button within the cover page control group with allow the technical operator to browse the host computer file dialog window for a suitable graphic image file or logo.

Selecting this option opens the "Project Root Directory" by default and is an excellent location to store any number of optional logo images that might be required for active field deployment.

The technical operator may also browse any directory file location containing (PNG) graphic image files for inclusion as a cover page logo.

By default, the Kestrel TSCM ® logo graphic image is selected for inclusion within the report.

TIP: It is important to note that only (PNG) files are supported within the Kestrel TSCM ® Professional Software application and the technical operator may need to utilize a third-party graphics program to convert .BMP), or (JPG) files to the supported (PNG) file format.

The cover page prints as the first and front page of the generated session report document and becomes the un-numbered first page of the report.

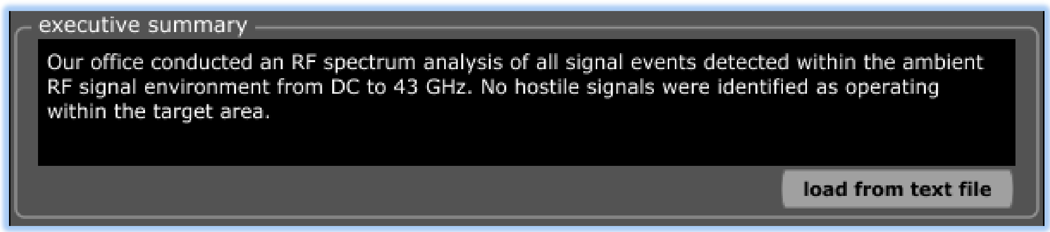
Executive Summary (Report)

The technical operator can input a text-based narrative for inclusion within the session report.

This dialog entry window, is a direct “text” input box, to include an "Executive Summary" which can be typed directly by the technical operator, cut and paste from a reference file, or imported from a standard, existing | TXT | file source, as desired.

This ability permits the technical operator to create a directory of common reference text files for direct import and editing within the “Executive Summary” input window.

Session Report Generator (SRG) | Executive Summary | Default | v1.39xx



Session Report Generator (SRG) | Executive Summary | v1.39xx

The space allocation for the “Executive Summary” text input box is currently set for 8.00 inches on one (1) formatted report page and results in approximately 30 lines of text.

However, as text is kerned, predicting the exact text size is not straightforward or reasonably predictable.

The technical operator is advised to verify that the intended text annotation is displayed correctly in the actual output PDF report once generated.

Recommendations (Report)

The technical operator can input a text-based narrative for inclusion within the session report.

This is a text input box and the technical operator may type directly into the "Executive Summary" text input box, cut and paste from a reference file or import text directly from an existing “TXT” file source as desired.

This ability permits the technical operator to create a directory of common reference text files for direct import and editing within the “Recommendations” input window.

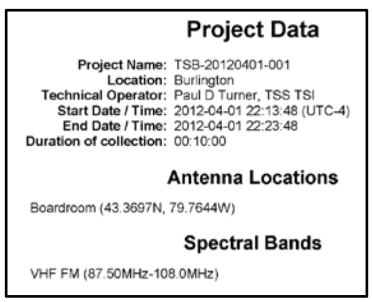
Session Report Generator (SRG) | Recommendations | v1.39xx

Any number of specific or common recommendations can be included within the report.

Project Data (Report)

The Project Data output page provides an operational summary of the runtime session and technical operator defined reporting elements such as Antenna Locations, GPS Coordinates and Spectral Bands contained within the report.

By default, some elements of Project Data are automatically selected and may be deactivated by the technical operator, if desired.



Project Data

Project Name: TSB-20120401-001
Location: Burlington
Technical Operator: Paul D Turner, TSS TSI
Start Date / Time: 2012-04-01 22:13:48 (UTC-4)
End Date / Time: 2012-04-01 22:23:48
Duration of collection: 00:10:00

Antenna Locations

Boardroom (43.3697N, 79.7644W)

Spectral Bands

VHF FM (87.50MHz-108.0MHz)

Project Locations | v1.38xx

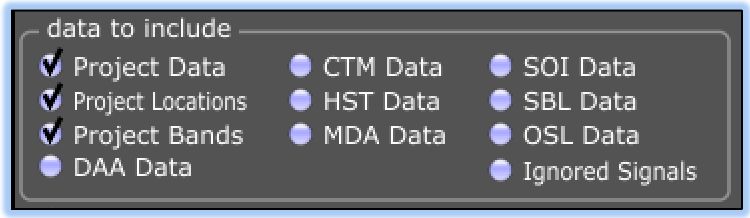
By default, the Project Name, Location, Technical Operator, | Start Date / Time |, | End Date / Time |, and Duration of Collection are automatically included as part of the Project Data set.

Tables

The unique ability of the technical operator to select, include, display and print an extremely detailed, "Discrete Signal" list is fully supported within the Kestrel TSCM ® Professional Software.

This workflow-based approach is unique to the Kestrel TSCM ® Professional Software and is a process that remains under the full and unrestricted control of the technical operator.

Report simplicity or complexity is accomplished by accepting the default settings or by actively selecting or deselecting various table options available, for various data sets.



Session Report Generator (SRG) | v1.39xx

Each signal event as captured on one of the included signal lists is displayed as a table containing the signals database reference ID, frequency captured, date and time the signal was detected and the capture (antenna) location.

Other captured details; include the type of signal, modulation and bandwidth, harmonically related signals, signal level, dBc level, dB ANF level and the Correlation Confidence Factor (CCF).

By default, the Project Data, Project Locations and Project Bands are selected and may be deselected by the technical operator should this information not be wanted in the generated report.

Report Generator - Tables Control Group	
Project Data	Identifies the Project Name, Location, Technical Operator, Start Date / Time, Duration of Collection
Project Locations	Identifies each included Antenna Location
Project Bands	Identifies each included Spectral Band
DAA Data	Includes signal details for each discrete DAA alert captured event.
CTM Data	Includes signal details for each discrete CTM signal event
HST Data	Includes signal details for each discrete HST signal event and displays harmonic relationships
MDA Data	Includes signal details for each discrete MDA signal event
SOI Data	Includes signal details for each discrete SOI signal event
SBL Data	Includes signal details for each discrete SBL signal event
OSL Data	Includes all signal details for each discrete OSL signal event in the currently loaded OSL database
Ignored Signals	Includes signal details for each discrete signal event, selected by the technical operator as "Ignored"

Report Generator Tables | v1.38xx

Data sets, can contain significant amounts of signal level data included within the report output, for rendering.

Document Labels | Sensitivity

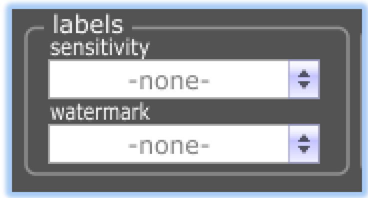
The technical operator can select and include an optional statement of “document sensitivity” that will print centered on the footer of each page of the session report.

By default, no “document sensitivity” label is selected and must be selected by the technical operator, if required.

Document Labels | Watermark

The technical operator can select and include an optional statement of “document sensitivity” that will print as a watermark across report pages within the session report.

By default, no “document sensitivity” watermark is selected and must be selected by the technical operator, if required.



Session Report Generator (SRG) | v1.38xx

The following chart describes the options that are currently available from the “document sensitivity” option list for inclusion within a session report.

Document Sensitivity | Labels	
Default	None
Confidential	Option list < available > selection
Classified	Option list < available > selection
Sensitive	Option list < available > selection
Technical Operator “Defined” Value	The technical operator can define a custom “document sensitivity” label by direct text input box entry. For example; “Protected B” or “Secret” may be utilized as a custom value.

Sensitivity Statement | v1.38xx

Document Sensitivity | Watermark	
Default	None
Draft	Option list selection
Confidential	Option list selection
Technical Operator "Defined" Value	The technical operator can type a custom "document sensitivity" watermark into the text input box. For example; "Classified" or "Internal Only" may be utilized as a custom value.

Sensitivity Statement | v1.38xx

Image Import

The Session Report Generator (SRG) may be utilized to import a variety of graphic image types and / or target area photographs, for inclusion in an interim runtime, or final session report is fully supported.

The ability to import actual target area photographs or specific target area vulnerabilities identified is fully supported and may be utilized to support the technical operator's observations and findings.

To add a photograph or other graphic image, the technical operator may utilize a right or left mouse click on the image import table area.

Image Import | v1.38xx

The | ADD IMAGE | dialog window is displayed and the technical operator can browse and select photographs or other graphic images from the host computer hard-drive or removable storage device.

The ability to include any established DSA Antenna Location from the | LOCATION | selection dialog box and include a short descriptive caption for each imported image is fully supported.

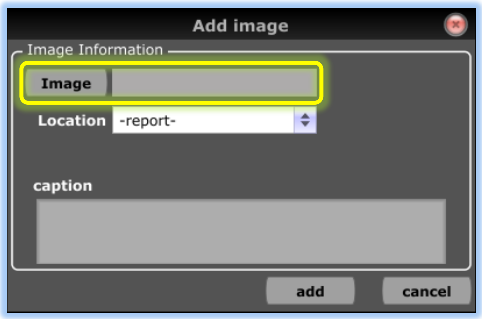


Image Import | v1.38xx

Once the technical operator has selected a suitable image or photograph, selected a DSA Antenna Location and entered a short image description or caption consisting of up to five (5) lines of text (approximately 350 characters), pressing the | ADD | button places the graphic on the import image table.

The technical operator can repeat the process to include any number of additional images or photographs.

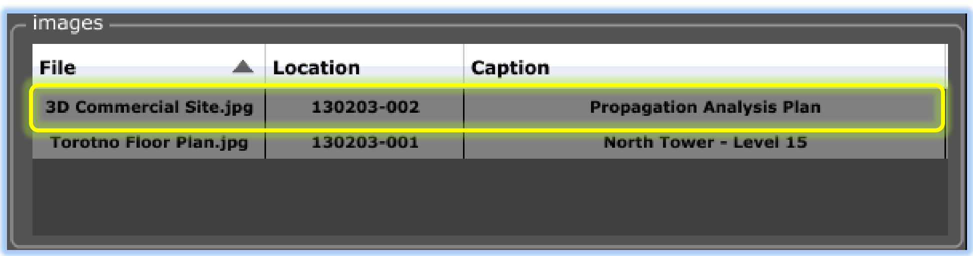


Image Import | v1.38xx

The image import capability permits reference photographs to be included in the session report, as well as floor plans, schematics, block diagrams and other desired images (.JPG) (.PNG) (.GIF) for inclusion within the session report.

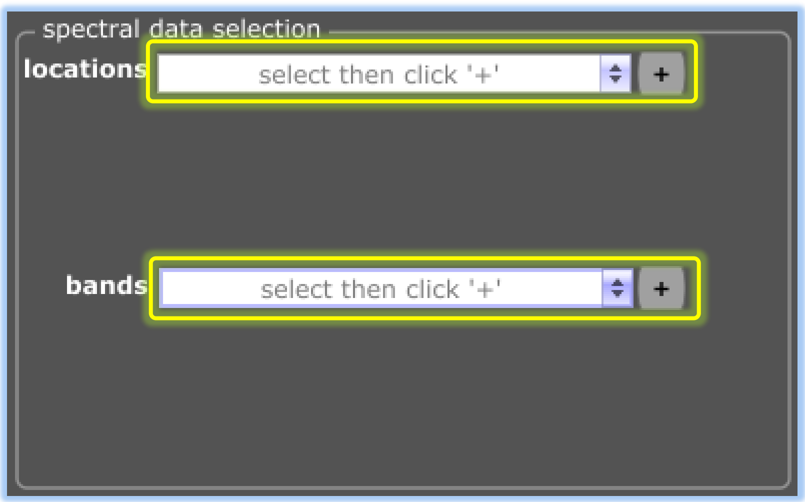
During the import process, a copy of the original image or photograph is automatically placed into the Kestrel Project File for future reference.

Digital reference photographs taken of the target area or facility during deployment may be downloaded to the host computer in the field and then directly imported into the Kestrel TSCM ® Professional Software Session Report Generator (SRG).

Spectral Data Selection (SDS)

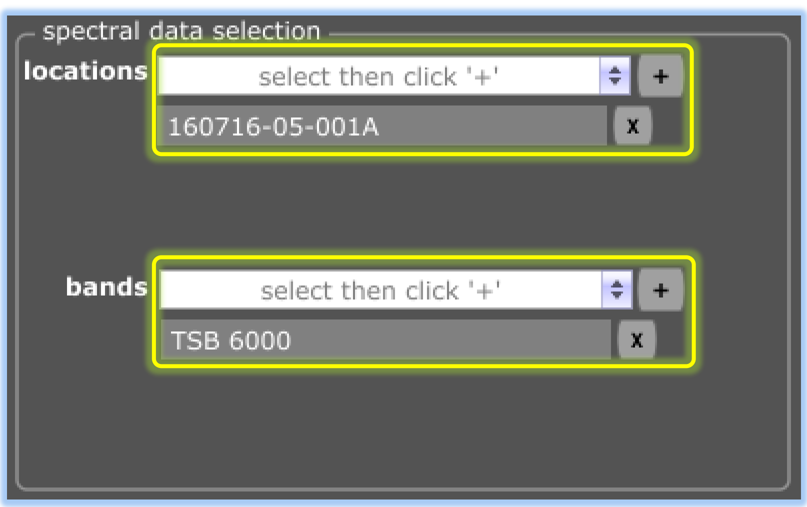
The technical operator may select any number of active | Antenna Locations | and | Spectral Bands | to be included within the session report.

This advanced flexibility provides the technical operator with the unique ability to collect from any number of DSA locations and include all or some of the locations and all or specific active spectral profiles or bands utilized during deployment. This is an essential control element as not all collected data holds the same importance and oftentimes creates confusion for the reader if included within the generated report.



Session Report Generator (SRG) | v1.38xx

It is essential that the | **+** | button be pressed after selecting the desired locations and bands.



Session Report Generator (SRG) | v1.38xx

As an example, it is possible to deploy the software to actively collect spectrum data from several locations and only include relevant information based on the intended recipient of the report.

The same applies for deployment in which several discrete Spectral Profiles or custom Ranges of Interest (ROI) are part of the overall collection process.

In-fact, the Kestrel TSCM ® Professional Software fully supports the ability to create several different levels of the session report, depending on report dissemination requirements.

To select the “Locations” for reporting purposes, the technical operator first selects an available defined location from the option list box.

The second step once an available location has been selected for inclusion within the generated report, it is necessary to press the | **+** | to set the location.

This process must be repeated for each of the locations that the technical operator wishes to include from the option list box.

Each must be first selected and then set utilizing the | **+** | symbol.

Each of the selected options will be displayed and may be removed by selecting the | **x** | symbol.

To select an available “Band” for inclusion within the generated report; the technical operator first selects an available option from the “Bands” option list box.

The second step once an available “Band” has been selected for inclusion within the generated report, it is necessary to press the | **+** | symbol to set the band for inclusion within the generated report.

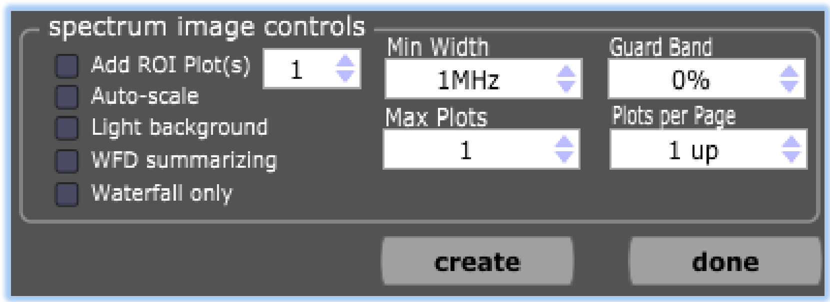
This process must be repeated for each of the bands that the technical operator wishes to include from the option list box.

Each must be first selected and then set utilizing the | **+** | symbol.

Each of the selected options will be displayed and may be removed by selecting the | **x** | symbol.

Spectrum Image Control (SIC) ™

The Spectrum Image Control (SIC) ™ group provides significant flexibility in determining how the Range of Interest (ROI) is segmented and plotted for inclusion within the generated session report.



Session Report Generator (SRG) | v1.38xx

There are a number of important controls that determine the actual number of image plot pages, rendering and level of report detail.

These important control issues may be significant, based on the reports planned dissemination and whether or not the technical operator intends to print, store, or email the report.

For example, printing a hard copy report with 350 pages may not be desirable and emailing such a report may prove problematic due to the large file size.

Selecting the | MIN WIDTH |, | MAX PLOTS |, and | PLOTS PER PAGE | directly affects the number of pages generated.

The technical operator can utilize the | MAX PLOTS | and | MIN WIDTH | functionality to focus priority on either the maximum number of actual plots, based on the mathematical equation logic, of ROI divided by the maximum number of plots, is equal to the individual plot bandwidth.

Alternatively, the technical operator is able to give priority and focus to the minimum width, based on the mathematical equation of minimum width multiplied by the | MAX PLOTS | selected.

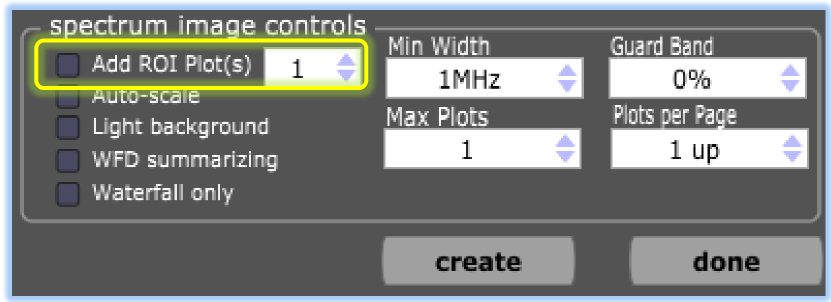
When the ROI is 1500 MHz and the technical operator sets the | MAX PLOTS | to 100 and the | MIN WIDTH | to 50 MHz, the result will be 30 individual plots at 50 MHz.

When the ROI is 1500 MHz and the technical operator sets the | MAX PLOTS | to 50 and the | MIN WIDTH | to 50 MHz, the result will be 30 individual plots at 50 MHz.

When the ROI is 1500 MHz and the technical operator sets the | MAX PLOTS | to 20 and the | MIN WIDTH | to 50 MHz, the result will be 20 individual plots at 75 MHz.

Add ROI Plot(s)

The | Add ROI Plot(s) |selection checkbox, places a single full ROI spectrum plot at the beginning of each Spectrum Band selected for SRG inclusion.



Spectral Image Controls | v1.38xx

Leaving the | Add Full ROI Plot |check box un-checked results in only the individual SPAN specific spectral images being included in the SRG output.

When working with a large Range of Interest (ROI) span, it might be beneficial to split the single ROI plot into | 2 | or | 4 | plots for improved clarity.

Options include | 1 | 2 | 4 | rendering divisions for the ROI overview spectrum plot.

The default value is a | 1 | plot, when the Add ROI Plot(s) option is first selected.

Auto Scale

The | Auto Scale |check box allows the software to scale the output reference level rendering to ensure all spectrum data is visible within the plot rendering region.

Rather than plotting the WFD backwards from the last trace to simply fill the physical plot rendering space available, selecting the | AUTO SCALE | option results in all the WFD data being summarized and represented.

Spectral Image Controls | v1.38xx

To utilize | AUTO SCALE |, select the checkbox.

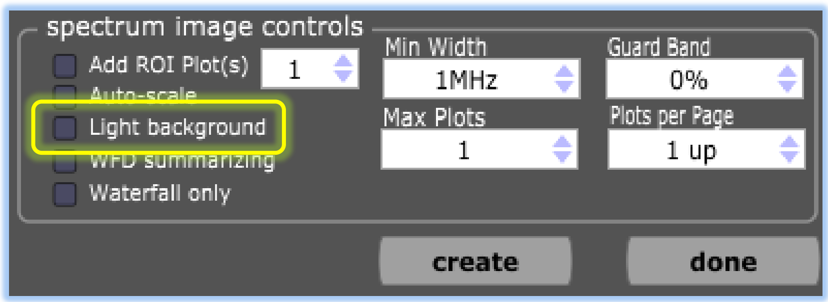
It is important to note that selecting this option will result in a significant increase in the report rendering time.

This is true of each reporting parameter selected, as well as the detail level programming by the technical operator.

Light Background

The | LIGHT BACKGROUND | check box removes the black background from the spectrum plots, when a hardcopy of the report must be produced for physical printing.

The | LIGHT BACKGROUND | option can be utilized even when the report is not being printed, but might be in the future.



Spectral Image Controls | v1.38xx

When the | LIGHT BACKGROUND | check box is not checked by the technical operator, the standard black background will be rendered.

WFD Summarizing

The | WFD SUMMARIZING | feature is utilized when plotting any of the output options associated with waterfall rendering.

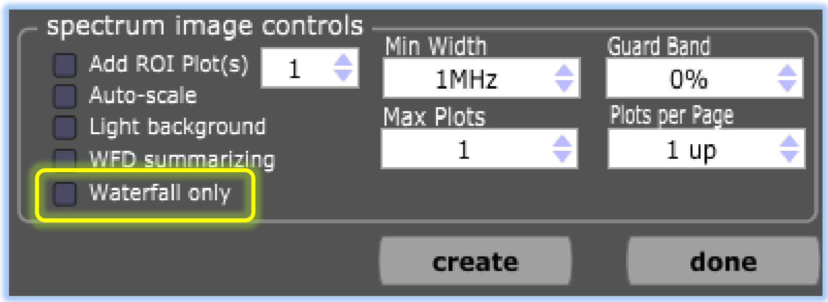
Spectral Image Controls | v1.38xx

For example, | 1 UP | 2 UP | 3 UP | contain waterfall plots that normally can only plot the waterfall data that is visible within the physical display space available.

Checking the | WFD SUMMARIZING | checkbox, better represents WFD data, that otherwise might not be included or visible during rendering.

WFD Only Plot Rendering

The | WFD SUMMARIZING | feature is utilized when plotting any of the output options associated with waterfall rendering.



Spectral Image Controls | v1.38xx

For example, the | 1 UP | 2 UP | 3 UP | 4 UP | options can be populated with a Waterfall Display (WFD) plot only without the spectrum trace detail allowing more waterfall data to be displayed for analytical purposes.

Checking the | WATERFALL ONLY | checkbox, better represents WFD data that otherwise might not be included or visible during rendering in combination with trace level data or may be compressed by write management or WFD summarizing, if this SRG option is selected.

The | WATERFALL ONLY | option displays best when the | LIGHT BACKGROUND | option is not selected.

<table>
<tr><th colspan="3">SRG | Spectrum Image Control (SIC) | Functionality</th></tr>
<tr><th>Control Group</th><th>Options Available</th><th>Description</th></tr>
<tr><td>Add Full ROI Plot</td><td>Default - Not Selected</td><td>Adds | 1 | full ROI plot at the beginning each print range, and may be split into | 2 | 4 | plots.</td></tr>
<tr><td>Auto Scale</td><td>Default - Not Selected</td><td>When selected, the dB scaling is chosen to fit the largest and smallest displayed traces across all ROI plots.</td></tr>
<tr><td>Light Background</td><td>Default - Not Selected</td><td>Printer friendly option removes the black background from the trace plots</td></tr>
<tr><td>WFD Summarizing</td><td>Default – Not Selected</td><td>Rather than plotting the WFD backwards from the last trace to the fill the physical plot space, selecting this option results in all the WFD being represented.</td></tr>
<tr><td>Waterfall Only</td><td>Default – Not Selected</td><td>Permits 1 UP, 2 UP, 3 UP, and 4UP Waterfall Plot (only) rendering.</td></tr>
<tr><td>Minimum Width</td><td>100 kHz, 200 kHz, 500 kHz, Default – 1 MHz, 2 MHz, 5 MHz, 10 MHz, 20 MHz, 25 MHz, 50 MHz, 100 MHz, 200 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz</td><td>Defines the minimum displayed plot bandwidth based on the maximum number of spectral plots. The report generator will automatically adjust the plot width based on the maximum number of plots selected.</td></tr>
<tr><td>Maximum Plots</td><td>Default – 1, 2, 5, 10, 20, 25, 50, 100, 200, 500, and 1000</td><td>Defines the maximum number of plots based on the minimum width selected. Minimum Width and Maximum Plots use logic to adjust the correct values, if outside the operators set parameters.</td></tr>
<tr><td>Guard Band</td><td>Default – 0%, 5%, 10% and 20%</td><td>Percentage based graphical guard band added to trace display, and logical adjustment of the rendered plot width.</td></tr>
<tr><td>Plots Per Page</td><td>Default – 1 UP, 2 UP, 3 UP, 4 UP (no WFD), 5 UP (no WFD), WFD Only</td><td>Defines the number of plots formatted on each page. If the (4 up) option is selected, only the RSD will display and the WFD will be excluded.</td></tr>
</table>

Once the various preferences have been set by the technical operator, pressing the | CREATE | button opens the File Save Dialog Window.

The default file location is the working Project File Directory and the default File Naming Convention (FNC) is the Project File Name with a (.PDF) extension.

The technical operator can change the file location or file name if desired, however, it is recommended that the current located be utilized as this ensures that all files and data are contained in the master project file directory.

Pressing the | SAVE | button completes the process and the report generator will automatically create the formatted (.PDF) report and immediately opens the completed report in Adobe Acrobat, Adobe Reader, or other PDF reader installed on the host computer, required to view rendered reports.

No special software is required to generate the PDF report as this software is integrated within the Kestrel TSCM ® Professional Software application.

However, the technical operator or reader of the report will require the ability of open and view (.PDF) files.

The technical operator can change the default or current file location, or file name, if desired prior to saving the generated report.

If the technical operator is planning to send the document to a physical printer, it is important to understand that Kestrel TSCM ® Professional Software reports can easily run into the hundreds of pages.

The number of pages is dependent on which reporting elements have been selected by the technical operator and the parameters of those elements.

The following chart outlines the number of pages for spectral image plots, but does not reflect the number of pages in relation to the various signal list options, if selected by the technical operator for printing.

Number of Pages | Spectral Image Plots (1 Up)				
ROI	**10 MHz**	**25 MHz**	**50 MHz**	**100 MHz**
1 GHz	100 Pages	40 Pages	20 Pages	10 Pages
2 GHz	200 Pages	80 Pages	40 Pages	20 Pages
3 GHz	300 Pages	120 Pages	60 Pages	30 Pages
4 GHz	400 Pages	160 Pages	80 Pages	40 Pages
5 GHz	500 Pages	200 Pages	100 Pages	50 Pages
6 GHz	600 Pages	240 Pages	120 Pages	60 Pages
7 GHz	700 Pages	280 Pages	140 Pages	70 Pages
8 GHz	800 Pages	320 Pages	160 Pages	80 Pages
9 GHz	900 Pages	360 Pages	180 Pages	90 Pages
10 GHz	1000 Pages	400 Pages	200 Pages	100 Pages
11 GHz	---	440 Pages	220 Pages	110 Pages
12 GHz	---	480 Pages	240 Pages	120 Pages
15 GHz	---	600 Pages	300 Pages	150 Pages
18 GHz	---	720 Pages	360 Pages	180 Pages
20 GHz	---	800 Pages	400 Pages	200 Pages
26 GHz	---	---	520 Pages	260 Pages
27 GHz	---	---	540 Pages	270 Pages
30 GHz	---	---	600 Pages	300 Pages
32 GHz	---	---	640 Pages	320 Pages
43 GHz	---	---	860 Pages	430 Pages
50 GHz	---	---	1000 Pages	500 Pages

Number of Pages | Spectral Image Plots (2 Up)				
ROI	**10 MHz**	**25 MHz**	**50 MHz**	**100 MHz**
1 GHz	50 Pages	20 Pages	10 Pages	5 Pages
2 GHz	100 Pages	40 Pages	20 Pages	10 Pages
3 GHz	150 Pages	60 Pages	30 Pages	15 Pages
4 GHz	200 Pages	80 Pages	40 Pages	20 Pages
5 GHz	250 Pages	100 Pages	50 Pages	25 Pages
6 GHz	300 Pages	120 Pages	60 Pages	30 Pages
7 GHz	350 Pages	140 Pages	70 Pages	35 Pages
8 GHz	400 Pages	160 Pages	80 Pages	40 Pages
9 GHz	450 Pages	180 Pages	90 Pages	45 Pages
10 GHz	500 Pages	200 Pages	100 Pages	50 Pages
11 GHz	550 Pages	220 Pages	110 Pages	55 Pages
12 GHz	600 Pages	240 Pages	120 Pages	60 Pages
15 GHz	750 Pages	300 Pages	150 Pages	75 Pages
18 GHz	900 Pages	360 Pages	180 Pages	90 Pages
20 GHz	1000 Pages	400 Pages	200 Pages	100 Pages
26 GHz	---	520 Pages	260 Pages	130 Pages
27 GHz	---	540 Pages	270 Pages	135 Pages
30 GHz	---	600 Pages	300 Pages	150 Pages
32 GHz	---	640 Pages	320 Pages	160 Pages
43 GHz	---	860 Pages	430 Pages	215 Pages
50 GHz	---	1000 Pages	500 Pages	250 Pages

Spectral Image Control (SIC) | v1.38xx

Number of Pages | Spectral Image Plots (3 Up)				
ROI	**10 MHz**	**25 MHz**	**50 MHz**	**100 MHz**
1 GHz	33 Pages	13 Pages	6 Pages	3 Pages
2 GHz	66 Pages	26 Pages	13 Pages	6 Pages
3 GHz	100 Pages	40 Pages	20 Pages	10 Pages
4 GHz	133 Pages	53 Pages	26 Pages	13 Pages
5 GHz	166 Pages	66 Pages	33 Pages	16 Pages
6 GHz	200 Pages	80 Pages	40 Pages	20 Pages
7 GHz	233 Pages	93 Pages	46 Pages	23 Pages
8 GHz	266 Pages	106 Pages	53 Pages	26 Pages
9 GHz	300 Pages	120 Pages	60 Pages	30 Pages
10 GHz	333 Pages	133 Pages	66 Pages	33 Pages
11 GHz	366 Pages	146 Pages	73 Pages	36 Pages
12 GHz	400 Pages	160 Pages	80 Pages	40 Pages
15 GHz	500 Pages	200 Pages	100 Pages	50 Pages
18 GHz	600 Pages	240 Pages	120 Pages	60 Pages
20 GHz	667 Pages	267 Pages	133 Pages	67 Pages
26 GHz	867 Pages	347 Pages	173 Pages	87 Pages
27 GHz	900 Pages	360 Pages	180 Pages	90 Pages
30 GHz	1000 Pages	400 Pages	200 Pages	100 Pages
32 GHz	---	427 Pages	213 Pages	107 Pages
43 GHz	---	573 Pages	287 Pages	143 Pages
50 GHz	---	667 Pages	334 Pages	167 Pages

Spectral Image Control (SIC) | v1.38xx

Number of Pages | Spectral Image Plots (4 Up) | No WFD | (4 UP) WFD Only				
ROI	**10 MHz**	**25 MHz**	**50 MHz**	**100 MHz**
1 GHz	25 Pages	10 Pages	5 Pages	3 Pages
2 GHz	50 Pages	20 Pages	10 Pages	5 Pages
3 GHz	75 Pages	30 Pages	15 Pages	8 Pages
4 GHz	100 Pages	40 Pages	20 Pages	10 Pages
5 GHz	125 Pages	50 Pages	25 Pages	13 Pages
6 GHz	150 Pages	60 Pages	30 Pages	15 Pages
7 GHz	175 Pages	70 Pages	35 Pages	18 Pages
8 GHz	200 Pages	80 Pages	40 Pages	20 Pages
9 GHz	225 Pages	90 Pages	45 Pages	23 Pages
10 GHz	250 Pages	100 Pages	50 Pages	25 Pages
11 GHz	275 Pages	110 Pages	55 Pages	28 Pages
12 GHz	300 Pages	120 Pages	60 Pages	30 Pages
15 GHz	375 Pages	150 Pages	75 Pages	38 Pages
18 GHz	450 Pages	180 Pages	90 Pages	45 Pages
20 GHz	500 Pages	200 Pages	100 Pages	50 Pages
26 GHz	650 Pages	260 Pages	130 Pages	65 Pages
27 GHz	675 Pages	270 Pages	135 Pages	68 Pages
30 GHz	750 Pages	300 Pages	150 Pages	75 Pages
32 GHz	800 Pages	320 Pages	160 Pages	80 Pages
43 GHz	---	430 Pages	215 Pages	108 Pages
50 GHz	---	500 Pages	250 Pages	125 Pages

Sample Report | Cover Page (Kestrel Logo)

TSB-20170311-005

Location: Toronto

Paul D Turner, TSS TSI
2017-03-25

CONFIDENTIAL

Sample Report | Cover Page (Custom Logo 1)

PROFESSIONAL DEVELOPMENT TSCM GROUP

TSB-20110621-001-RC3

Location: Four Seasons Hotel

Paul D Turner, TSS TSI

2011-06-22

CONFIDENTIAL

SRG | Cover Page | v1.38xx

Sample Report | Cover Page (Custom Logo 2)

TSB-20110614-001-RC3

Location: Toronto

Paul D Turner, TSS TSI

2011-08-23

Secret

SRG | Cover Page | v1.38xx

Sample Report | Executive Summary

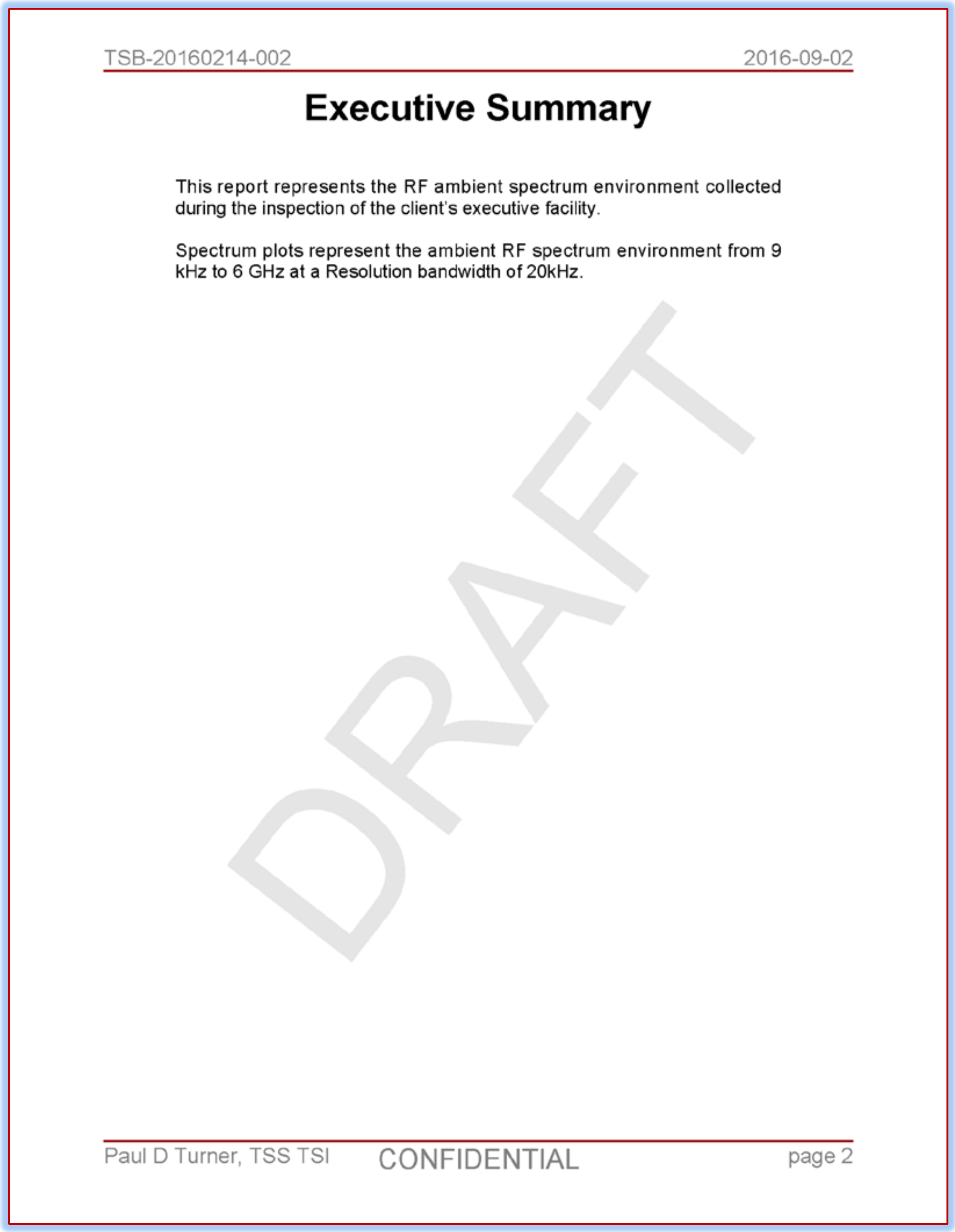
TSB-20110614-001-RC3 2011-08-23

Executive Summary

The attached Technical Surveillance Countermeasures (TSCM) inspection report was generated utilizing the Kestrel TSCM Professional Software - Signal Intelligence Support System (SISS). No hostile signals were detected or otherwise identified in relation to the inspected target area of the client's facility. All detected signals were reviewed by our Technical Security Specialist (TSS) and confirmed as friendly. Several Signals of Interest (SOI) were detected and identified as authorized client controlled communication devices. Our office conducted a limited physical inspection of the adjacent rooms, dropped ceiling areas and areas above and below the immediate target area.

Paul D Turner, TSS TSI Protected "B" page 2

Sample Report | Executive Summary



TSB-20160214-002 2016-09-02

Executive Summary

This report represents the RF ambient spectrum environment collected during the inspection of the client's executive facility.

Spectrum plots represent the ambient RF spectrum environment from 9 kHz to 6 GHz at a Resolution bandwidth of 20kHz.

DRAFT

Paul D Turner, TSS TSI CONFIDENTIAL page 2

SRG | Executive Summary + Watermark | v1.38xx

Sample Report | Recommendations

TSB-20160214-002 2016-09-02

Recommendations

It is recommended that the client replace the analog wireless microphone located in the main boardroom with an digitally encrypted system.

Paul D Turner, TSS TSI CONFIDENTIAL page 3

SRG | Recommendations | v1.38xx

Sample Report | Project Data

TSB-20120401-001 2012-04-01

Project Data

Project Name: TSB-20120401-001
Location: Burlington
Technical Operator: Paul D Turner, TSS TSI
Start Date / Time: 2012-04-01 22:13:48 (UTC-4)
End Date / Time: 2012-04-01 22:23:48
Duration of collection: 00:10:00

Antenna Locations

Boardroom (43.3697N, 79.7644W)

Spectral Bands

VHF FM (87.50MHz-108.0MHz)

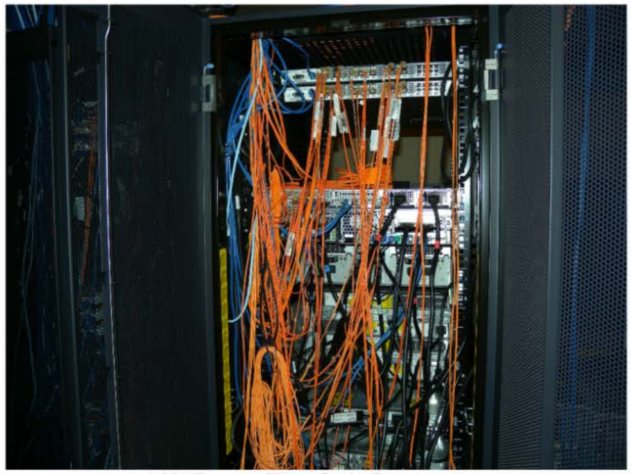
Paul D Turner, TSS TSI CONFIDENTIAL page 3

Sample Report | Image Import (By Location)

TSB-20130314-003 2013-03-15

Locations

Level 2



LAN Room - Fiber-Optic Demarcation

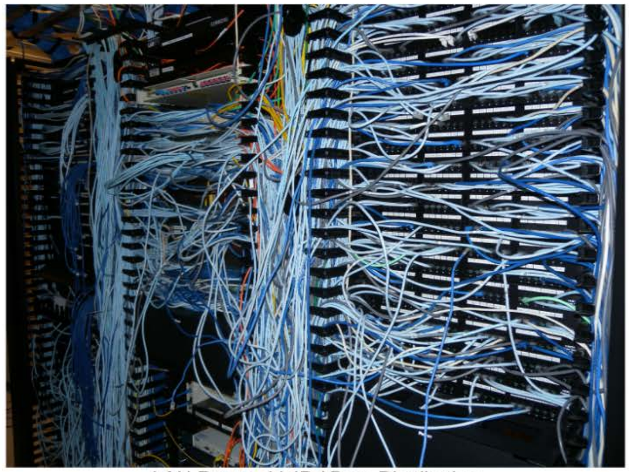
Paul D Turner, TSS TSI CONFIDENTIAL page 4

SRG | Image Import (Assign to Location) | v1.38xx

Sample Report | Image Import (Project)

TSB-20130314-003 2013-03-15

Project images



LAN Room - VoIP / Data Distribution

Paul D Turner, TSS TSI CONFIDENTIAL page 5

SRG | Image Import (Assign to Project) | v1.38xx

Sample Report | CTM | HST Data

TSB-20120315-002 2012-03-17

CTM Data

ID: 58
Frequency: 433.7814MHz
Detected: 2012-03-15 12:02:31
Location: Level 2A

Type: CTM
Mod: FM(50KHz)
Rel: -
Level: -112.9dBm
dBc: -
dBANF: -30.2dB
Chirp: 24%

ID: 62
Frequency: 867.5856MHz
Detected: 2012-03-15 12:02:31
Location: Level 2A

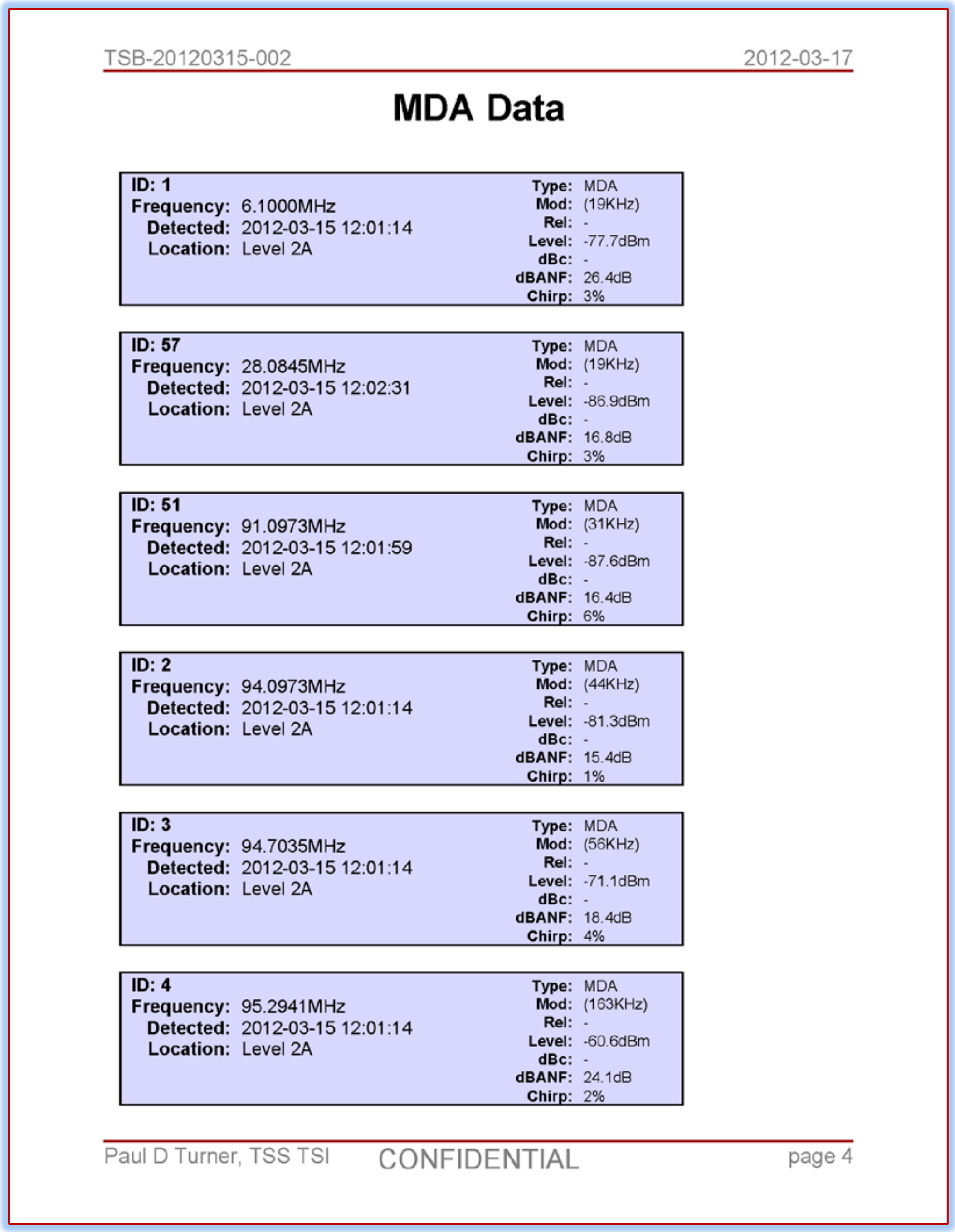
Type: HST
Mod: AM(125KHz)
Rel: (H2 of 58)
Level: -43.8dBm
dBc: 69.2dB
dBANF: 39.5dB
Chirp: 43%

ID: 63
Frequency: 1.3014GHz
Detected: 2012-03-15 12:02:31
Location: Level 2A

Type: HST
Mod: FM(100KHz)
Rel: (H3 of 58)
Level: -44.0dBm
dBc: 68.9dB
dBANF: 49.6dB
Chirp: 36%

Paul D Turner, TSS TSI CONFIDENTIAL page 3

Sample Report | MDA Data



MDA Data

ID: 1
Frequency: 6.1000MHz
Detected: 2012-03-15 12:01:14
Location: Level 2A
Type: MDA
Mod: (19KHz)
Rel: -
Level: -77.7dBm
dBc: -
dBANF: 26.4dB
Chirp: 3%

ID: 57
Frequency: 28.0845MHz
Detected: 2012-03-15 12:02:31
Location: Level 2A
Type: MDA
Mod: (19KHz)
Rel: -
Level: -86.9dBm
dBc: -
dBANF: 16.8dB
Chirp: 3%

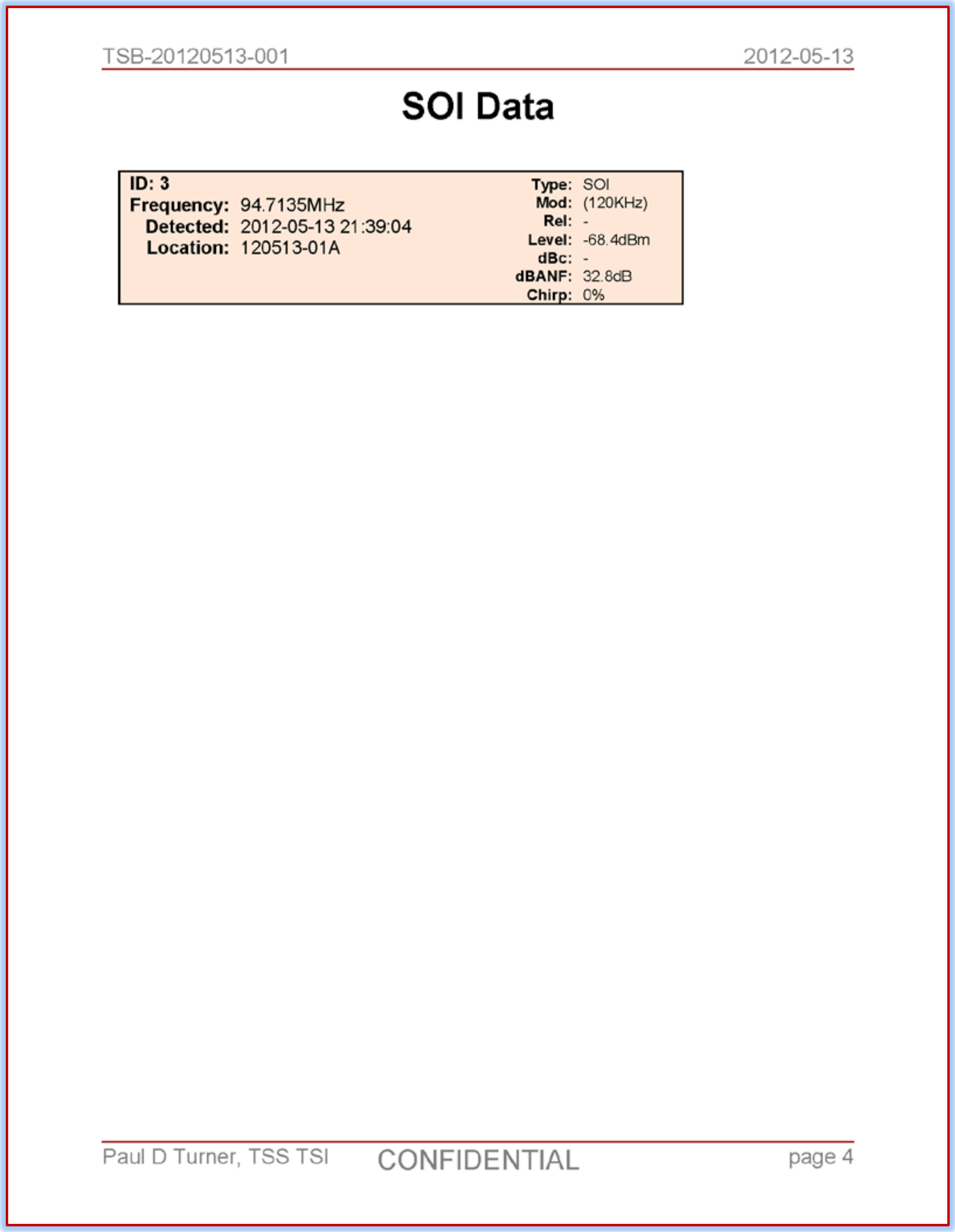
ID: 51
Frequency: 91.0973MHz
Detected: 2012-03-15 12:01:59
Location: Level 2A
Type: MDA
Mod: (31KHz)
Rel: -
Level: -87.6dBm
dBc: -
dBANF: 16.4dB
Chirp: 6%

ID: 2
Frequency: 94.0973MHz
Detected: 2012-03-15 12:01:14
Location: Level 2A
Type: MDA
Mod: (44KHz)
Rel: -
Level: -81.3dBm
dBc: -
dBANF: 15.4dB
Chirp: 1%

ID: 3
Frequency: 94.7035MHz
Detected: 2012-03-15 12:01:14
Location: Level 2A
Type: MDA
Mod: (56KHz)
Rel: -
Level: -71.1dBm
dBc: -
dBANF: 18.4dB
Chirp: 4%

ID: 4
Frequency: 95.2941MHz
Detected: 2012-03-15 12:01:14
Location: Level 2A
Type: MDA
Mod: (163KHz)
Rel: -
Level: -60.6dBm
dBc: -
dBANF: 24.1dB
Chirp: 2%

Sample Report | SOI Data



TSB-20120513-001 2012-05-13

SOI Data

ID: 3		**Type:**	SOI
Frequency:	94.7135MHz	**Mod:**	(120KHz)
Detected:	2012-05-13 21:39:04	**Rel:**	-
Location:	120513-01A	**Level:**	-68.4dBm
		dBc:	-
		dBANF:	32.8dB
		Chirp:	0%

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Sample Report | Operator “Ignored” Data

TSB-20120513-001 2012-05-13

Operator ‘Ignored’ Data

ID: 8		**Type:**	SOI
Frequency:	94.0863MHz	**Mod:**	(124KHz)
Detected:	2012-05-13 21:45:21	**Rel:**	-
Location:	120513-01A	**Level:**	-77.9dBm
		dBc:	-
		dBANF:	26.1dB
		Chirp:	0%

ID: 7		**Type:**	SOI
Frequency:	96.3027MHz	**Mod:**	(135KHz)
Detected:	2012-05-13 21:45:11	**Rel:**	-
Location:	120513-01A	**Level:**	-79.0dBm
		dBc:	-
		dBANF:	25.8dB
		Chirp:	0%

ID: 9		**Type:**	SOI
Frequency:	97.3178MHz	**Mod:**	(113KHz)
Detected:	2012-05-13 21:45:26	**Rel:**	-
Location:	120513-01A	**Level:**	-89.0dBm
		dBc:	-
		dBANF:	15.0dB
		Chirp:	0%

ID: 10		**Type:**	SOI
Frequency:	98.1215MHz	**Mod:**	(164KHz)
Detected:	2012-05-13 21:45:31	**Rel:**	-
Location:	120513-01A	**Level:**	-75.6dBm
		dBc:	-
		dBANF:	26.9dB
		Chirp:	0%

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Sample Report | SBL Data

TSB-2011-621-001-RC3 2011-06-21

Spectrum Baseline Data

ID: 1
Frequency: 53.1261KHz
Detected: 2011-06-21 11:57:41
Location: Suite 3112

Type: SBL
Mod: (106KHz)
Rel: -
Level: 101.1dBm
dBc: -
dBANF: 192.4dB
Chirp: 0%

ID: 3
Frequency: 1.3125MHz
Detected: 2011-06-21 11:57:41
Location: Suite 3112

Type: SBL
Mod: (25KHz)
Rel: -
Level: -68.2dBm
dBc: -
dBANF: 30.4dB
Chirp: 0%

ID: 195
Frequency: 1.5031MHz
Detected: 2011-06-21 11:58:01
Location: Suite 3112

Type: SBL
Mod: (44KHz)
Rel: -
Level: -70.8dBm
dBc: -
dBANF: 28.0dB
Chirp: 0%

ID: 4
Frequency: 3.6938MHz
Detected: 2011-06-21 11:57:41
Location: Suite 3112

Type: SBL
Mod: (25KHz)
Rel: -
Level: -73.9dBm
dBc: -
dBANF: 25.4dB
Chirp: 0%

ID: 5
Frequency: 5.1125MHz
Detected: 2011-06-21 11:57:41
Location: Suite 3112

Type: SBL
Mod: (25KHz)
Rel: -
Level: -67.9dBm
dBc: -
dBANF: 32.2dB
Chirp: 0%

ID: 6
Frequency: 6.0938MHz
Detected: 2011-06-21 11:57:41
Location: Suite 3112

Type: SBL
Mod: (88KHz)
Rel: -
Level: -67.1dBm
dBc: -
dBANF: 33.5dB
Chirp: 0%

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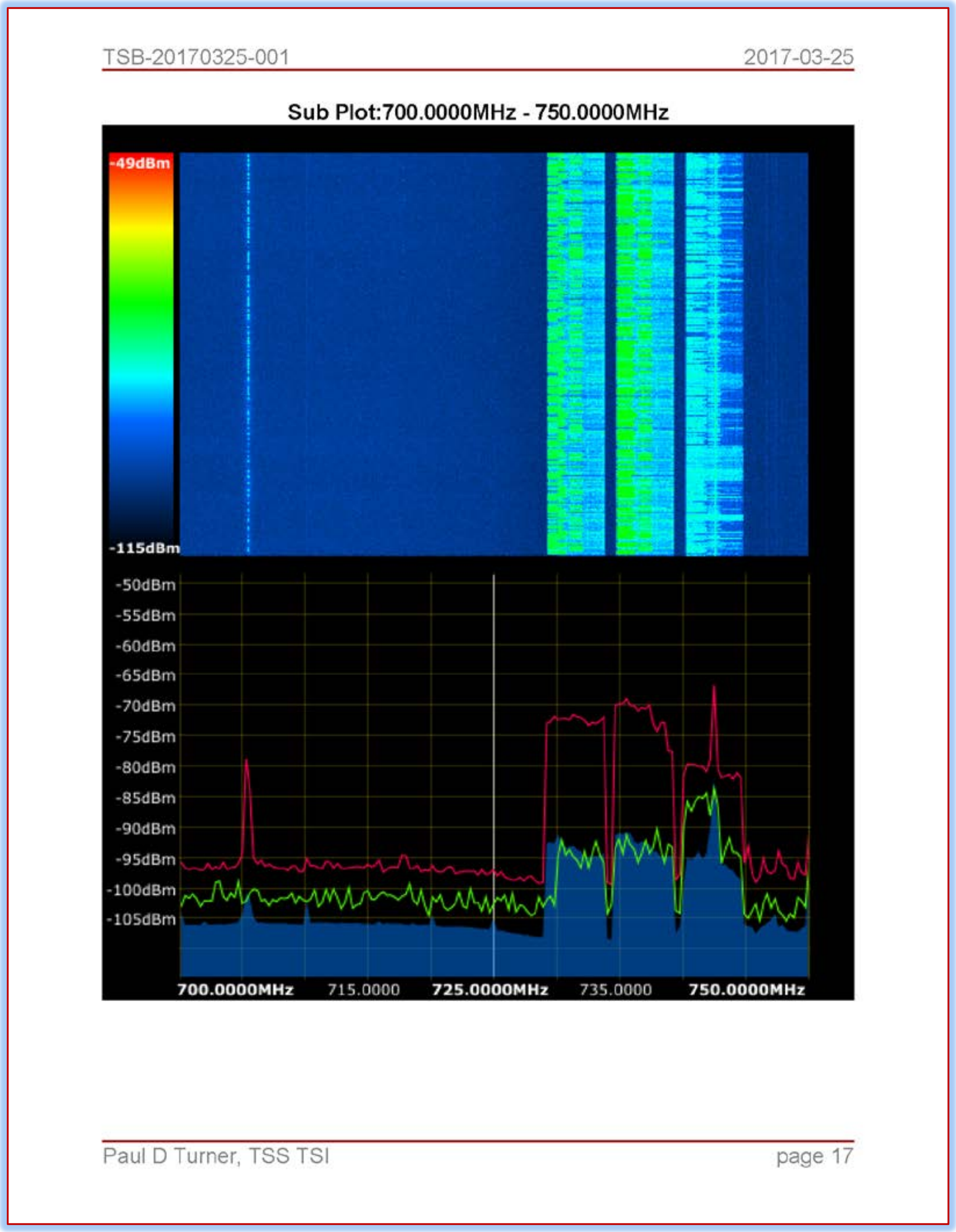
Sample (1 Up) | Spectrum | Waterfall Plot


TSB-20170325-001 2017-03-25

Sub Plot:700.0000MHz - 750.0000MHz

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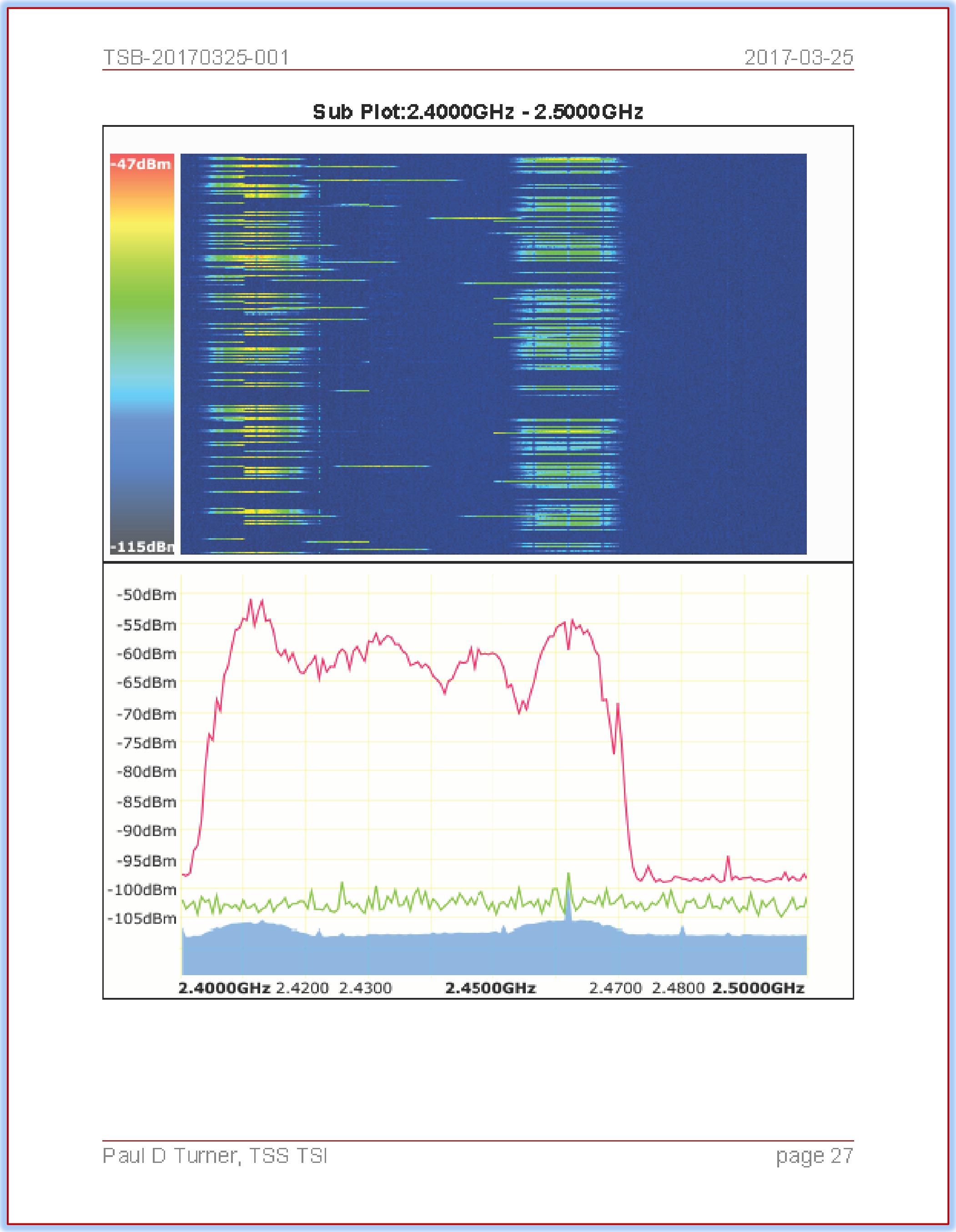
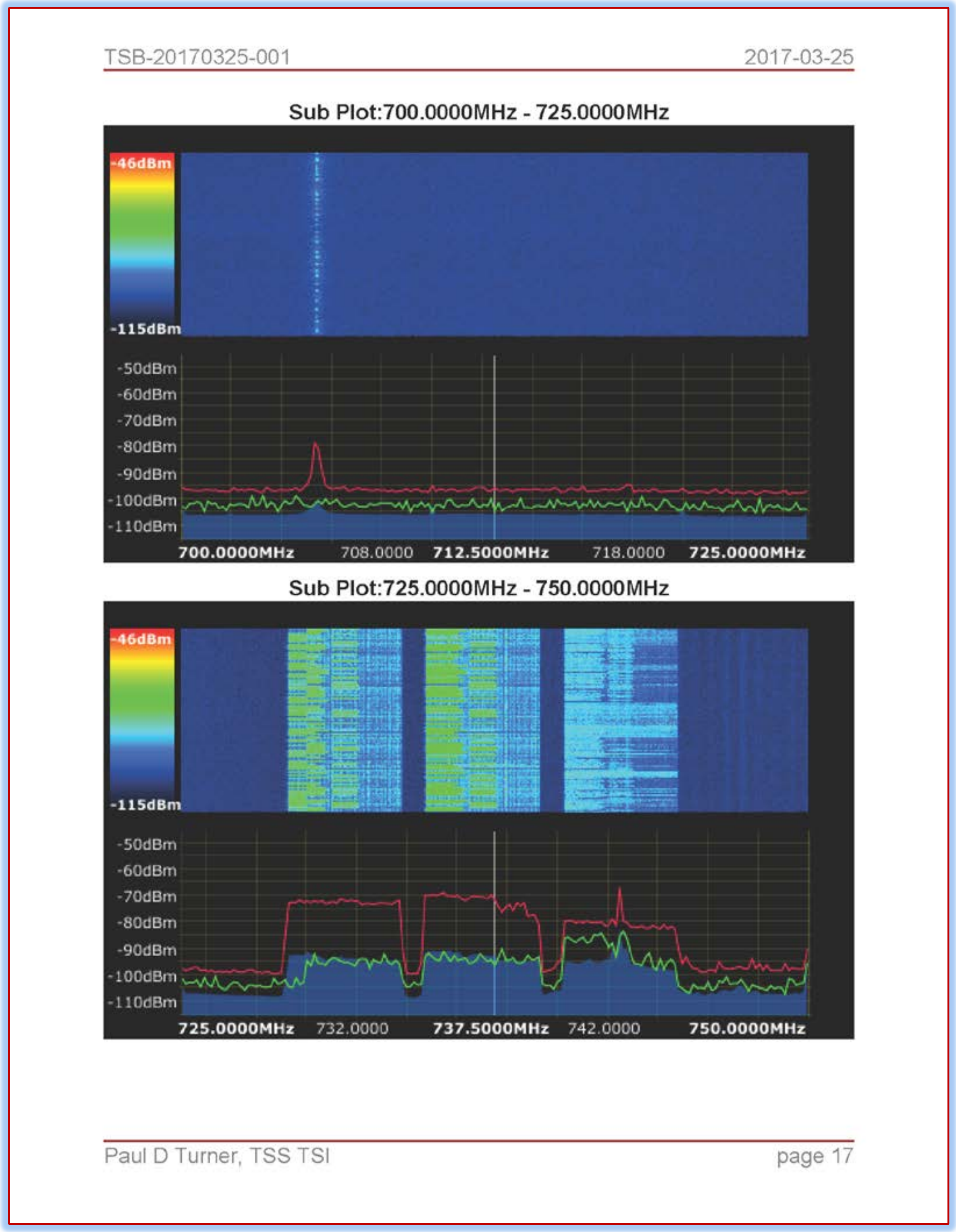
Spectral Image Control | 1 UP (Dark Background) | Spectrum + Waterfall | v1.38xx

Sample (1 Up) | Spectrum | Waterfall Plot



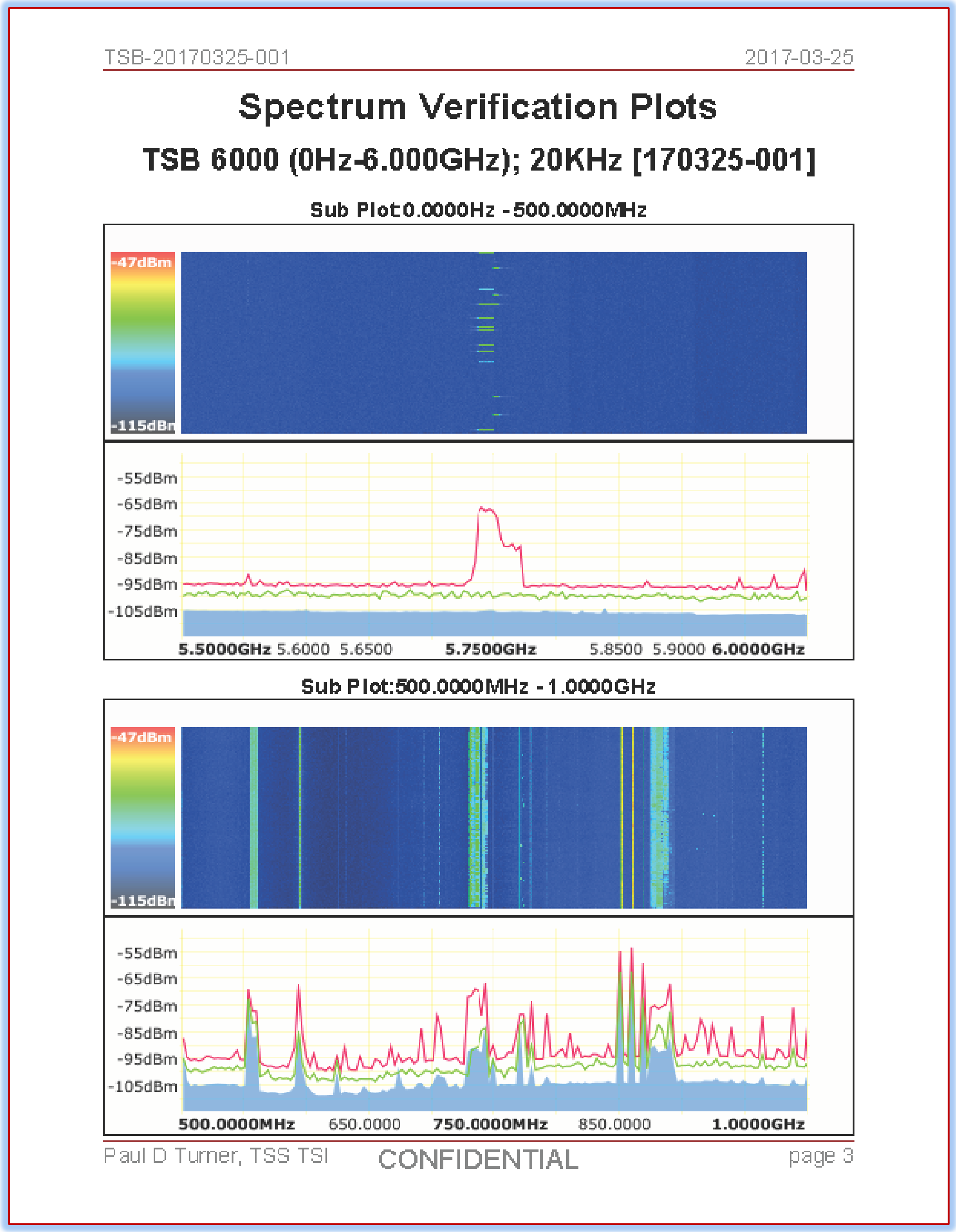
Spectral Image Control | 1 UP (Light Background) | Spectrum + Waterfall | v1.38xx

Sample (2 Up) | Spectrum | Waterfall Plot



Spectral Image Control | 2 UP (Dark Background) | Spectrum + Waterfall | v1.38xx

Sample (2 Up) | Spectrum | Waterfall Plot


TSB-20170325-001 2017-03-25

Spectrum Verification Plots

TSB 6000 (0Hz-6.000GHz); 20KHz [170325-001]

Sub Plot0.0000Hz -500.0000MHz

Sub Plot:500.0000MHz - 1.0000GHz

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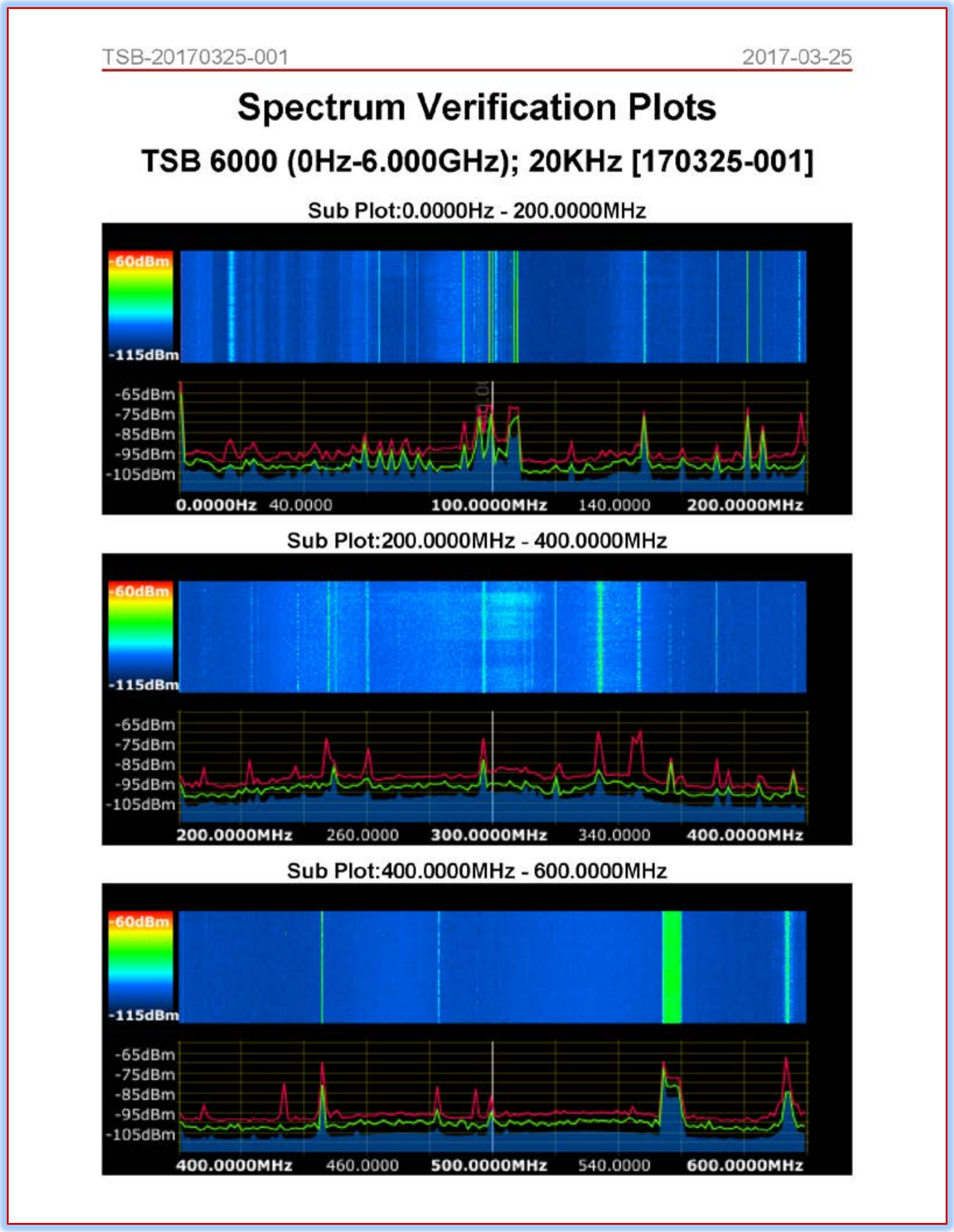
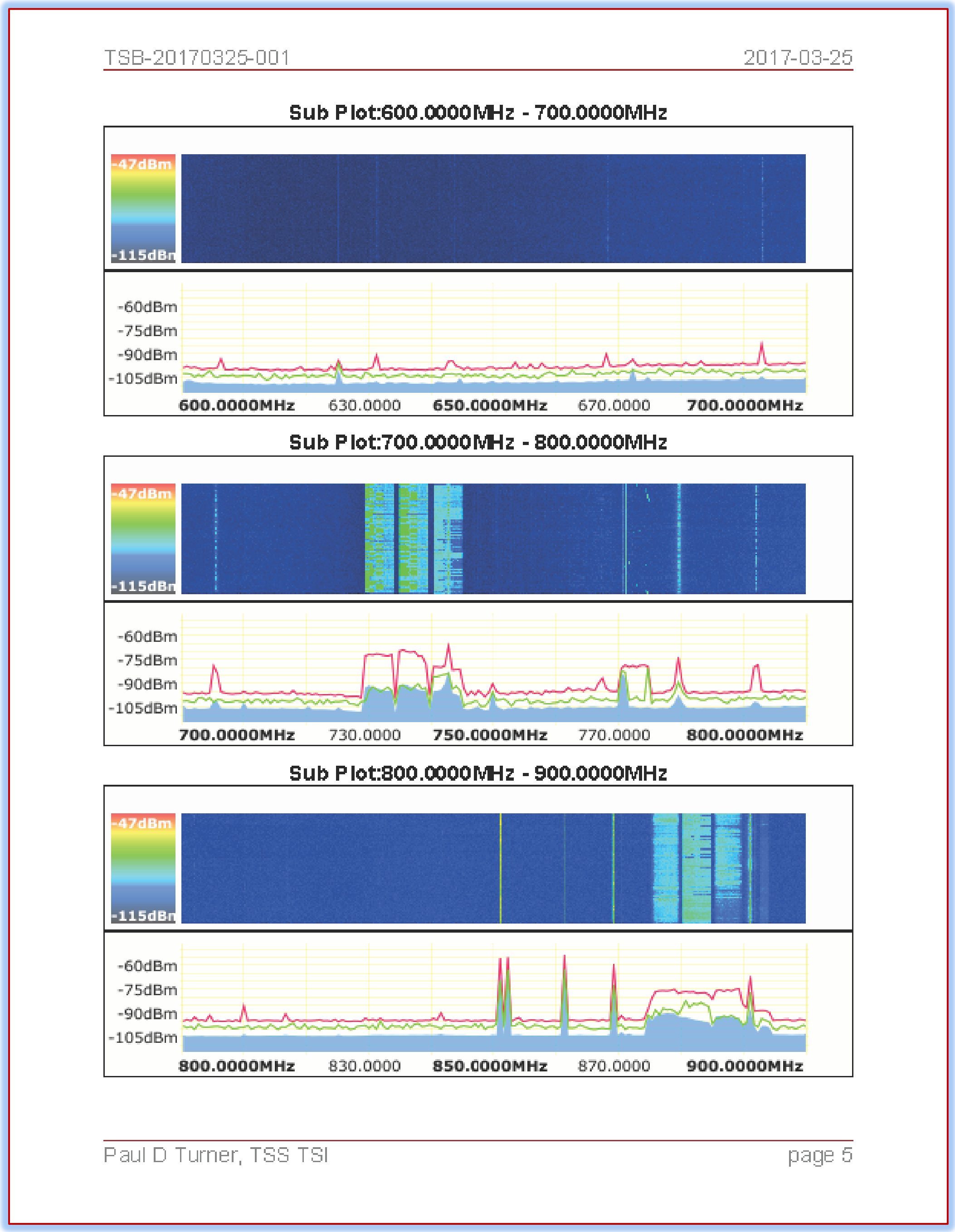
Spectral Image Control | 2 UP (Light Background) | Spectrum + Waterfall | v1.38xx

Sample (3 Up) | Spectrum | Waterfall Plot



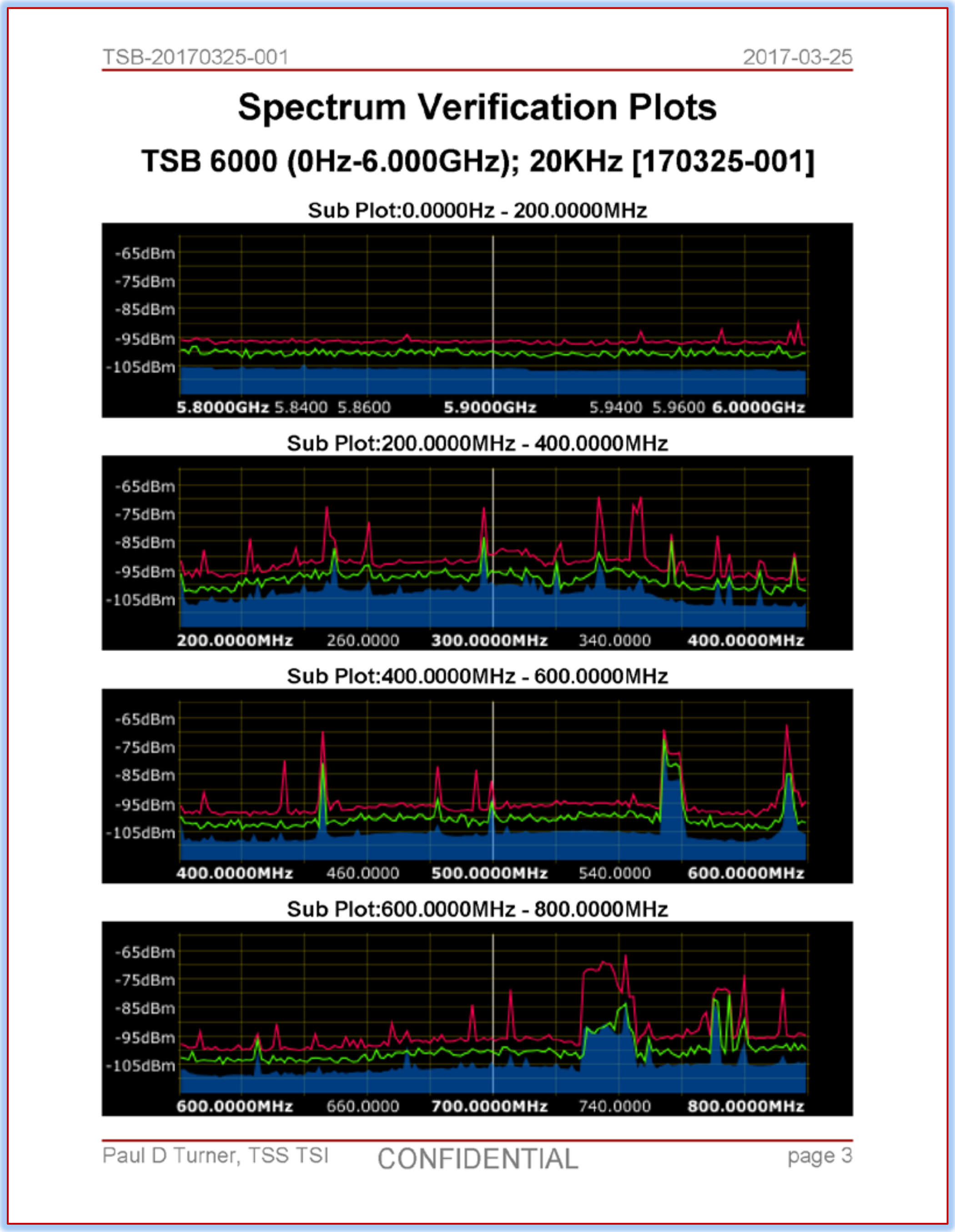
Spectral Image Control | 3 UP (Dark Background) | Spectrum + Waterfall | v1.38xx

Sample (3 Up) | Spectrum | Waterfall Plot



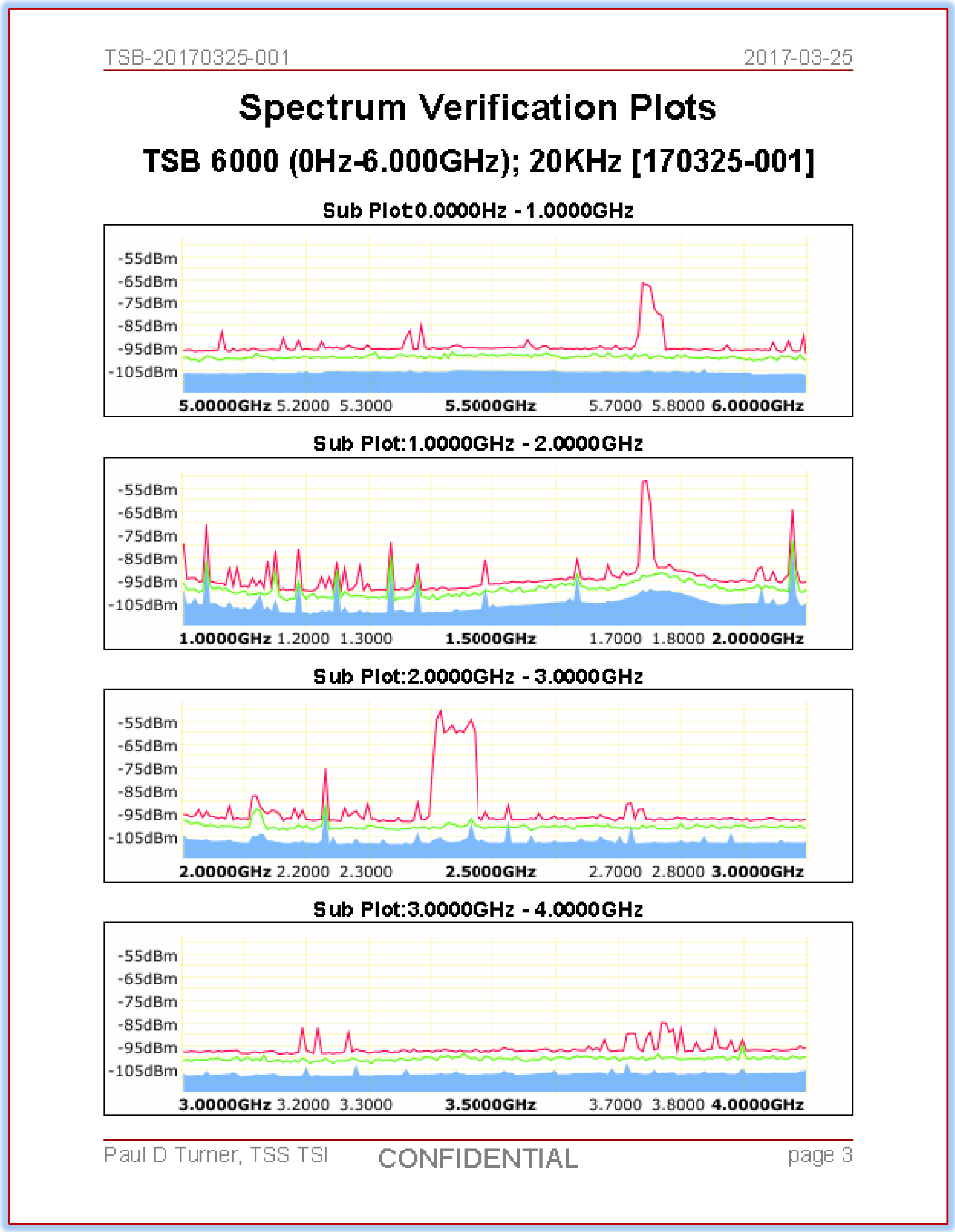
Spectral Image Control | 3 UP (Light Background) | Spectrum + Waterfall | v1.38xx

Sample (4 Up) | Spectrum Plot



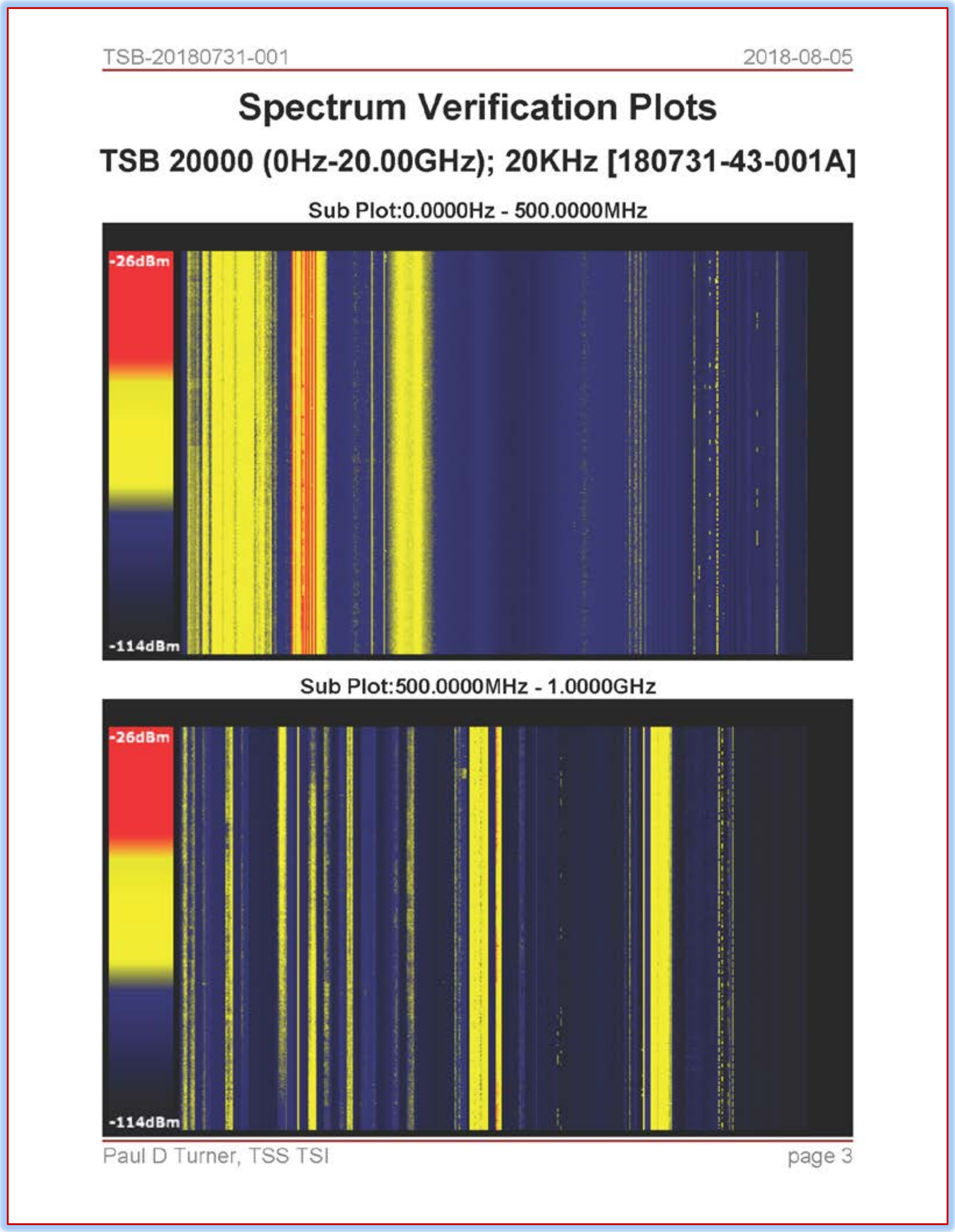
Spectral Image Control | 4 UP (Dark Background) | Spectrum + Waterfall | v1.38xx

Sample (4 Up) | Spectrum Plot



Spectral Image Control | 4 UP (Light Background) | Spectrum + Waterfall | v1.38xx

Sample (2 Up) | Waterfall Only Plot



TSB-20180731-001 2018-08-05

Spectrum Verification Plots

TSB 20000 (0Hz-20.00GHz); 20KHz [180731-43-001A]

Sub Plot:0.0000Hz - 500.0000MHz

Sub Plot:500.0000MHz - 1.0000GHz

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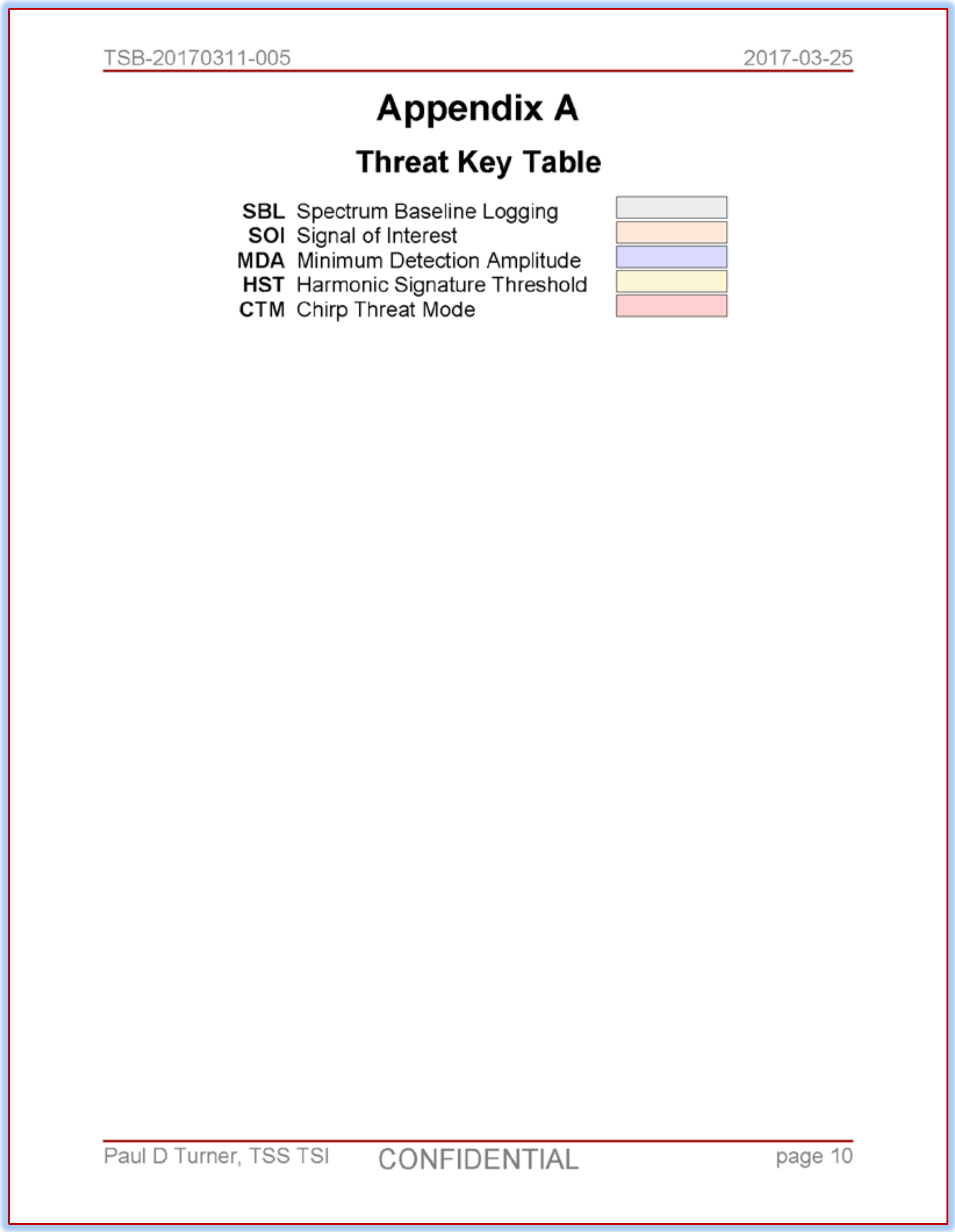
Spectral Image Control | 2 UP (Dark Background) | Waterfall Only | v1.38xx

Sample Report | Appendix A



TSB-20170311-005 2017-03-25

Appendix A

Threat Key Table

SBL	Spectrum Baseline Logging	
SOI	Signal of Interest	
MDA	Minimum Detection Amplitude	
HST	Harmonic Signature Threshold	
CTM	Chirp Threat Mode	

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SRG | Threat Key Table | Appendix A | v1.38xx

Sample Report | Appendix B

Appendix B

DSA Key Table

170311-17-001A
170311-17-004A
170311-17-005A
170311-17-006A
170311-17-007A
170311-17-010A

Report Formats | Recommended Rendering

One of the key features of the Kestrel TSCM ® Professional Software is the ability to generate any number, and type variations, of graphical reporting elements, as formatted PDF attachments.

There are a number of uniquely formatted report styles that can serve as an independent standalone report, or form part of a series of SRG output files that provide and assist the technical operator, in the analysis of captured historical spectra, and permits multiple levels of end-user client documentation, with powerful visual data rendering, referred to as Kestrel Signal Analytics (KSA) ™.

The ability to format displayed spectra, from the | Spectrum Display and Activity | control group, before creating a functional report utilizing the | Session Report Generator (SRG) ™ |, is fully supported.

The most common report styles, as described within the TSB 2000 (Technical) Standard allow the technical operator to filter and define the reporting structure, to be able to present meaningful data rendering of complex | Waterfall Display (WFD) |and associated Spectra at the trace level, graphically.

The current ability to automatically format and generate a standard PDF formatted file structure, provides the means to create technical data, to be included with the main inspection report, in an electronic format.

TIP: Due to the large number of output pages possible, printing reports is not recommended. If reports must be printed, we recommend programming wider bandwidth plots and selecting multiple plots per page, to effectively reduce the number of pages that must be printed. The | Session Report Generator (SRG) | provides the means to control the complexity, simplicity, or the detail to be included within the report. Multiple versions of the same report can be generated depending on the target audience (technical and non-technical).

The following report types are examples to illustrate just a few of the possible reporting formats, that can significantly enhance the reader’s ability to understand the scope of the technical findings, and bring meaning and clarity, to the technical operator’s observations, relating to the ambient RF spectrum environment.

The technical operator can customize any of the structured formats by first setting up the user-interface to represent the style and look of the SRG output.

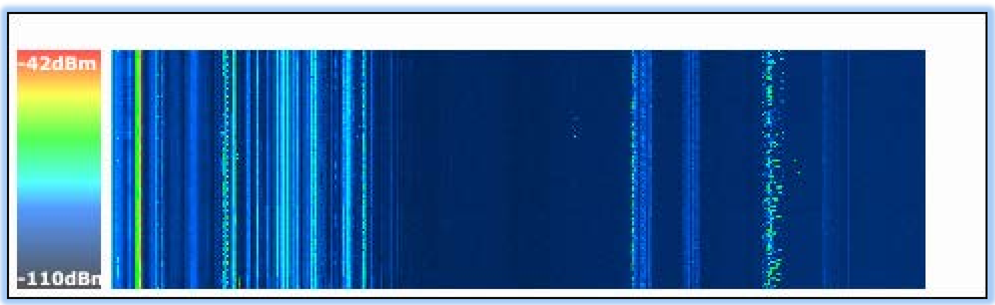
It is essential to note that whatever the current user-interface is displaying, will be what the | SRG | will output.

TIP: In the event that the technical operator has collected trace level data at multiple | LDSA ™ | antenna locations, the operator must set the spectrum "view" the same for each defined location. The Spectrum Display and Activity control group is not a global feature, and controls only the currently displayed location.

The following examples highlight some of the possible analytical report styles that can be defined by the technical operator. The SRG ™ allows a title to be produced fro the following plot rendering styles.

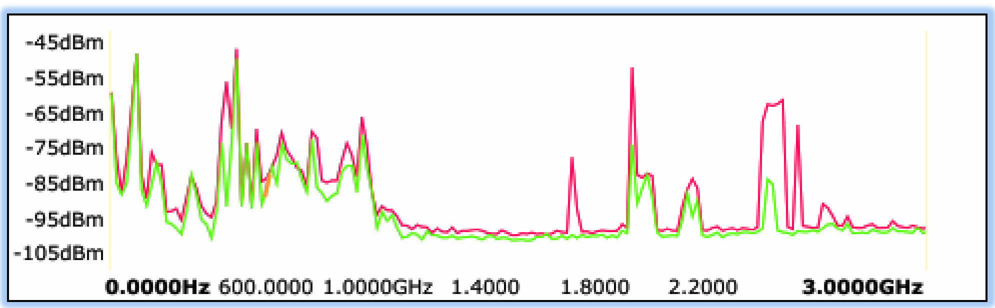
01 | RTE Vs PEC

The graphical display of the | Real-Time Event (RTE) | trace (lines) Vs the | Peak Envelope Capture (PEC) | trace (lines) is a simple spectra plot that provides a clear picture of all captured activity, as represented within the | PEC | trace.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected | DSA | collection location.



SRG | RTE (Green) Vs PEC (Red) | v1.38xx

Even a single spectral event in time, will be captured and displayed within the | PEC | trace, as an indicator of a historical signal event.

The | RTE | trace data represents the spectra at a given point in time, and it the case of the | SRG | output, represents the Spectra, based on the last | RTE | trace update.

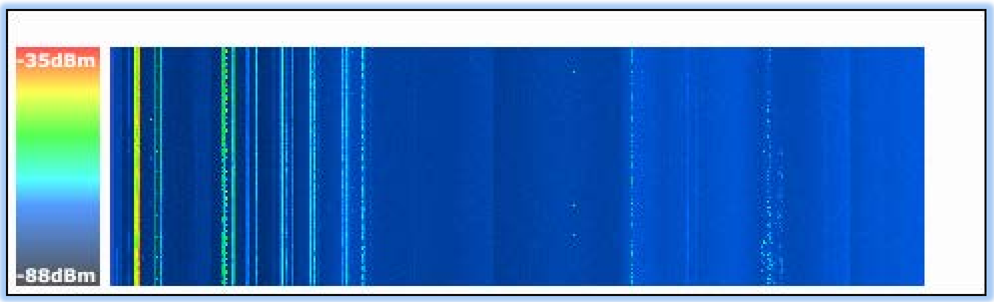
The technical operator can include the | SAT | plot (fill) as a variation to the | RTE Vs PEC | format.

For example, adding the | SAT | plot (fill) provides yet another dimension to the analytical reporting process.

The technical operator can determine the best reporting elements to include within the | SRG | output.

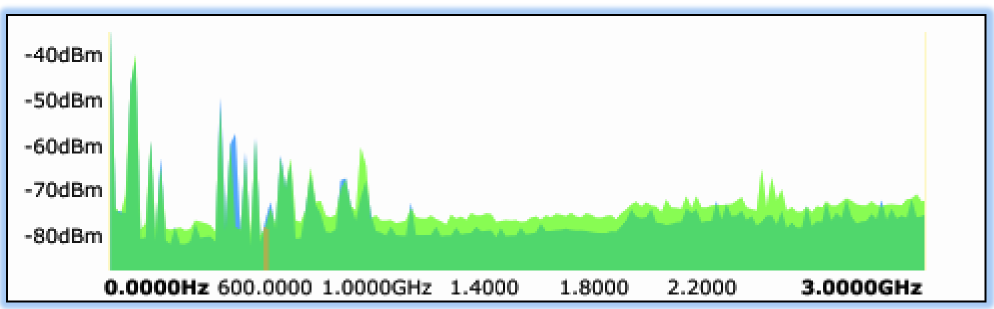
RTE Vs SAT

The | Real-Time Event (RTE) | trace (fill) Vs the | Spectrum Average Trace (SAT) | plot (fill) also provides the means to quickly assess the nature of the ambient spectrum environment by referencing the last trace update, against the | Spectrum Averaging Trace (SAT) | over time.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected | DSA | collection location.



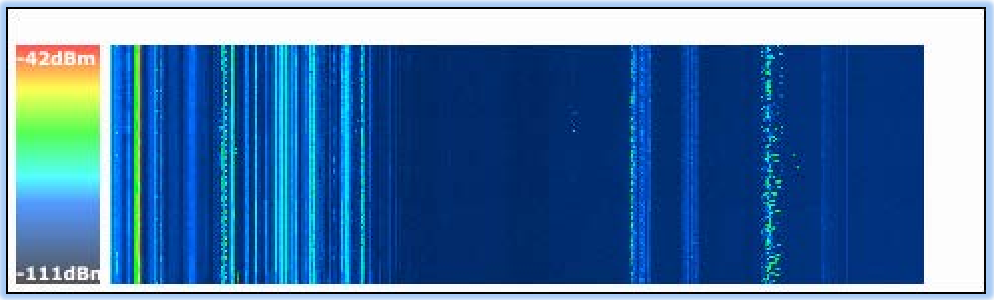
SRG | RTE (Green) Vs SAT (Red) | v1.38xx

The darker green (fill) represents the | RTE | trace and the lighter green (fill) represents the | SAT | plot overlap area with the | RTE | trace.

The blue represents the | SAT | plot in areas of the spectrum where no overlap exists and the (orange) bar represents a Signal of Interest (SOI) added by the operator.

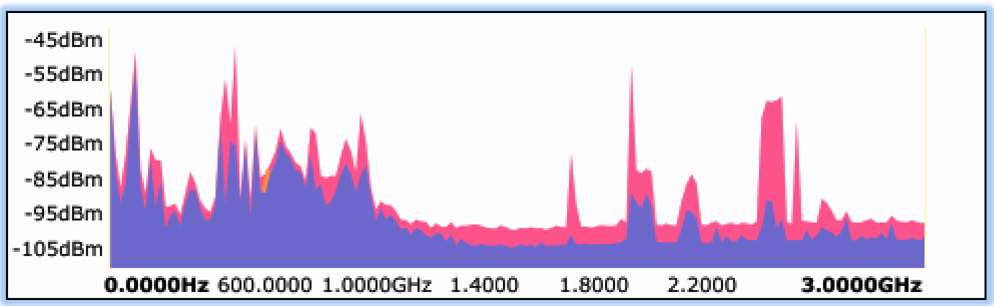
02 |PEC Vs SAT

The graphical display of the | Peak Envelope Capture (PEC) | trace (fill) Vs the | Spectrum Average Trace (SAT) | plot (fill), displays the distributed energy patterns across the spectrum, over a period of time, at the band or channel level.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected | DSA | collection location.

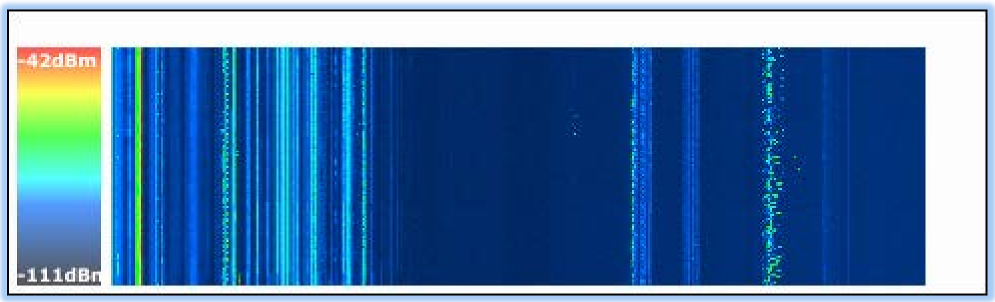


SRG PEC (Red) Vs SAT (Blue) | v1.38xx

The | PEC | trace represents all captured peak data, and the | SAT | plot provides information as to the continuous or periodic nature of energy at any given frequency or band.

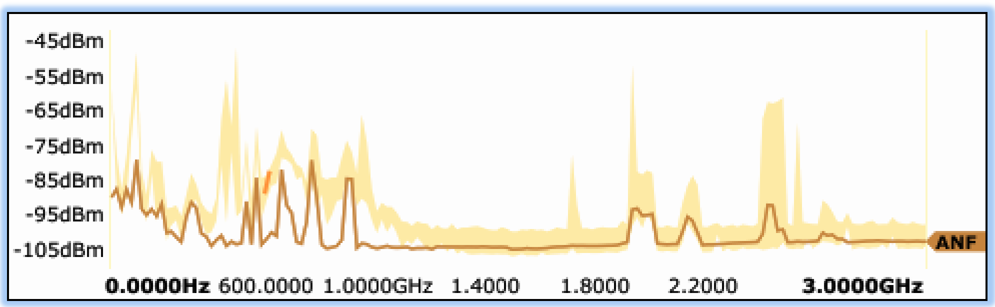
03 | MIN-MAX REF vs ANF

The | Ambient Noise Floor (ANF) | can be useful in determining the | Probability of Detection (POD) |, or perhaps better described as determining the ability to see and detect a Signal of Interest (SOI) within the confines of the spectrum environment, for signal events that are perhaps at / or near, or even within the noise floor by identifying regions of the spectrum that are exhibiting a high ambient noise floor.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected collection location.



SRG | MIN-MAX (Profile) Vs ANF | v1.38xx

Generating a report profile that displays the | MIN-MAX REF (Profile) | Vs the | Ambient Noise Floor (ANF) | provides the technical operator with valuable insight as to the distributed energy patterns over time and provides a visual understanding of the actual | ANF | across the entire Range of Interest (ROI) or at the band level.

The | MIN-MAX REF | trace is captured over-time during runtime and produces a snapshot image of all occurring spectral activity. The | ANF | trace provides a snap-shot of the regions of the spectrum where signal (or noise) activity is of a continuous or relatively consistent presence.

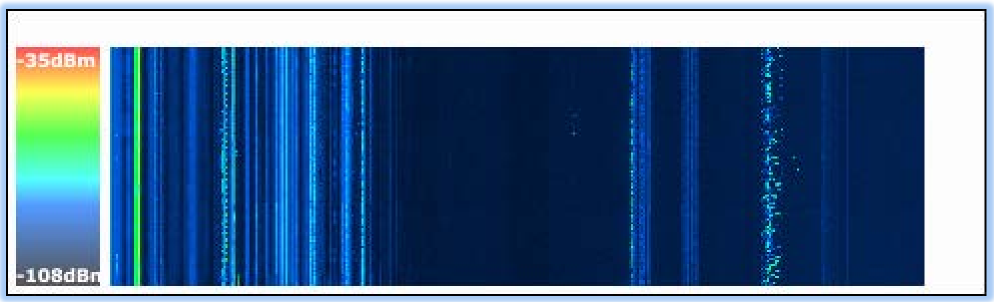
04 | LDSA vs LOC

The ability to display spectrum trace data captured at different locations within the same facility, across different locations, dates and times, and / or geographic locations is fully supported.

A key feature within the Kestrel TSCM ® Professional Software, is | Differential Signal Analysis (DSA) |, described as a very powerful technique dating back to the 1960's, with the advent of trace math capability on analog spectrum analyzers.

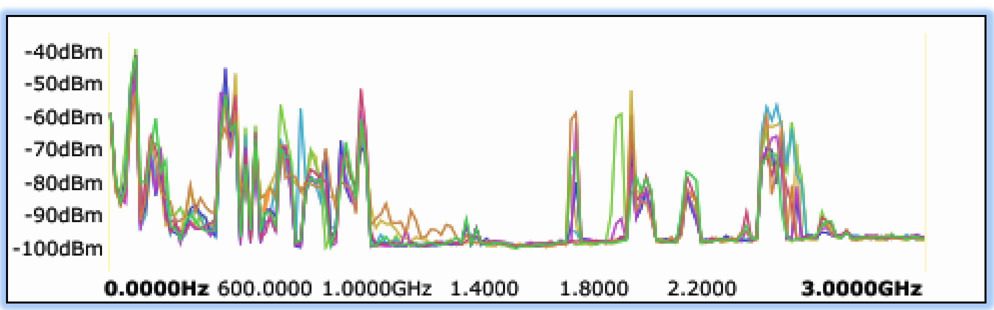
The technique was pioneered and widely utilized by the military in the 1070's and 1980's.

Advances in Software Defined Radio (SDR), have made it possible to develop much more sophisticated implementations of the methodology, however, it must be understood that modern power and frequency agile surveillance devices can easily evade historical location-based analytics.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected | DSA | collection location.



SRG | Differential Signal Analysis (DSA) | v1.38xx

See Chapter 12

Differential Signal Analysis (DSA)

The ability to overlay Spectra using different colours to represent unique trace level data from any number of locations from the same, or different locations, and from the same or different dates, for direct comparative analysis.

Unique, periodic and continuous signal events are easily identified at the band or channel level.

However, the DSA ™ feature alone does not provide the total picture, as required in today's modern moving target threat model, and complex spectrum environment.

The Kestrel TSCM ® Professional Software includes a new and powerful feature referred to as | Time Differential Signal Analysis (TDSA) ™ |.

The |TDSA ™ | feature allows operator defined time block analysis at a single DSA antenna location, with | DSA | style rendering, in either a runtime, real-time collection environment, or during operator assisted, post analysis and analytical review.

The | TDSA | feature provides a powerful analytical tool during | Remote Spectrum Surveillance and Monitoring (RSSM) ™ | assignments.

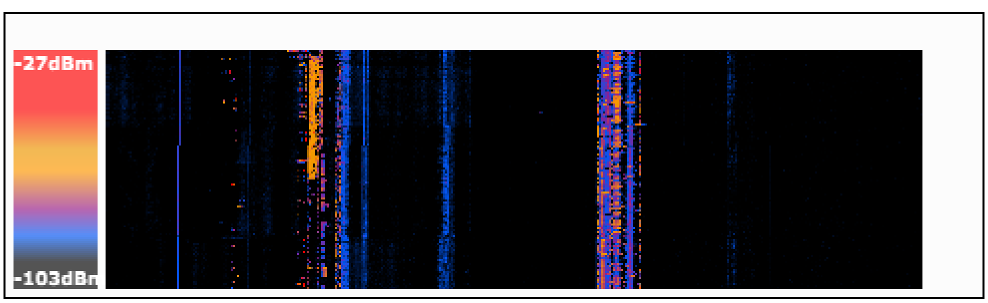
05 | TDSA vs TIME

The | TDSA | feature provides a powerful analytical tool during | Remote Spectrum Surveillance and Monitoring (RSSM) TM | assignments as data can be interpreted across a single collection location or any number of multiple collection locations collected under the LDSA methodology.

The advanced capability of | TDSA | to be deployed at a single collection point for an extended period of time permits the technical operator to build a | TIME PERIODIC | analytical review of the total data picture to quickly identify unique and elusive signal events that may be occurring a regular, or randomized times across the entire Range of Interest (ROI) spectrum.

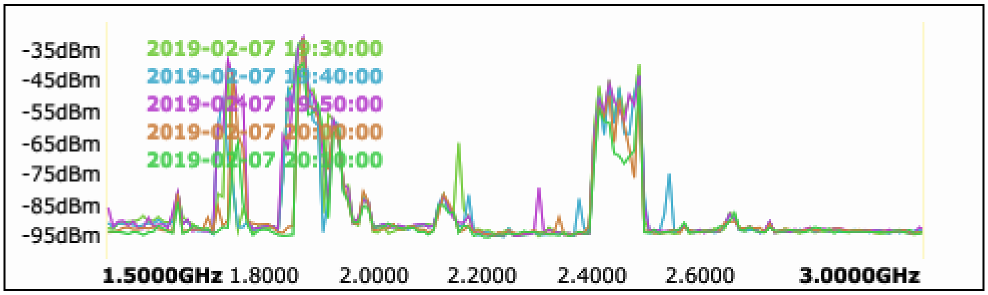
TDSA TM is utilized as a primary RSSM TM technique that provides an operator defined comparative plot based on the | PERIOD | selected.

The following example highlights the benefits of the TDSA TM methodology in quickly identifying Signals of Interest (SOI).



SRG | Waterfall Display | v1.38xx

The waterfall plot indicates the energy patterns over time and can provide some insight as to the presence of periodic signal events. However, it is necessary for the technical operator to review hours, days, weeks, or months of complex data. The | TDSA TM | spectra plot simplifies the task by identifying and isolating uniquely occurring signals.



SRG | Time Signal Analysis (TDSA) | v1.38xx

The TDSA ™ plot provides a | PEAK | trace comparative of the data across a 1.5 GHz ROI with a 10-minute operator defined | PERIOD | and renders a comparative based on the total collection time.

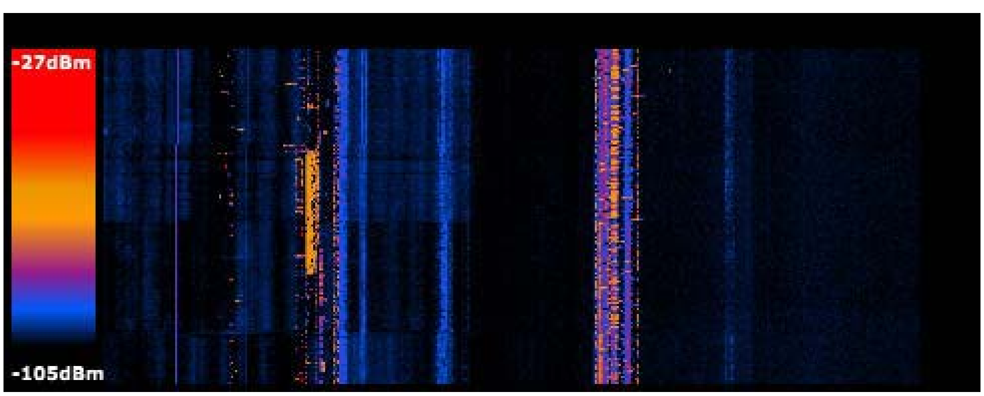
Unique events can be quickly visualized and investigated with minimal effort to determine the nature and characteristics of the event.

The operator has complete control over the TDSA ™ capability and can render and change the parameters during both runtime and post collection analysis and review.

06 | WFD vs TIME

The ability to render a continuous waterfall plot covering the entire Range of Interest (ROI) is supported within the SRG rendering mechanism.

The | WFD PLOT vs TIME | capability is operator defined to allow more or less detail by altering the number of plots per page, and the actual bandwidth of the plots separate and apart for the WFD | SPECTRA plots of other reporting styles.

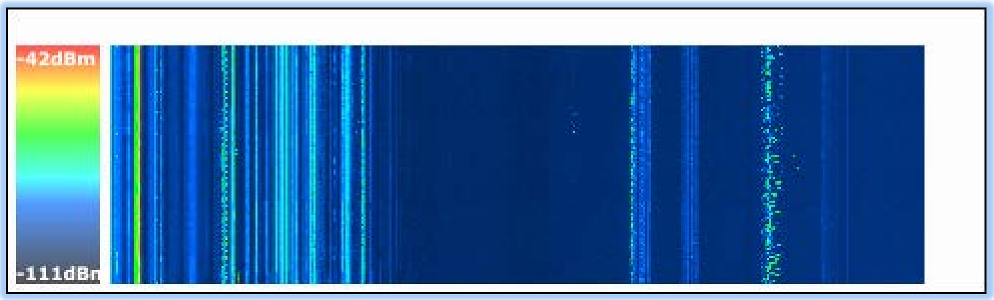


This report style can be utilized to highlight significant events or activity that have occurred at any frequency range or time period within the captured data structure.

Spectrum Characterization

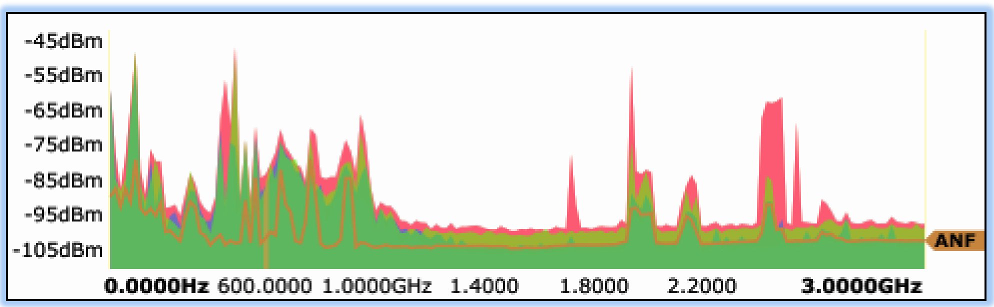
This comprehensive | SRG | rendering plot utilizes the | MIN-MAX | RTE (fill) |PEC (fill) | SAT (fill) | and | ANF | trace level Spectra, providing a total picture of all available trace reference data.

Spectrum characterization is an excellent format for end-user client reports due to the rich graphic content and single all-inclusive rendering.



SRG | Waterfall Display (WFD) | v1.38xx

The | WFD | rendering represents the spectrum based on the currently selected | DSA | collection location.



SRG | Spectrum Characterization | v1.38xx

This style reference plot, provides an all-encompassing picture of captured spectrum properties, by layering all available trace level Spectra, on a single graphical profile.

The ability to control the bandwidth of the plots, and number of plots per page, allows the technical operator the number of pages required within the report.

The TSB 2000 (Technical) Standard ™ requires that technical operators analyze the entire Range of Interest (ROI) at 25 MHz spans (or less), with a minimum upper and lower guard band of 1 MHz.

Utilizing the 2 UP (with WFD) provides an excellent analytical document.

At higher operational threat levels, it is essential to analyze the entire ROI at 10 MHz spans to ensure sufficient spectral detail is available to identify narrow band, low power emissions that may be present at or near the Ambient Noise Floor (ANF).

For client reports that are not necessarily provided for analytical purposes, the operator may comfortably utilize 50 MHz or 100 MHz spans, effectively, reducing the number of pages rendered.

Utilizing the 3 UP (with WFD), or 4 UP (without WFD) significantly reduces the number of pages.

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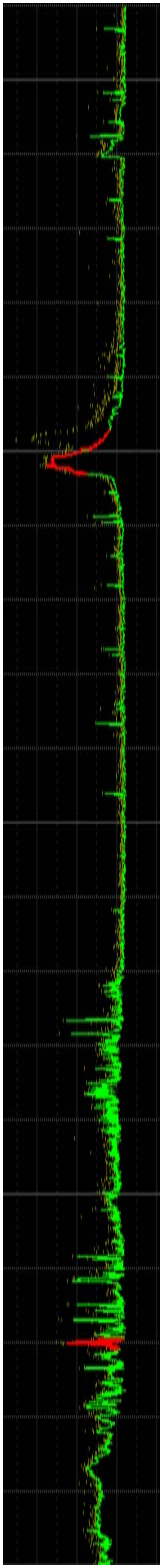
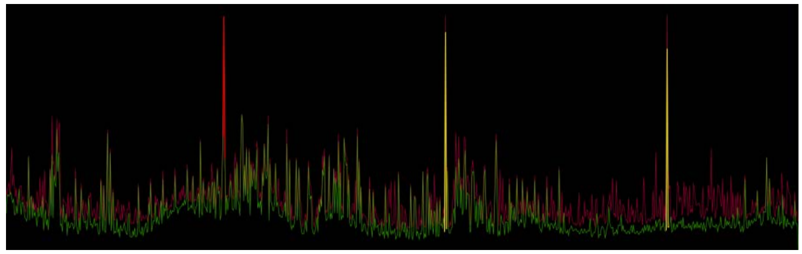


Chapter 18



Advanced Report Generator (ARG)

TM

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Advanced Report Generator (ARG) ™

The ability to generate a comprehensive component-based, operator defined and formatted full written and technical inspection report is an essential capability simply not found in any other TSCM specific software application.

Our existing | Session Report Generator (SRG) ™ | will continue to remain a valuable resource in generating powerfully fast technical attachments in PDF format when required by the technical operator and the new | ARG ™ | will define the future of professional TSCM | SIGINT reports for analytical and evidentiary documentation purposes for many years to come.

Our | Advanced Report Generator (ARG) ™ | has been specifically developed by our Technical Research and Standards Group (TRSG) ™ as the next generation of standards based advanced report management tools for direct implementation within the Kestrel TSCM ® Professional Software.

The | ARG ™ | is a powerful component of our operator centric and workflow-based project management concept; as no technical inspection is deemed to be complete until the captured data has been expertly processed and a | Final Inspection Report (FIR) ™ | as defined by the TSB 2000 (Technical) Standard ™ has been rendered and / or delivered to the end-user.

The | ARG ™ | provides the necessary advanced building blocks far beyond the existing | Session Report Generator (SRG) ™ | capability, so widely regarded by technical operators as the best in the industry.

Generating a separate, yet essential inspection related technical reports is oftentimes one of the most time-consuming elements faced by the technical operator, aside from conducting the actual Scope of Work (SOW) inspection.

The ability to generate a detailed technical report quickly utilizing the existing | Session Report Generator (SRG) ™ | technology during runtime is the original ground-breaking new technology included as a standard feature within the Kestrel TSCM ® Professional Software 10 years ago and remains the most advanced report generator in the industry.

The Kestrel TSCM ® Professional Software has always provided a comprehensive, first in its class, | Session Report Generator (SRG) ™ | as a standard included feature from the beginning of the development process recognizing the importance and necessity of having a powerful operator centric reporting resource.

Our original | SRG ™ | feature will remain in the software as a unique and important milestone and remain an essential resource for those operators who prefer a simple "point and shoot" style, easy to use reporting tool; that is primarily designed for generating custom based session reports as PDF attachments for other user-defined, externally generated written report content, as a technical attachment for the end-user.

Our | Advanced Report Generator (ARG) ™ | capability builds on the existing the existing | Session Report Generator (SRG) ™ | methodology using the latest technology by providing a fully integrated database enabled, component-based report manager and rendering mechanism, regarded as the next generation of TSCM | SIGINT specific disruptive technology feature and is designed to meet our operator centric methodology as outlined within the TSB 2000 (Technical) Standard ™.

The | ARG ™ | is intuitive and operator interactive, with our dynamic "drag-and-drop" technology applied to various sectional report components that fully support "on-the-fly" report generation during runtime and for the generation of historical post event analytical reporting requirements.

In-fact, a properly rendered technical report significantly enhances post capture analytics for TSCM operators and SIGINT analysts, while providing evidentiary documentation for any number of legal reasons and litigation support scenarios.

The | Advanced Report Generator (ARG) ™ | is a totally new industry standard that provides a very powerful reporting capability with never before seen advanced features that span not only the | Kestrel Project File (KPF) ™ | session data, but also includes a fully customized content-based master written inspection report that can be saved, edited, reused and rendered in various forms, as may be required to address all aspects of a complex multiple phase Technical Surveillance Countermeasures (TSCM) inspection.

The | ARG ™ | is a new technology that essentially eliminates the requirement of building a separate formatted written content-based document and allows the technical operator to build ad hoc | Kestrel Field Reports (KFR) ™ | and time permitting allows the technical operator to build a fully formatted | Final Inspection Report (FIR) ™ | before leaving the target area, in many cases.

The | ARG ™ | is a totally progressive concept only found within the | Kestrel TSCM ® Professional Software | and will have a tremendous impact on the efficiency of the reporting process.

The | ARG ™ | is relatively easy to use, however, to maximize the full capability and benefit, the technical operator is encouraged to attend one of our advanced | Certified Technical Operator (CTO) ™ | training programs.

The entire reporting structure and content is designed and developed around a powerful operator defined | Document Directory Tree | that can be customized, edited, ordered and reordered as desired by the technical operator to build and render a professional inspection report.

Reports can be rendered in a more traditional post collection role, or in many cases prepared for delivery to the end-user as a professionally formatted | Final Inspection Report (FIR) ™ | before leaving the facility.

This advanced capability decidedly qualifies as an exciting new milestone in the history of the | Kestrel TSCM ® Professional Software | that significantly enhances the efficiency of the inspection process; significantly reduces the amount of on-task working hours for report writing; and gets critical information to the end-user faster while freeing up the technical operator for other mission critical tasks.

Our powerful "drag and drop" technology is a standard included feature within the | Kestrel TSCM ® Professional Software | application and allows the technical operator to "drag and drop" powerful component-based building blocks that either contain all required formatting automatically in the back ground upon selection, or may offer optional custom functionality designed to enhance the rendered output document structure and style.

The rendered document represents the same powerful usability of our original first generation | Session Report Generator (SRG) ™ | and the introduction of the new | Advanced Report Generator (ARG) ™ | significantly expands and enhances the report writing process with many new features, and the promise of even more unique features, yet to be introduced in the future.

ARG ™ Control Elements

Modern report management requires a powerful database driven resource that allows the technical operator to utilize existing or preferential reporting structures, styles and customization practices and pull them into a dynamic "drag-and-drop" environment.

The Kestrel TSCM ® Professional Software combines a sophisticated reporting capability, driven by the technical operator's unique reporting styles and customization preferences, while incorporating all the complex technical data generated during the runtime collection process and rendering a clear picture of the inspection results and recommendations.

A properly formatted technical findings report is all about – clarity!

The | ARG ™ | utilizes an intuitive visual directory-style menu tree containing all of the needed report control elements and objects, which can then be independently arranged to qualify and quantify significant findings textually and graphically.

There are several important advantages to this approach from a continuity perspective in maintaining readily available, previous reporting and style control elements that can be reused, modified and edited to build several unique versions of the same report, for readers with different technical backgrounds or reader focus requirements.

The ability to import existing data sets (written and graphical) and software generated spectra, unique to the target area, such as text, images, photographs, floor plans, maps, riser plots, etc., provides the technical operator with a powerful resource.

The ability to build unique and proprietary formatted styles, allows the technical operator to create or import existing report structures to build on those report structures that are likely painstakingly being completed manually; and pull them directly into the | ARG ™ | and then render the preferred output, controlling the focus and look of the report.

The ability of the technical operator to create, store, access, build, alter, re-issue, encrypt, and review independent or an on-going technical report series enhances analytics and brings continuity over any period for which inspection reports must be maintained.

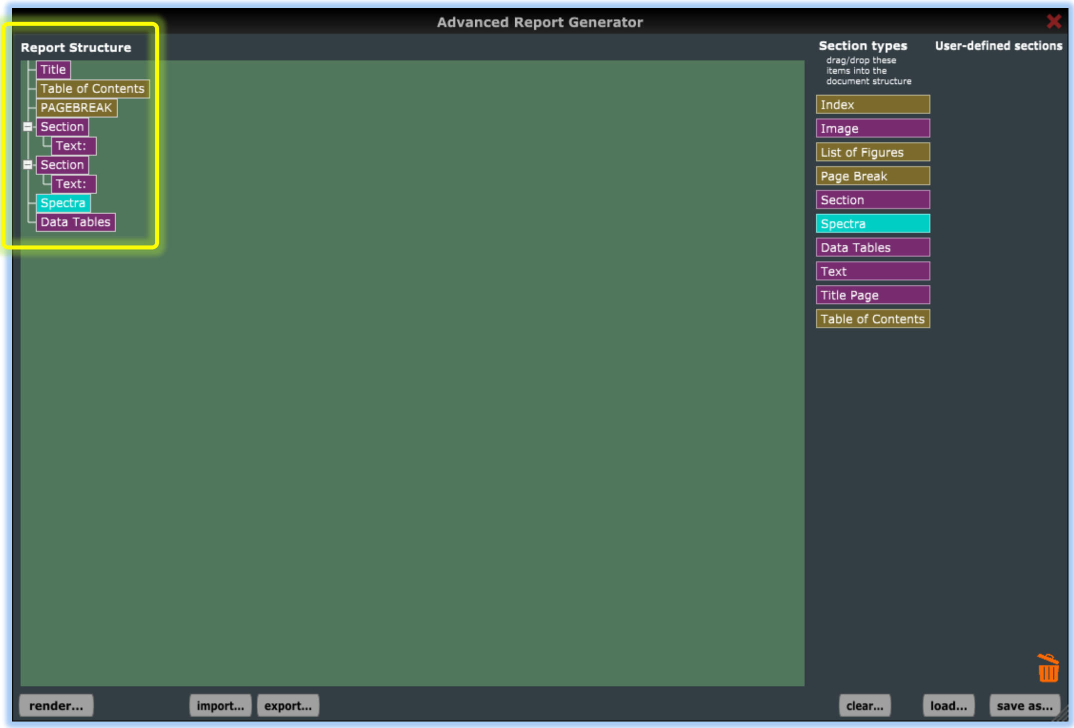
The modular based structure of the | ARG ™ | permits the database to be backed-up and moved to another host computer as may be required to facilitate operational field requirements and best data protection and security practices.

To illustrate the advanced capability of the | ARG ™ | in the example below, the technical operator has dragged the | TITLE PAGE | section type onto the document workspace structure, along with additional default | SECTION TYPES | creating the basis of a working technical report document structure.

The operator has also selected a | TITLE PAGE | TABLE OF CONTENTS | PAGEBREAK | SECTION | TEXT BLOCK | SECTION | TEXT BLOCK | SPECTRA | TABLES |, with each of the section types “drag and drop” nested under the | SECTION | as a starting point in formatting a professional, mission specific report.

The technical operator can then select the | TITLE PAGE | and invoke a pop-up menu consisting of both an | EDIT | and | DELETE | option to configure available options presented.

When the | EDIT | option is selected, all relevant | TITLE PAGE | information and details can be appended in a familiar format just like the original | Session Report Generator (SRG) TM | layout, but with several important differences and significant new feature options.



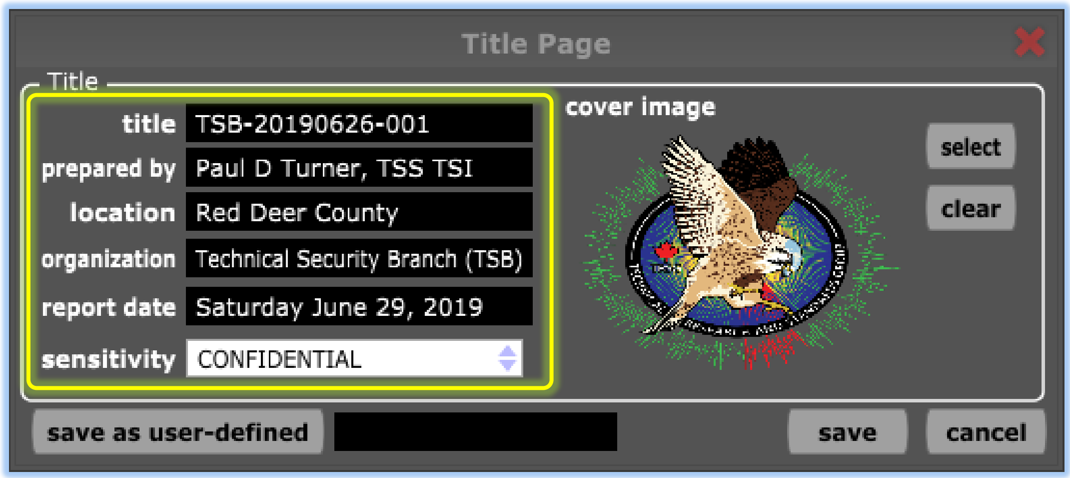
ARG | Report Structure | v1.40xx

The technical operator can select and include a unique | COVER IMAGE | in | PNG | or | JPG | format and will display a thumbnail reference image of the full resolution graphic that will render in the final output.

Support for either a menu selected option, or custom operator defined document | SENISTIVITY | flag can also be invoked from the | TITLE PAGE | dialog window.

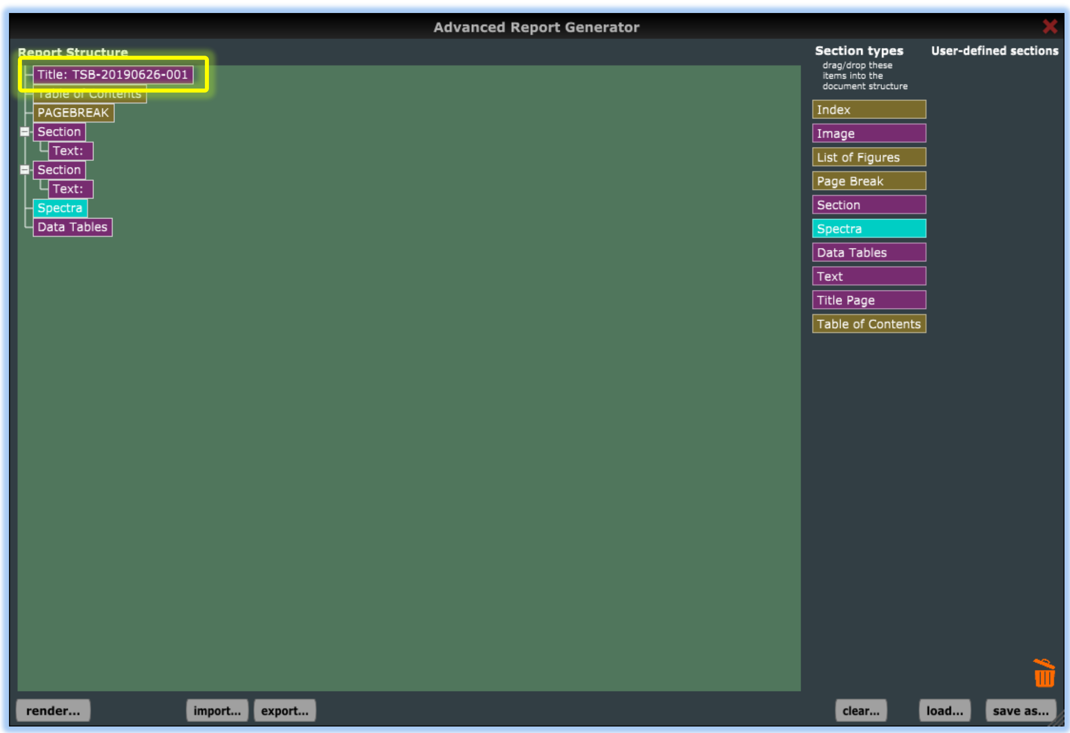
The following | ARG TM | dialog window represents the operator completed | TITLE PAGE | entry for the current reporting structure.

Pressing the | SAVE | button closes the window and saves any changes made to the edited content.



ARG | Edit Title Page | v1.40xx

Saving the | TITLE PAGE | dialog window updates the document report structure.



ARG | Report Structure | v1.40xx

For technical operators that provide third-party sub-contract services, the sub-contractor's branding | LOGO | or even the | LOGO | of the end-user may be selected from a file directory and included on the rendered cover page quickly and easily.

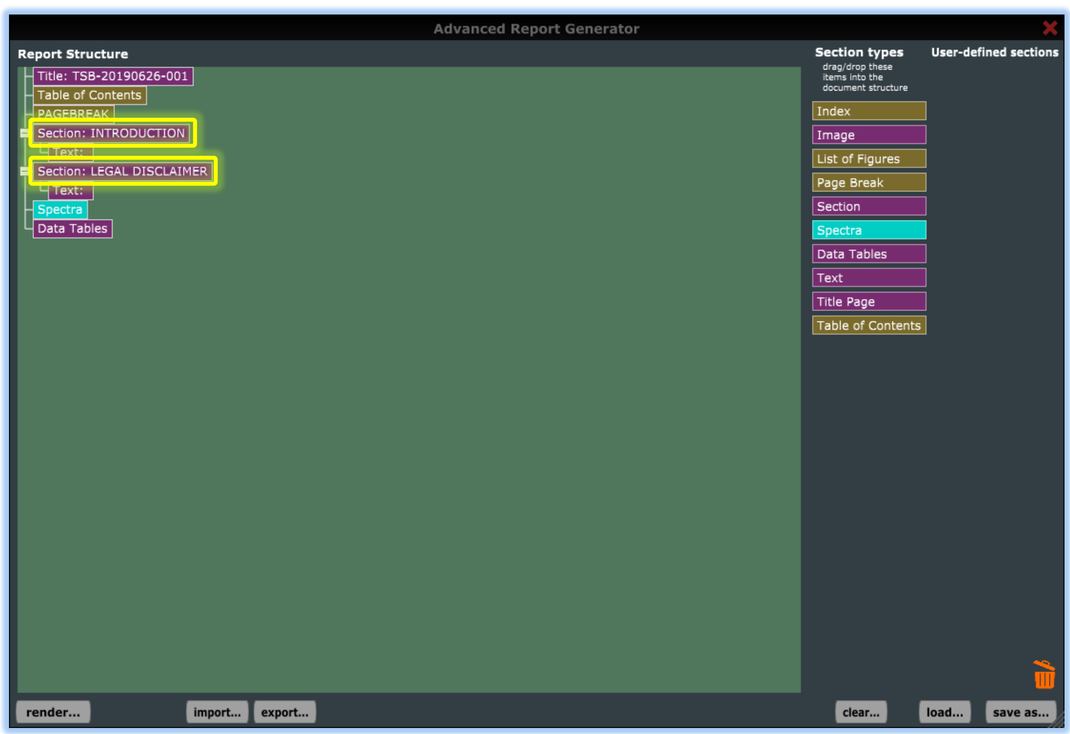
Any generic image in either the preferred | PNG |, or | JPG | file may be included as a custom graphical display embellishment, bringing a level of sophistication and substance, to the rendered reporting process.

Once the | TITLE PAGE | dialog has been completed and saved, the technical operator can provide the reports first | SECTION | TITLE | such as | INTRODUCTION | and the next | SECTION | TITLE | as | LEGAL DISCLAIMER |.

The technical operator moves through the | REPORT STRUCTURE | completing each section with the appropriate content, which can be reordered and edited as necessary during the build process as illustrated in the | REPORT STRUCTURE | below.

It's a well-established and a recognized fact that the technical operators work product is primarily defined by the | Final Inspection Report (FIR) ™ |, as rarely will the end-user see or appreciate the amount and scope of work on which a formal technical inspection is ideally based.

The | ARG ™ | feature is one of the most important new additions ever introduced within the | Kestrel TSCM ® Professional Software | based on the TSB 2000 (Technical) Standard ™ and our modern industry disruptive operator centric approach.



ARG | Report Structure | v1.40xx

The document window workspace can be resized as desired.

Once the report document is complete and rendered in PDF format (for example), the output will provide a fully formatted | TITLE PAGE |, as illustrated below complete with logo, file name, document sensitivity, and other included details added by the technical operator during the setup process.

When no image (or logo) has been included, the | TITLE PAGE | text will render centered on the cover page in the absence of the image or graphic.

The | REPORT DATE | format can be determined by technical operator or the organizations preference for a consistent flow throughout the document.


TSB-20190626-001

TRSG
TECHNICAL RESEARCH AND STANDARDS GROUP

TSB-20190626-001
Technical Security Branch (TSB)
Paul D Turner, TSS TSI
Red Deer County
Saturday June 29, 2019

CONFIDENTIAL
Page 1

ARG | Cover Page | v1.40xx

The header, footer, and page numbering are all automatically appended and optimized during the rendering process, creating a professionally formatted report that includes all aspects and phases of the working assignment and not just the | Kestrel TSCM ® Professional Software | spectrum data, images and signal tables, as is the case with the original | Session Report Generator (SRG) ™ |.

The ability of the operator to utilize the | Kestrel TSCM ® Professional Software | as a total assignment-based report generator and advanced database manager has a profound impact and ability to reduce report writing requirements by hundreds of working hours every year!

TIP: Even using modest calculations, I personally spend approximately 1820 hours a year writing complex technical reports for on average 280 technical inspections annually across three (3) technical operators. The ARG ™ is expected to reduce this workload from approximately 6.5 hours per inspection report to approximately 1.5 hours per inspection report, or just 420 hours a year, realizing a workload reduction of 1400 hours a year. This is the working equivalent of 58.3 days every year! Consider the further ARG ™ efficiencies realized based on the capability of generating simple ad hoc Kestrel Field Reports (KFR) ™ in a matter of minutes on-site, or even the awesome ability to deliver a fully formatted end-user Final Inspection Report (FIR) ™ with spectra, images, signal tables and detailed written elements all in about 30 to 45 minutes, assuming the technical operator has prepared a master ARG ™ template in advance.

ARG ™ Set-Up and Rendering Process

It is essential for the technical operator to understand the | DOCUMENT RENDERING | process and the directories and files generated during the rendering process.

A directory called | REPORT | will be appended to the | Kestrel Project File (KPF) | primary directory and will become the focus of the rendered document and all support files generated as a direct result of the rendering process once the | ARG ™ | feature is invoked within the project.

This essentially places all the files in one basket, or directory so the speak, and makes it an easy task to manage the | ARG ™ | content without corrupting the | Kestrel Project File (KPF) ™ |.

The | REPORT | directory as generated by the | ARG ™ | rendering process contains working copies of the cover page image, imported images, automatically rendered spectrum plots, rendered report document, and | Kestrel Cache (KRC) ™ | files, for each spectrum set.

This allows spectra to be rendered faster from a file copy rather than having to create them from the | KPF ™ | when rendering multiple times during the build process.

The cache file | KRC ™ | allows the technical operator to render future copies of the report significantly faster and without the need to fully render the output document from the | Kestrel Project File (KPF) |, including other image files for which the original files might have been removed or stored on another system, network or storage drive.

All relevant support files are copied and appended to a master working | REPORT | directory for each individual project, so should the need arise to render a new copy of the report, make changes or corrections to the report, etc., all the required data elements can be recalled regardless of the disposition of the original support files.

Once the report document structure is ready to render, the technical operator can select various options for the | RENDERED (Output Format) | and | (Report) STYLE | from the drop-down menu options provided.

The current default is | PDF (Output Format) | and | STANDARD (Report Style) | with additional options to be added as the | ARG ™ | development rollout progresses over time.

Title Page (Section Type)

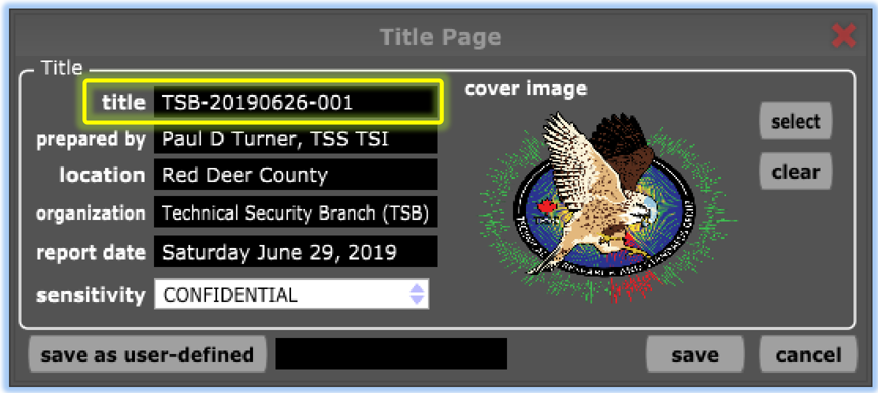
The | TITLE PAGE | SECTION TYPE | as illustrated, provides relevant key information about the assignment and supports expertly formatted text and graphics.

The | TITLE PAGE | section dialog window calls for a | TITLE | PREPARED BY | LOCATION | ORGANIZATION | REPORT DATE | SENSITIVITY | and | COVER IMAGE | setup to be entered by the technical operator.

It is recommended that the | TITLE | be utilized for a unique | File Naming Convention (FNC) | consistent across all | Kestrel Project Files (KPF) ™ |.

For example, our in-house file naming standard | TSB-20190614-001 | provides a consistent structure that references the type of report | TSB (Operational) | or | TRN (Training) | - | INSPECTION DATE | - | ASSIGNMENT NUMBER | on that date.

Utilizing the above | FNC | format, all | KPF ™ | files and associated reports will appear in chronological order within the storage file directory, bringing clarity to complex reference files and associated data file sets.



Title Page | v1.40xx

The | TITLE PAGE | section type dialog window provides a powerful graphical presentation style appearance to the final rendered inspection report.

Table of Contents (Section Type)

The | TOC | SECTION TYPE | does not require any operator configuration and can simply be “drag and drop” positioned to anywhere within the document structure to invoke a page numbered | TABLE OF CONTENTS |.

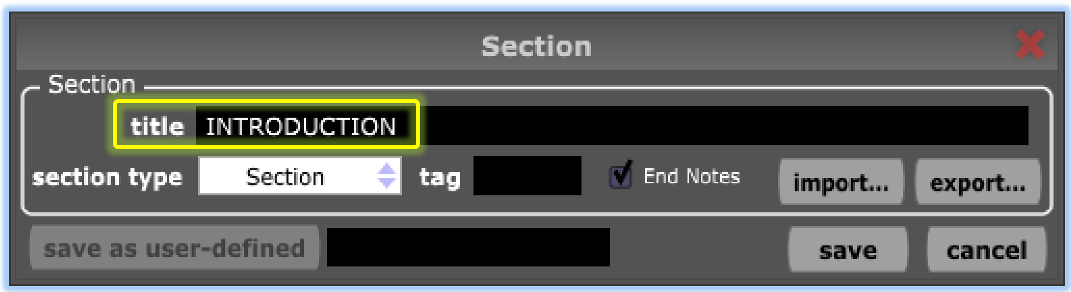
The | TABLE OF CONTENTS | magically builds automatically in the background depending on what reporting elements are “drag and drop” positioned into the document structure and reflects page numbering that is fully automated during the rendering process to reflect the | SECTIONS | NESTED SUB-SECTIONS | and other advanced reporting elements including the use of simplified mark-up to extend the page numbering to reflect text paragraphs within | TEXT | SECTION TYPES |.

Section (Section Type)

The | SECTION | is a | SECTION TYPE | and provides the top-level formatting for each operator defined or required reporting element; perhaps best described as formalized | SECTION TYPES | within the document structure and becomes the basis for independent inspection elements.

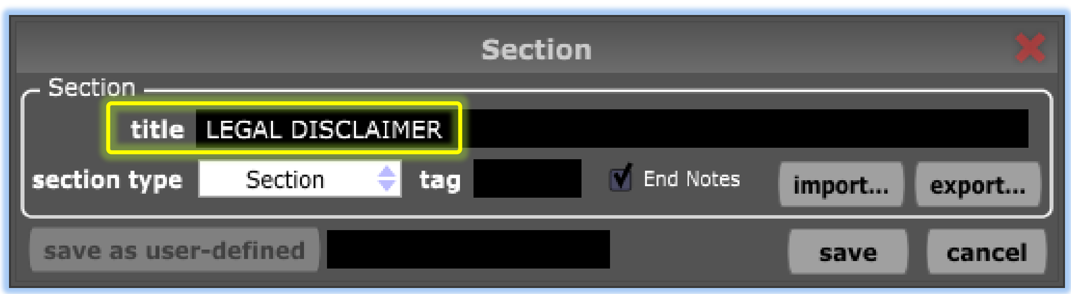
The technical operator can simply define a | TITLE | for the | SECTION | or nested | SUB-SECTION | and the operator can further define the | SECTION TYPE | as | SECTION (Default) | APPENDIX | BIBLIOGRAPHY | REFERENCES | or | NOTES |.

The operator defined selection will affect the way the information is displayed within the rendered document and relative to the | TOC | bringing absolute clarity to the flow of the inspection report.



Section Title | v1.40xx

The ability to | IMPORT | and | EXPORT | text directly to the | SECTION | TITLE | and then | SAVE AS USER DEFINED | sections is also supported with the | ARG ™ |.



Section Title | v1.40xx

The above example illustrates the technical operators defined first | SECTION | of the inspection report called | INTRODUCTION | and the second | SECTION | TITLE | defined as | LEGAL DISCLAIMER |.

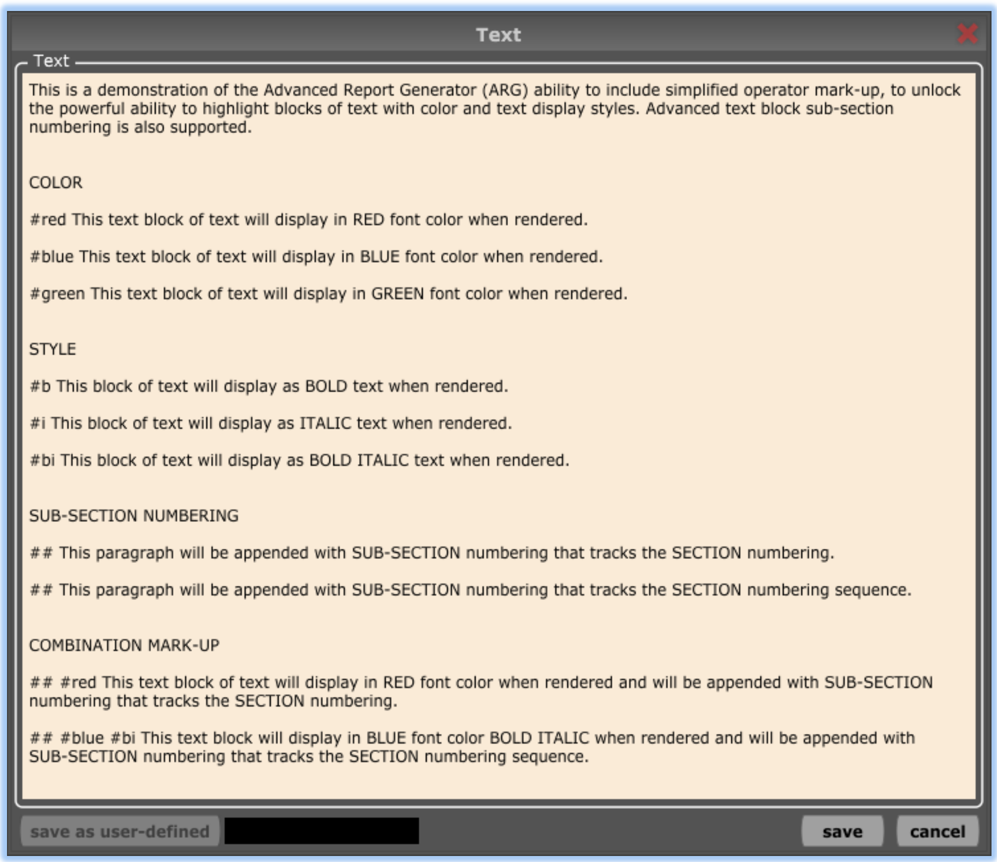
All page numbering, coding, formatting and | TOC | rendering, etc., are all automatically processed within the formal | DOCUMENT STRUCTURE | without any operator formatting required.

Text (Section Type)

The | TEXT | SECTION TYPE | allows the technical operator to manually enter text content, cut and paste text content, import | MARK-UP | text or load a | KRA | file.

The | TEXT | dialog window consists of a resizable window (drag left bottom corner of window), with the ability to | SAVE | a text block to the document structure, or | SAVE AS USER-DEFINED | section for future recall.

The ability to render additional text color and style formatting is supported with simple control flags during text block entry.



Mark-Up Coding | v1.40xx

For example, to flag a paragraph of text in | RED | BLUE | or | GREEN | in the rendered output file, the technical operator can quickly add | #red | #blue | #green | at the beginning of the text line for which a defined text color is desired.

Support for | BOLD | and | ITALIC | text formatting is provided by adding | #b | or | #i | at the beginning of the text line and | #bi | can be used for | BOLD ITALIC | rendering.

To assign a block of text as | RED | BOLD | the technical operator can assign a combination of control flags at the beginning of the text string such as | #red #b |, whereby the rendered output would display | RED BOLD | text.

To include | SUB-SECTION | numbering that tracks the | SECTION | numbering, the technical operator can simply add | ## | at the beginning of the paragraph.

The | SAVE | button adds the text block to the document structure and closes the dialog window.

Text Spell Checking (TSC) ™

The | ARG ™ | would simply not be complete without a built-in spell-checking algorithm with an independent custom technical report-oriented dictionary.

The | TSC ™ | utilizes a custom dictionary database that contains common technical security terminology.

The technical operator can manually invoke the spell-checking feature relative to any populated | TEXT | SECTION TYPE |.

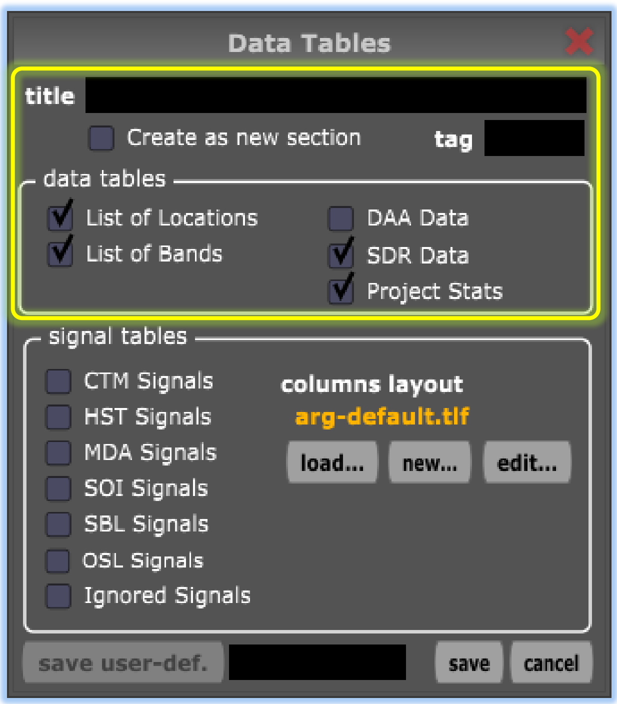
The technical operator can select corrections from a suggested spelling list, add words to the technical dictionary, ignore words, edit the text window and cancel the spell-checking process.

The process is invoked by pressing the | TSC ™ | button once the desired text as been appended to the | TEXT | SECTION TYPE | dialog window.

Data Tables (Section Type)

The | DATA TABLES | SECTION TYPE | can be appended anywhere within the | REPORT STRUCTURE | and there is also support for the implementation of multiple table elements throughout the reporting structure.

The | DATA TABLE | dialog window contains several operator-defined elements that be independently configured, including a | TITLE | DATA TABLES | SIGNAL TABLES | and | COLUMNS LAYOUT | as illustrated below.

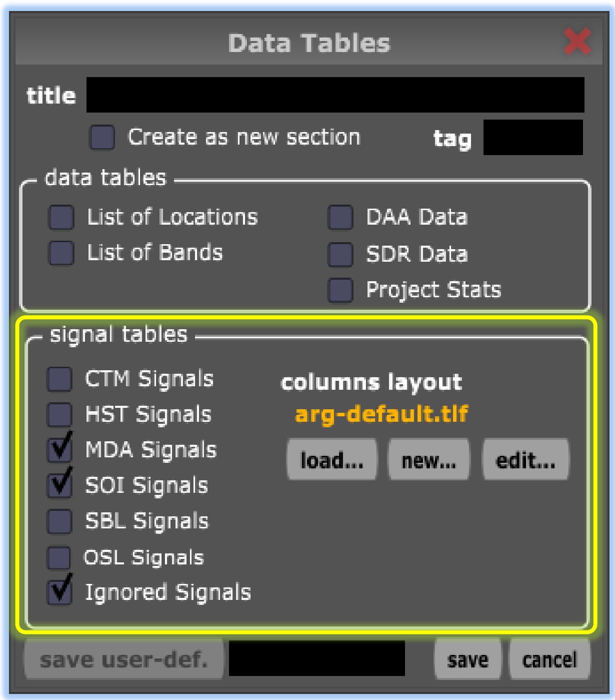


Data Tables | v1.40xx

To insert and define a | DATA TABLE | within another existing | SECTION | the technical operator checks the desired available data tables and unchecks the | CREATE AS NEW SECTION | box.

There is no need to define a | TITLE |, however, it will display in the document tree as a reference.

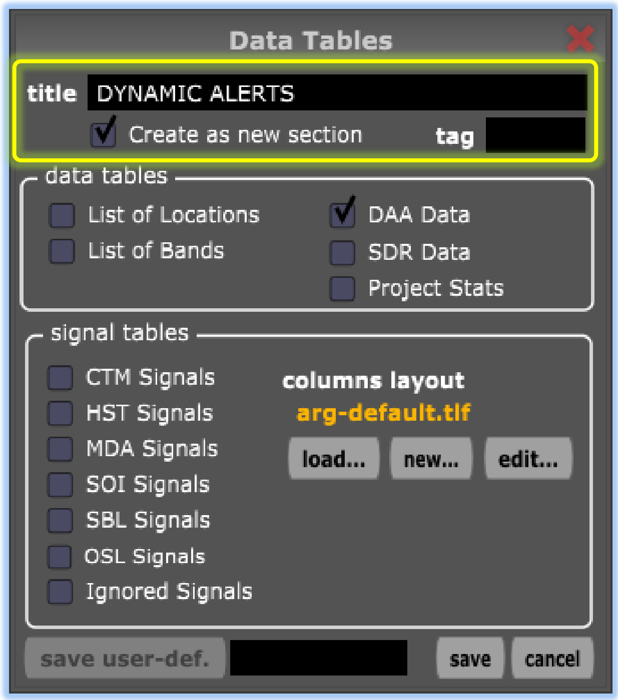
The programming necessary depends on the operators defined report structure.



Data Tables | v1.40xx

To insert and define a | SIGNAL TABLE | within another existing | SECTION | the technical operator checks the desired available signal tables and unchecks the | CREATE AS NEW SECTION | box.

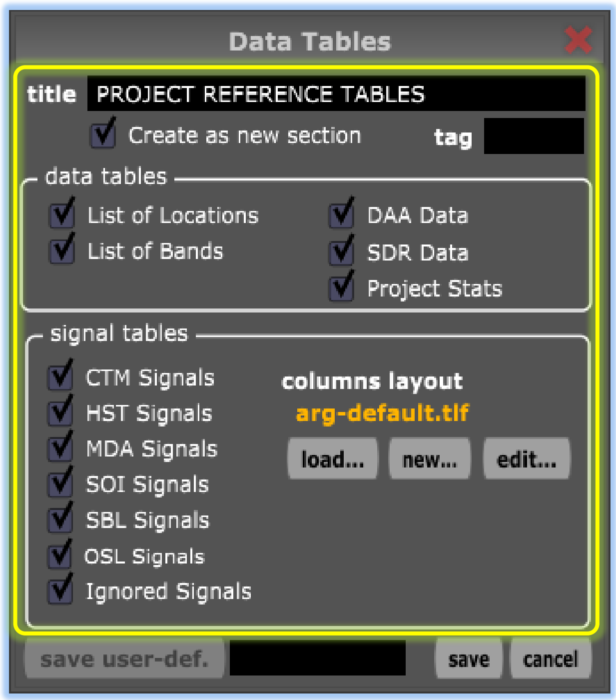
There is no need to define a | TITLE |, however, it will display in the document tree as a reference.



Data Tables | v1.40xx

To insert and define a | DATA TABLE | as a new | SECTION | the technical operator checks the desired available data tables and checks the | CREATE AS NEW SECTION | box (checked by default), and defines a | TITLE | such as | DYNAMIC ALERTS | as illustrated in the above example.

This action makes the table an independent | SECTION | within the numbered document structure.



Data Tables | v1.40xx

To insert and define a signal | DATA TABLE | and | SIGNAL TABLE | as a new | SECTION | the technical operator checks the desired available data and signal tables and checks the | CREATE AS NEW SECTION | box (checked by default), and defines a | TITLE | such as | PROJECT REFERENCE TABLES | as illustrated in the above example.

This action makes the table an independent | SECTION | within the numbered document structure and renders all available table elements.

The | COLUMNS LAYOUT | is yet another example of operator centric functionality within the Kestrel TSCM Professional Software application.

The operator can define the structure of the | SIGNAL TABLE | columns utilizing a master column layout editor.

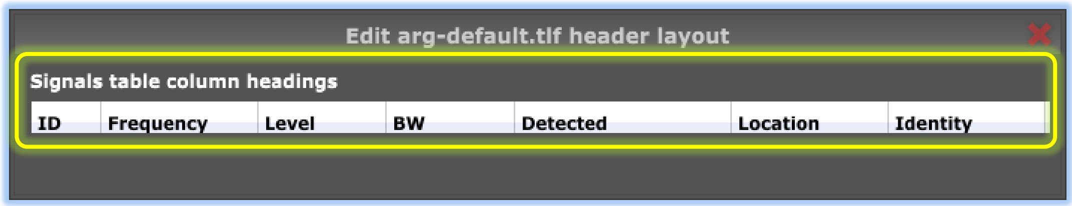
Support for loading an existing layout or building a new layout, or editing an existing layout is fully realized, so there is no need to adjust each table individually, to achieve a common table flow within the report.

The default | ARG-DEFAULT.TIF | file displays in the | COLUMNS LAYOUT | located in the | SIGNAL TABLES | dialog window.

Selecting the | LOAD | button, invokes the | SETTING DIRECTORY | where the various | TIF | column layout files are stored.

The | NEW | button also invokes the | SETTING DIRECTORY | and the technical operator can define a new columns layout file.

However, the easiest method is to simply press the | EDIT | button and adjust the columns as they will render within the report.

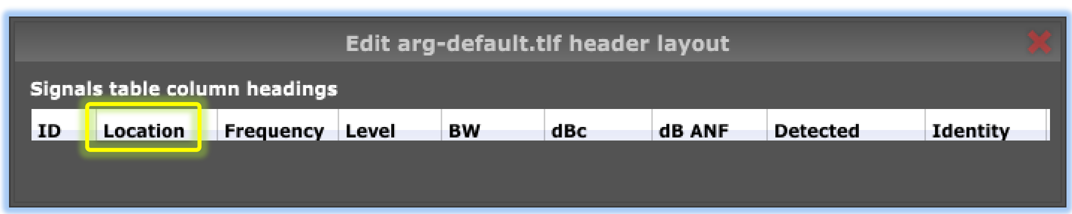


Signal Table Column Editor | v1.40xx

Based on the default column structure, the rendered document | SIGNAL TABLES | will appear as illustrated above.

Signal Table Column Editor | v1.40xx

The operator has added the | dB ANF | column using the | EDIT | button by right mouse clicking on the column header and can select and deselect any available column headings.



Signal Table Column Editor | v1.40xx

Utilizing the same strategy, the technical operator has added the | dBc | column using the | EDIT | button by right mouse clicking on the column header and also reordered the columns by dragging the | LOCATION | column to a new location within the column structure.

Image (Section Type)

The | IMAGE | SECTION TYPE | permits the inclusion of any image type in | PNG | or | JPG | format to be introduced into the | REPORT STRUCTURE | tree as independent or grouped images.

Screen captures, photographs, images, floor plans, maps, riser plots, etc., by dragging and dropping the | IMAGE | SECTION TYPE | into the | DOCUMENT STRUCTURE | tree and configuring the dialog window.

The | IMAGE | SECTION TYPE | can be appended anywhere within the document as content relevant, or images can be placed in a single dedicated | SECTION |.

Navigating the | IMAGE | dialog window is simple and provides a balanced approach to automatic formatting combined with powerful image formatting tools all under operator control.

The first important feature is the image rotation tool as often images my not render corrected when imported from a variety of camera types and file locations as illustrated below.

The image rotation tool allow the default image to be rotated as required.

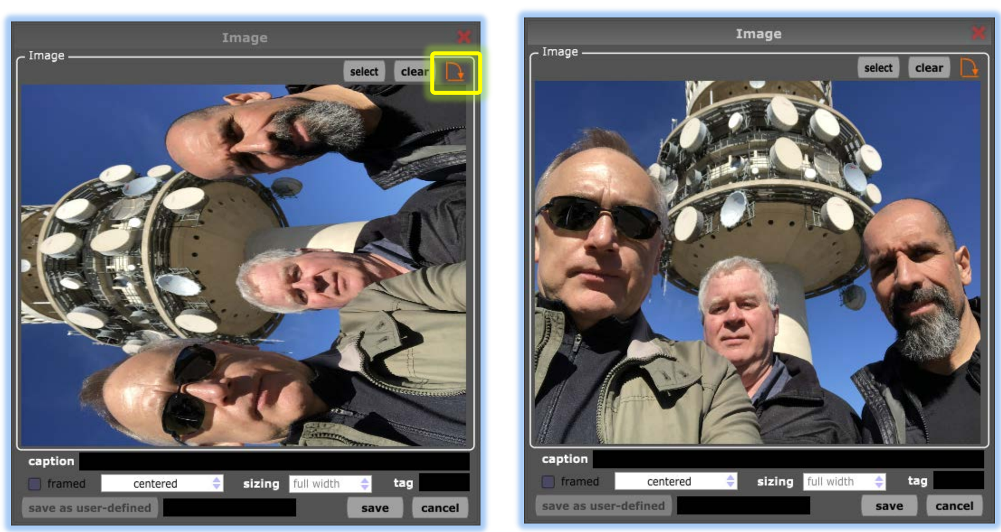


Image Selection and Formatting | v1.40xx

The image can be selected from any storage location and cleared (removed) as required and a text caption, description or even recommendation can be appended to the | IMAGE | SECTION TYPE |.

Additional formatting capability is also supported, allowing the technical operator to place a | FRAME | around the image, select | JUSTIFICATION | type and adjust the | SIZING | of the image, all within the document structure.

The image | JUSTIFICATION | can be selected as | CENTERED | LEFT JUSTIFIED | or | RIGHT JUSTIFIED | for each included image.

The image | SIZING | can be set for | FULL WIDTH | HALF WIDTH | QUARTER WIDTH | EIGHTH WIDTH | and FULL HEIGHT | HALF HEIGHT | QUARTER HEIGHT | and | EIGHTH HEIGHT |.

Once all the image options are defined, pressing the | SAVE | button completes the process.

List of Figures (Section Type)

The | LIST OF FIGURES | automatically configures an ordered and numbered list of all images throughout the entire rendered document.

The | LIST OF FIGURES | is separate and apart from the | TABLE OF CONTENTS |.

The process is fully automatic when the document is rendered and there are no configurable or definable elements.

The technical operator can drag and drop the | LIST OF FIGURES | SECTION TYPE | into the | REPORT STRUCTURE | tree as required.

Spectra (Section Type)

The | SPECTRA | SPECTION TYPE | provides the ability to build grouped or separate and unique spectrum plot profiles within an automated background process.

When the | SPECTRA | SECTION TYPE | is drag and dropped to the | DOCUMENT STRUCTURE | tree, the option to edit or delete is available.

Selecting the | EDIT | option invokes the | SPECTRUM SECTION | dialog window populated with all available | LOCATIONS | and | BANDS | found within the current Kestrel Project File (KPF).

Each of the | LOCATIONS | and | BANDS | can be removed from the list, if they are not required for the intended reporting process.

An operator defined | TITLE | can be included as a starting point and will render only if the | CREATE AS NEW SECTION | checkbox is selected.

Providing a | TITLE | even with the | CREATE AS NEW SECTION | checkbox deselected will use the title within the document tree and is recommended.

In the example below, the operator has utilized Real-Time Event (RTE) vs Peak Envelope Capture (PEC), or | RTE vs PEC | and the single project collection location is | 190620-11-001A | across a single spectrum band | TSB 20000 |.

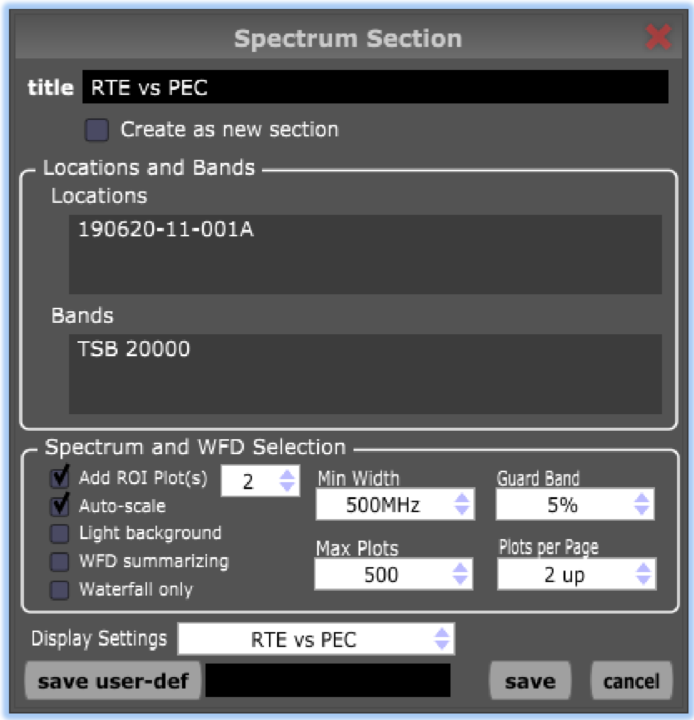
Additional operator defined programming includes adding an | ADD ROI PLOT | dividing the range across two (2) equal ranges of 0Hz to 10 GHz and 10 GHz to 20 GHz as an overview of the spectrum and has selected the | AUTO-SCALE | to produce an optimized display output during rendering.

The technical operator has selected the | MINIMUM (PLOT) WIDTH | of 500 MHz and the | MAXIMUM (NUMBER) PLOTS | as 500 with a designated | GUARD BAND | of 5% and a rendering of two (2) | PLOTS PER PAGE |.

Additional settings are available to produce a | LIGHT BACKGROUND | WFD SUMMARIZING | and | WATERFALL ONLY | plot rendering.

Selecting | DISPLAY SETTINGS | will invoke all | LOCATIONS | and all | BANDS | to render as per the | DISPLAY SETTINGS | selected.

This is an important feature when working with multiple | SPECTRUM BANDS | and | LOCATIONS | to ensure that the display parameters are the same.



Spectrum Section | v1.40xx

Please note that the operator must configured the | DISPLAY SETTINGS | at the application level before they will appear as options within the | Advanced Report Generator (ARG) ™ |, and the above noted example is representative of a pre-configured | DISPLAY SETTING | RTE vs PEC |.

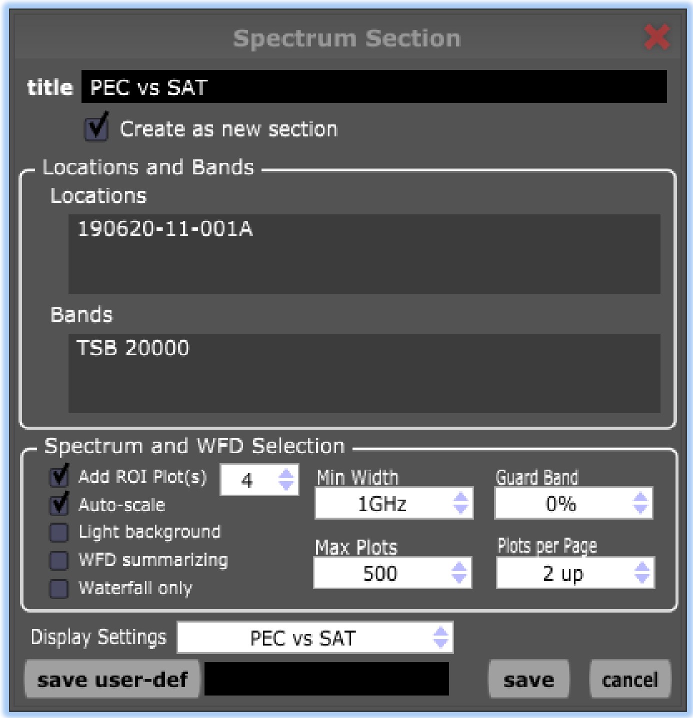
In the next example, the technical operator has defined the | SPECTRA | to represent the Peak Envelope Capture (PEC) vs Spectrum Averaging Trace (SAT), or | PEC vs SAT | reference data.

Providing a | TITLE | with the | CREATE AS NEW SECTION | checkbox selected renders the | SPECTRA | as an independently numbered section.

The operator has utilized Peak Envelope Capture (PEC) vs Spectrum Averaging Trace (SAT), or | PEC vs SAT | and the single project collection location is | 190620-11-001A | across a single spectrum band | TSB 20000 |.

Additional operator defined programming includes adding an | ADD ROI PLOT | dividing the range across four (4) equal ranges of 0Hz to 5 GHz, 5 GHz to 10 GHz, 10 GHz to 15 GHz, and 15 GHz to 20 GHz as an overview of the spectrum and has selected the | AUTO-SCALE | to produce an optimized display output during rendering.

The technical operator has selected the | MINIMUM (PLOT) WIDTH | of 1 GHz and the | MAXIMUM (NUMBER) PLOTS | as 500 and has set two (2) | PLOTS PER PAGE |.



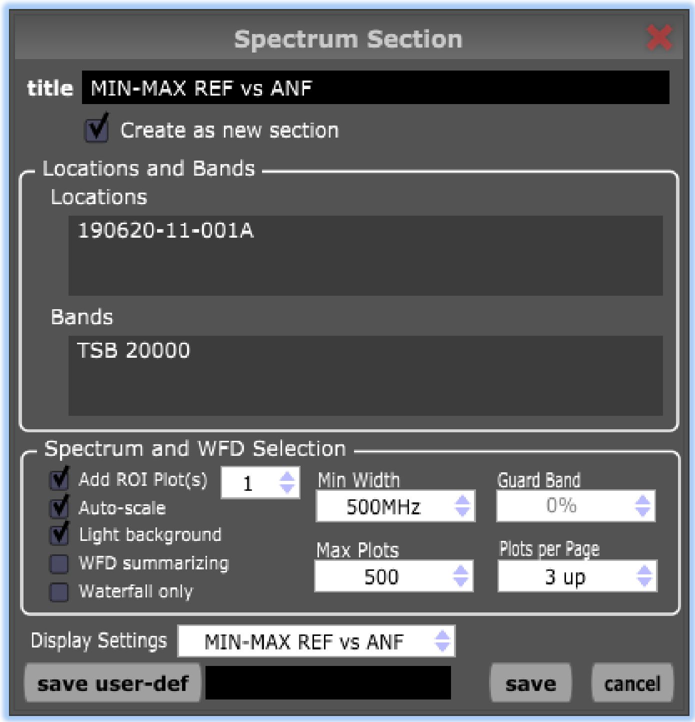
Spectrum Section | v1.40xx

The operator has added another | SPECTRA | SECTION TYPE | to represent the | MIN-MAX REF vs ANF | plots.

The technical operator has | CREATE AS NEW SECTION | selected the | ADD ROI PLOT | to produce a single 20 GHz overview, selected | AUTO-SCALE | and | LIGHT BACKGROUND |.

The minimum plot width is set at 500 MHz and the maximum number of plots is set at 500, with three (3) plots per page.

The ability to quickly build virtually any type of reference plots that best represent the ambient RF spectrum environment from both a technical and non-technical perspective should be the objective of every technical operator.



Spectrum Section | v1.40xx

The | SPECTRA | SECTION TYPE | can be edited at any time to produce multiple levels of the report for both technical and non-technical readers.

TIP: The reporting process by definition is essential to liability mitigation; meaning that the technical operator's ability to unequivocally prove that any future disputed hostile signal as might be identified after the completion of a technical inspection; was not in-fact operating within the ambient RF spectrum at the time of the inspection. The failure of the technical operator to adequately document the technical findings, whether or not an inspection report is even requested by the end-user, is just short of professional misconduct and utilizing TSCM resources that fail to render a total picture of the technical inspection, leaves the technical operator and their respective organization vulnerable from a liability standpoint on many levels. It is essential that a Final Inspection Report (FIR) be produced and properly stored as it has significant evidentiary value and may be used as a comparative briefing document during future technical inspection at the same facility or location.

The next | SPECTRA | SECTION TYPE | renders a waterfall plot independently without additional spectrum plots.

In the following example the operator provided the | TITLE | as | WFD vs TIME | and has unchecked the | CREATE AS NEW SECTION | option.

Spectrum Section | v1.40xx

The technical operator has selected two (2) | ADD ROI PLOTS |, enabled | AUTO-SCALE | and has selected the | WATERFALL ONLY | option.

The minimum plot width is set to 1 GHz with a maximum number of plots set at 500 with 2 plots per page.

Page Break (Section Type)

A | PAGE BREAK | SECTION TYPE | is not operator configurable and simply begins the next | SECTION | or other | SECTION TYPE | on a new page.

A | PAGE BREAK | can be inserted, moved and removed as required within the | REPORT STRUCTURE | to force the next section to start on a new page.

Index (Section Type)

The | INDEX | SECTION TYPE | has no configurable options from a formatting perspective.

User-Defined (Section Type)

The | SAVE AS USER-DEFINED | feature allows the technical operator to save the current formatting as a drag and drop template.

This permits the reuse of generalized reporting elements that generally do not change from report to report.

Once an item is | SAVED AS USER-DEFINED | the item will appear under the | USER-DEFINED SECTIONS | list.

The | SECTION | and | TEXT | can also be saved to the | USER-DEFINED SECTION | list.

TAGS (Image | Section | Tables)

The | TAGS | feature allows important information to be referenced by the section number.

AD HOC | Kestrel Field Report (KFR) ™

One of the key advantages of the | Advanced Report Generator (ARG) ™ | is the ability of the technical operator to generate a simple field report on-site at the completion of the inspection, containing immediate action points that that the end-user can perhaps consider or implement prior to receiving a full analytical report.

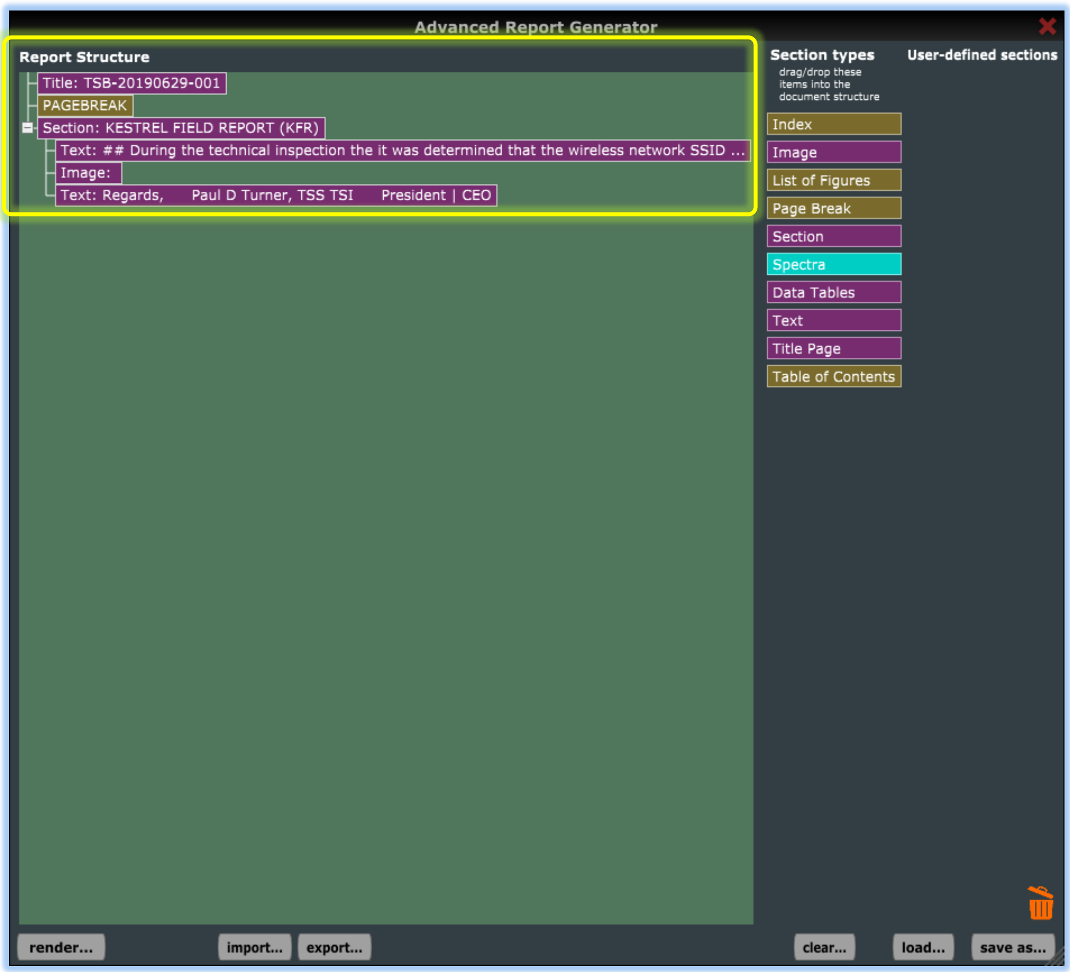
A simple formatted | KESTREL FIELD REPORT (KFR) ™ | can enhance the typical on-site verbal report provided ta the end of a technical inspection.

The | Kestrel TSCM ® Professional Software | KESTREL FIELD REPORT (KFR) ™ | can contain a formatted | TITLE PAGE | automatically generated | TABLE OF CONTENTS | field report | SECTION TITLE | Key Points and Recommendations | TEXT BLOCK | SPECTRA PLOTS | overview | and | TEXT BLOCK | signature line) | in just a few minutes.

The generated PDF file can be emailed directly to the sub-contractor, end-user, and company management, or can be copied to USB media and provided to the end-user as an interim report. The following example represents a recommended format for an ad hoc | Kestrel Field Report (KFR) ™ | to be provided to the end-user on-site.

This report renders a | TITLE PAGE | and a working | KESTREL FIELD REPORT (KFR) ™ | page that contains several significant findings and immediate action recommendations for consideration and action by the end-user.

The operator can define and render the | KESTREL FIELD REPORT (KFR) ™ | in just a few minutes and provide a PDF copy of the report to the end-user on USB media.

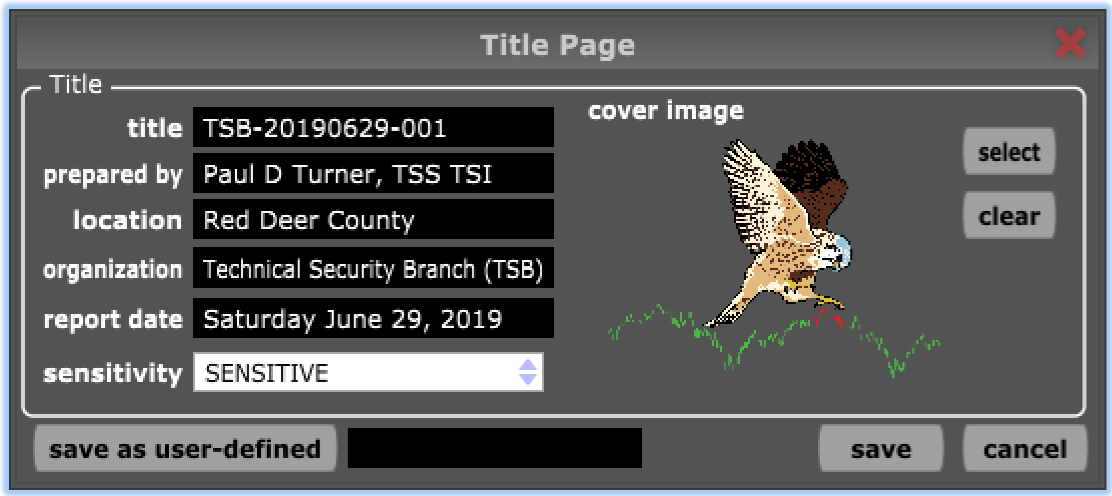


Report Structure | v1.40xx

The | REPORT STRUCTURE | is depicted in the above image can be imported from an existing | KRA | file and edited to address the key findings and immediate action considerations and recommendations for the client's attention.

This report reflects the same content as the provided verbal report and allows the end-user to react to findings, before the delivery of the more formal | FINAL INSPECTION REPORT (FIR) | that contains significantly more detail.

Let's take a closer look at the various component | SECTION TYPES | of the completed | KESTREL FIELD REPORT (KFR) ™ | both before and after rendering.

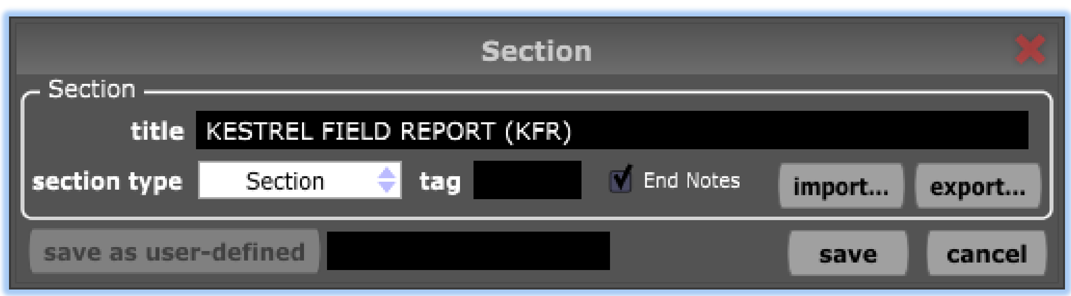


Title Page | v1.40xx

The | TITLE PAGE | producing the first page of the rendered document and provides a general overview of the assignment particulars and defines the | COVER IMAGE |.

< PAGE BREAK >

The | SECTION | | TITLE | defines the intend of the report, which in this instance the technical operator has defined the | TITLE | as | KESTREL FIELD REPORT (KFR) ™ |.



Section Type | v1.40xx

Following the | SECTION | TITLE |, the technical operator has nested a | TEXT | SECTION TYPE | which contains the formatted findings, observations, and constructive recommendations for which immediate resolution is expected to mitigate existing or potential compromise.

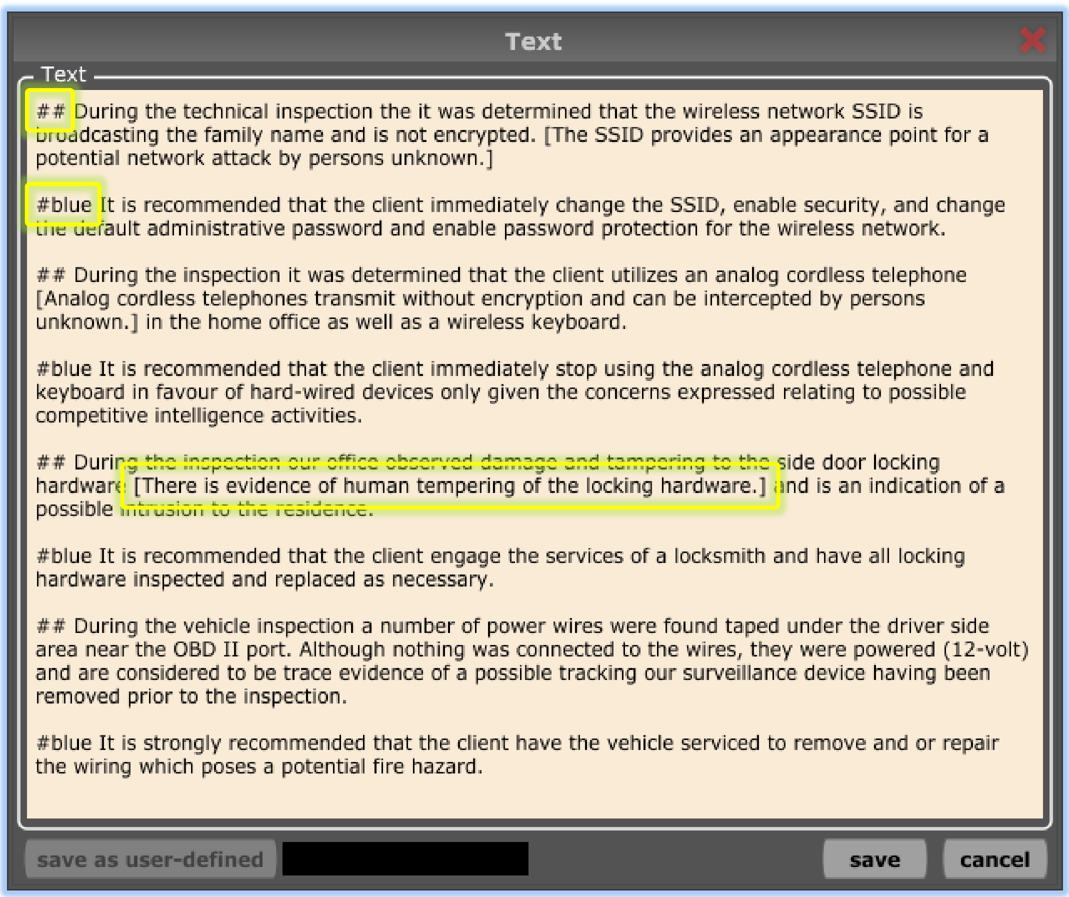
The actual mark-up provides clarity within the rendered output file by adding sub-section numbering and the use of colored text to further enhance the | KFR ™ |.

The use of < ## > adds sub-section numbering relative to the | SECTION | numbering scheme automatically appended to the rendered document.

The use the < #blue > invokes blue font text color to the rendered document.

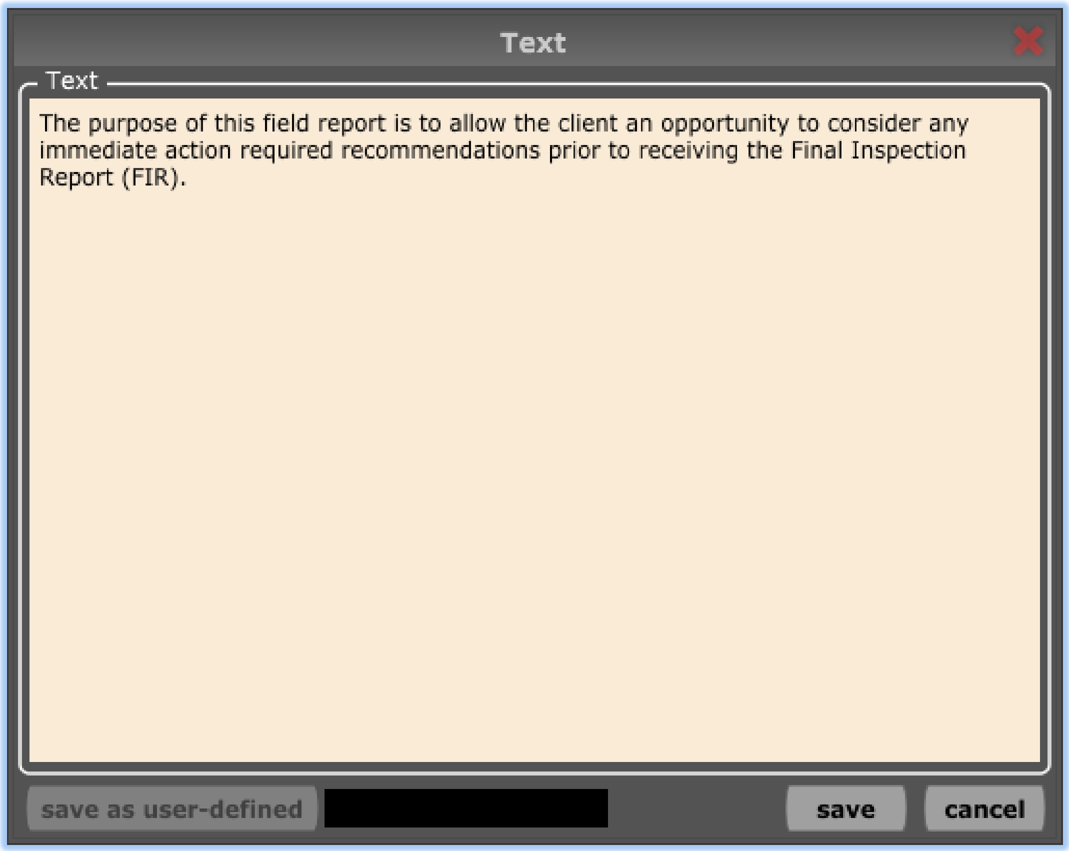
The rest is up to the technical operator to define the | PROBLEM | and a realistic | SOLUTION | for in this case four (4) issues and four (4) recommendations.

However, any number of formats can be used to customize the style, format, and content of the text dialog window.



The technical operator can utilize the | IMAGE | SECTION TYPE | to add a signature to the report from a | PNG | or | JPG | file.

When paragraph text is bracketed [The SSID provides an appearance point for a potential network attack by persons unknown.], the text becomes a numbered | END NOTE | when the | END NOTE | checkbox is checked for the section in which the | TEXT SECTION TYPE | is located.



Text Section Type | v1.40xx

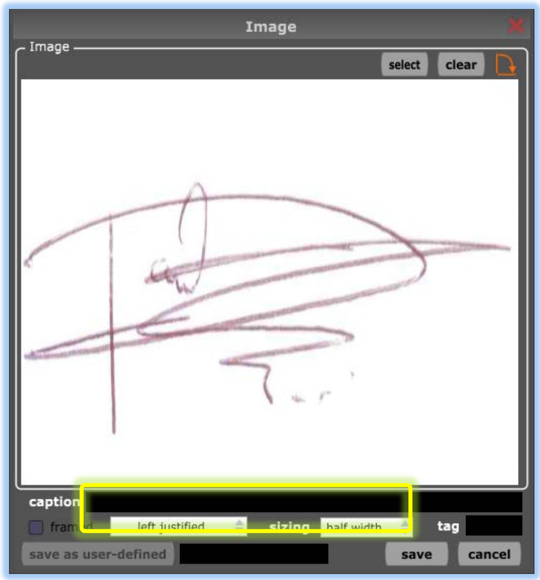
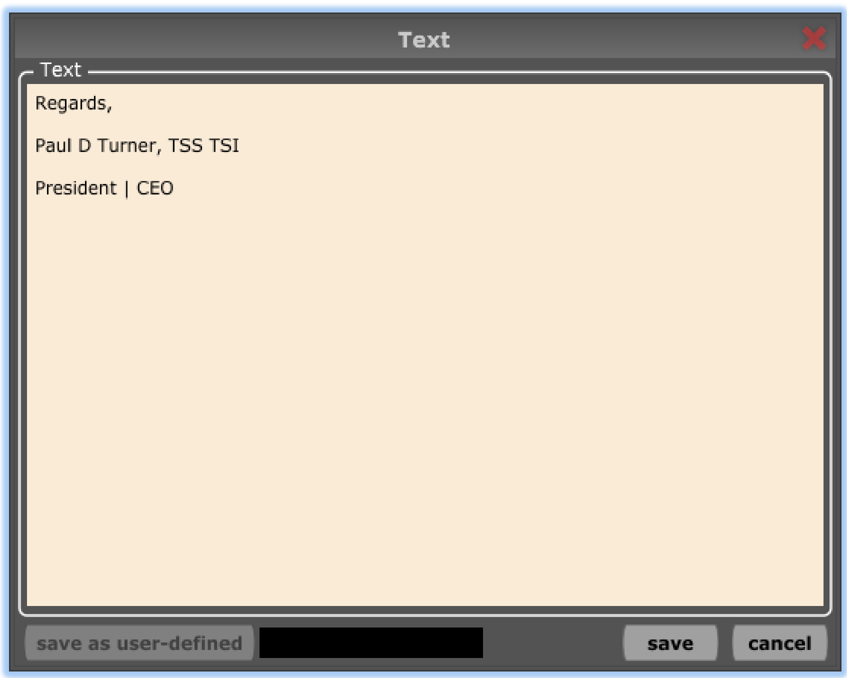


Image Section Type | v1.40xx

The last | SECTION | is a | TEXT | SECTION TYPE | providing the technical operators signature line text and / or other information.

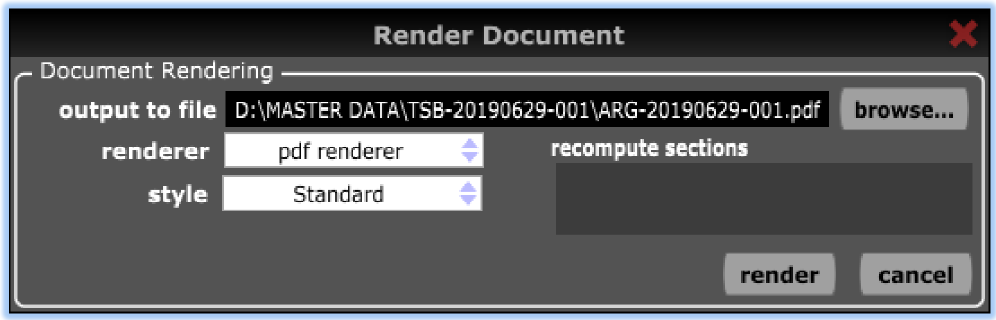


Text Section Type | v1.40xx

The entire process takes less than 5 minutes once the content for inclusion is defined within the | KESTREL FIELD REPORT (KFR) ™ |.

Render Document

Once the document is completely edited and ready to render, the technical operator presses the | RENDER | button to display the | RENDER DOCUMENT | dialog window.



Document Rendering | v1.40xx

The operator can accept the default file location or browse to select a custom file directory location for the rendered document, as noted in the above example.

The technical operator has named the output file as | ARG-20190629-001.PDF | and is placing the rendered output document within an existing Kestrel Project File (KPF) named | TSB-20190629-001 |.

Regardless of the operator defined location for the rendered report document, the support files will be placed in a directory named | REPORT | located within the Kestrel Project File (KPF) ™.

Files include the spectrum plot series, images (copies), photographs (copies), spectra plots (rendered), cache files, logos (copies), and other reference files resulting from the rendering process.

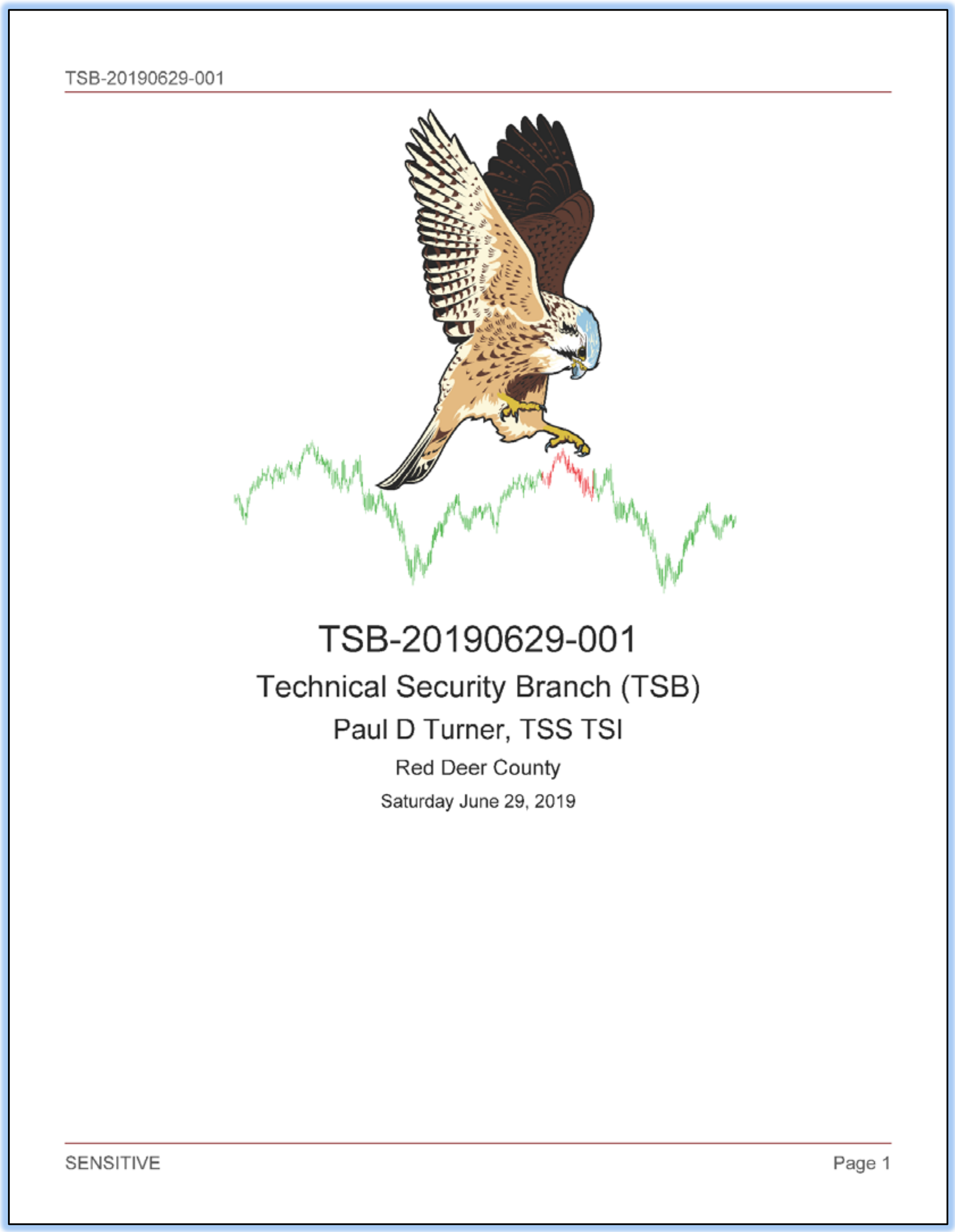
The | ARG ™ | does not in anyway alter or damage the original Kestrel Project File (KPF) ™ during the report rendering process.

Deleting the | REPORT | directory will remove all instances of the reporting support files and spectrum cache files allowing the technical operator a clean project file to start a fresh ARG ™ reporting process.

It is recommended that the technical operator maintain a master template file by saving a formatted | ARG ™ | report as a | KRA | file and export a | TXT | copy of the file from the | ARG ™ | dialog window. The | TXT | file contains all the markup formatting, as does the | KRA | file, however, the | TXT | file can be edited by the technical operator, where the | KRA | can only be edited within the | ARG ™ |application.

It is suggested that any logo files, etc., be stored in a directory with the | KRA | file.

The following is the derived rendered document output to | PDF | format.


TSB-20190629-001

TSB-20190629-001

Technical Security Branch (TSB)

Paul D Turner, TSS TSI

Red Deer County

Saturday June 29, 2019

SENSITIVE

Page 1

Rendered Report Cover Page | v1.40xx

TSB-20190629-001

1 | KESTREL FIELD REPORT (KFR)

1.1 | During the technical inspection the it was determined that the wireless network SSID is broadcasting the family name and is not encrypted. [1]

It is recommended that the client immediately change the SSID, enable security, and change the default administrative password and enable password protection for the wireless network.

1.2 | During the inspection it was determined that the client utilizes an analog cordless telephone [2] in the home office as well as a wireless keyboard.

It is recommended that the client immediately stop using the analog cordless telephone and keyboard in favour of hard-wired devices only given the concerns expressed relating to possible competitive intelligence activities.

1.3 | During the inspection our office observed damage and tampering to the side door locking hardware [3] and is an indication of a possible intrusion to the residence.

It is recommended that the client engage the services of a locksmith and have all locking hardware inspected and replaced as necessary.

1.4 | During the vehicle inspection a number of power wires were found taped under the driver side area near the OBD II port. Although nothing was connected to the wires, they were powered (12-volt) and are considered to be trace evidence of a possible tracking our surveillance device having been removed prior to the inspection.

It is strongly recommended that the client have the vehicle serviced to remove and or repair the wiring which poses a potential fire hazard.

[1] The SSID provides an appearance point for a potential network attack by persons unknown.

[2] Analog cordless telephones transmit without encryption and can be intercepted by persons unknown.

[3] There is evidence of human tempering of the locking hardware.

SENSITIVE Page 2

Rendered Section 1 | PDF | v1.40xx

2 | Technical Security Specialist (TSS)

The purpose of this field report is to allow the client an opportunity to consider any immediate action required recommendations prior to receiving the Final Inspection Report (FIR).

Regards,

Paul D Turner, TSS TSI

President | CEO

Rendered Section 2 | PDF | v1.40xx

In the next example, we will demonstrate the recommended methodology of utilizing the | Advanced Report Generator (ARG) ™ | to create a complex | FINAL INSPECTION REPORT (FIR) ™ | that encompasses all aspects of a technical inspection that meets or exceeds the requirements of the TSB 2000 (Technical Standard) ™.

Final Inspection Report (FIR) ™

The | TSB 2000 (Technical) Standard ™ | defines the recommended inspection report format for a competent technical inspection.

TSB Certified | Technical Security Specialists (TSS) ™ | are certainly free to customize the reporting format within the guidelines of the standard and define various aspects of reporting elements that may be unique to any inspection.

The reporting format is designed with flexibility and scalability across different types of inspection requirements and client types.

Each main section of the | FIR ™ | includes four (4) sub-sections | Introduction | Rationale | Findings and Observations | and | Recommendations | and becomes the foundation of a report that captures all aspects of a complex technical inspection.

The | INTRODUCTION | provides a general context and overview of the | SECTION | subject matter.

The | RATIONALE | provides context as to the importance of the | SECTION | subject matter.

The | FINDINGS AND OBSERVATIONS | provides a clear declaration of significant observed findings relating to a discovered compromise and observations that might suggest a future compromise.

The | RECOMMENDATIONS | sub-section provides a balanced mix of realistic recommendations designed to address findings and observations and to enhance the overall security posture.

Standards Based | Final Inspection Report (FIR)

The following is a well-defined | Final Inspection Report (FIR) ™ | template that would be used for typical medium and high threat level inspections for corporate and government level TSEC clients.

The < Title Page > provides a professional look and feel to the report and can include a company logo, sub-contractor logo, end-user logo, or a simple generic graphic image.

The < Project Statistics > section provides several automatically generated summary tables for inclusion within the rendered | FIR ™ | document that includes a | LIST OF LOCATIONS | LIST OF BANDS | SDR DATA | and | PROJECT STATISTICS |.

< Data Tables >

The < Table of Contents > section is an automatically generated feature that renders a fully numbered | TOC | within the document structure.

The < List of Figures > is an automatically generated feature that renders a fully numbered | LOF | within the document structure when an | IMAGE | SECTION TYPE | is inserted into the document structure.

The < Report Distribution Warning > section provides context for the end-users and other readers as to the sensitivity of the information contained within the report.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Legal Disclaimer > section addresses several legal, warranty, and responsibilities of the end-user with respect to the contracting of professional technical security services.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Survey Capabilities and Limitations > provides context to the end-user as to the realities of the many capabilities and limiting factors involved across timing, budget, equipment and experience.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Executive Summary > provides the end-user or other reader with a general non-technical overview and summary of the findings determined by the technical operator as determined by the completed inspection and provides enough detail for the client to determine with further study of the | FIR ™ | is necessary.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Reason for Inspection > section provides information and context as to threat level determination based on known and oftentimes unknown factors as provided by the end-user and ultimately determined by the technical operator.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Inspection History > section looks at the actual inspection history vs the recommended | TSEC | program implementation.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Detection Strategy > section introduces the general methodology, technology and technical operator strategy in deploying and identifying potential | Technical Security Devices (TSD) |, or | Technical Security Hazards (TSH) | and a range of additional trade-craft methodology that may be utilized by persons unknown during a targeted technical intelligence or espionage related attack.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Location and Geographical Area Review (GAR) ™ > is a threat assessment tool that looks at the geographical area (normally outside of the control of the end-user) from a competitive intelligence perspective, and completion of an external technical attack assessment, a radio-frequency analysis and critical infrastructure review.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Spectrum Analysis | Remote Spectrum Surveillance and Monitoring (RSSM) > section provides a comprehensive textual overview of the | Ambient RF Spectrum Environment | relative to the defined target area or facility.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Near-Field RF Energy Detection > section further defines the | Ambient RF Spectrum Environment | across critical and non-critical areas of the facility targeted for an elevated inspection criterion as defined by the | TSB 2000 (Technical) Standard ™ |.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Power Line Carrier (PLC) | Broadband Power Line (BPL) > section of the | FIR ™ | provides an in-depth overview of the powerline grid inspection from utility to local distribution, including an assessment of unintentional radiators such as occupancy-based resources.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Infrared (IR) Modulation | Visible Light Modulation (VLM) > section describes the evolving optical threat and the inspection criteria delivered during the inspection to detect and identify on-demand intermittent deployment of several optical interception methods.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Audio Acoustic Leakage (AAL) > section looks at the facility structure and susceptibility to room audio transfer across adjacent occupied space and uncontrolled space outside of the control of the client.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Active Microphone Detection (AMD) > section of the report provides context as to the number and type of microphones often found within the defined target area and methodology for the detection of hostile audio intercept.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Video Transmitter Detection > section defines the detection and identification strategy for the presence of covert video transmitters.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Computer Network Infrastructure (CNI) | Cyber Security Review (CSR) > section defines the nature and extent of the | CNI | and | CSR | review of the network riser cabling, equipment and network mapping.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Emanation Security (EMSEC) | Unintentional Radiators > section looks at shielding, grounding and unintentional emissions from network, telecommunication and occupancy-based resources within the target area, including audio visual equipment.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Telecommunication Network Analysis (TNA) > section provides an analysis of the telecommunication hardware vulnerabilities and identifies undocumented feature sets that can be utilized to intercept voice communications.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Telephone Equipment (VoIP) (PBX) > section looks at the actual network type and equipment utilized within the target area and identifies any vulnerabilities and by design compromises.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Wireless Technology Review (BLUETOOTH) (WIFI) (5G) (DECT 6.0) (ZIGBEE) > looks at a wide range of common technologies that are often utilized in building facilities management, outside of the control of the client.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Architectural Floor Plan Review > section provides for a review and analysis of the flow of the facility and the security zoning in-place to limit or restrict the free movement of persons unknown, once the perimeter is breached.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Physical Security Posture > section of the report attempts to validate the overall security posture of the facility, internal and external, as well as human factors that play an essential role in a strong physical security presence.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Non-Linear Junction Detection (NLJD) > section provides general information about the capabilities and limitations of NLJD technology and the extend of the NLJD survey conducted relative to the target area.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Threat Evaluation and Analysis > section is provide a balanced approach to establishing the true threat level in the face of oftentimes limited information provided by the end-user as to the real concerns or known threats of incidents, for which the technical operator must read between the lines and rely on the actual technical assessment results to determine the perceived threat level relative to the | TSB 2000 (Technical) Standard ™ |.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Thermal Imaging Review > section explains the thermal imaging role within a | TSEC | inspection and outlines the findings of the thermal imaging survey.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Counter-Intelligence (CI) Review > section looks deeply into the established threat level to accurately develop a working | CI | strategy and threat assessment for the facility, geographical location, media interest, political factors and many other threat indicators for both an insider and targeted external compromise.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Access Control Review > section provides real-world metrics as to the effectiveness of electronic access control hardware, practices and procedures, including physical security personnel.

< Introduction > < Rationale > < Findings and Observations > < Recommendations >

The < Photographic Recommendations > section provides actual photographic content to support key recommendations for visually observable deficiencies as noted by the technical operator.

The < Spectrum Verification and Management > section addresses the key methodology utilized to evaluate the | Ambient RF Spectrum Environment (ARFSE) ™ | within a modern moving target threat model utilizing | Location Differential Signal Analysis (LDSA) ™ |, | Time Differential Signal Analysis (TDSA) ™ | and | Receiver Differential Signal Analysis (RDSA) ™ | techniques.

The < Certification > section is a declaration of the facts and findings to the best of the technical operator's knowledge and experience based on the information provided by the end-user and the on-task findings.

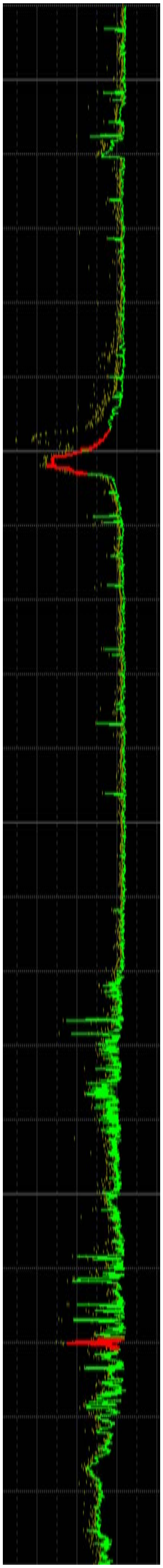
The < Ambient RF Spectrum Plots > section provides a complete project level rendering of all spectrum plots utilizing advanced analytical display criteria, producing full and unequivocal evidence of the | Ambient RF Spectrum Environment (ARFSE) ™ | across the entire Range of Interest (ROI).

< Introduction > < RTE vs PEC > < PEC vs SAT > < MIN-MAX REF vs ANF > < WFD vs TIME >

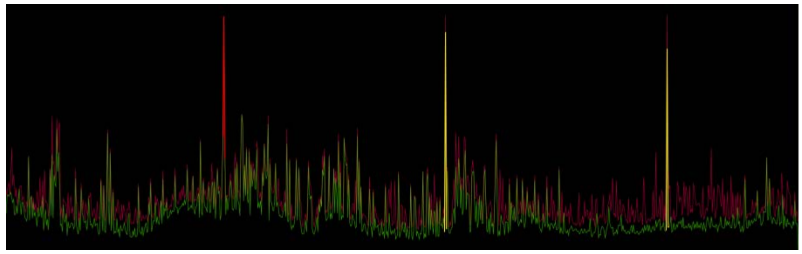
The < Automatic Threat List (ATL) | Tables > section provides significant signal level detail in the form of | ATL | reference data tables.

< Reference Data Tables >

Intentionally Left Blank



Chapter 19



Dynamic Trace Autonomous Platform (DTAP-GPS) ™ | OPT DTAP

Innovation is Simply the Beginning...

Review and Revision: 2020-04-21

Dynamic Trace Autonomous Platform (DTAP)

The Kestrel TSCM ® Professional Software | Dynamic Trace Autonomous Platform (DTAP-GPS) ™ is yet another essential technology achievement and milestone in the on-going development of our powerful | Tap Capture Plot (TCP) ™ | OPT TCP feature.

This incredible new capability has proven to be a very popular TSCM resource, and many professional technical operators worldwide have provided significant input and have requested an even more powerful capability to round out the geo-location heat mapping capability currently existing within the software application on several levels.

With our dimensional propagation visualization modeling that develops before your eyes in real-time, we have raised the industry bar yet again; bringing a fully autonomous capability to this powerful geo-location heat mapping feature with our DTAP-GPS ™ feature that allows the fully autonomous capture of wideband spectrum across our highly evolved multiple | Location Differential Signal Analysis (LDSA) ™ | resource, all on a single mobile deployed SDR radio.

The DTAP-GPS ™ resource can be deployed in a portable or mobile configuration for use in a backpack, vehicle, marine vessel, aircraft, helicopter, UAV, or spacecraft for virtually any mission specific application by the technical operator.

The Kestrel TSCM ® Professional Software has achieved this so-called lofty and admirable goal, introducing the first generation of | Free Space Dimensional Spectrum Propagation (FDSP) ™ | modeling that amazingly develops before your eyes in real-time during both operator assisted and autonomous operation via remote system access!

This powerful capability provides an entirely new level of sophistication allowing the Kestrel ® TSCM Professional Software enabled platform to capture full band channelized spectrum for real-time display as a geo-location heat map, complete with our advanced | RF Visualizer (RFV) ™ | technology to display real-time RF propagation modeling across any channelized Signal of Interest (SOI).

The mighty Kestrel ® has always been a high-flier with leading-edge technology that can now be utilized fully autonomously in a backpack configuration to build a covert heat map across government sites, large campuses, airports, military bases, private property, city blocks, or even and entire city, heat mapping <u>all</u> RF energy sources, including hostile emitters and unintentional radiators that might otherwise go undetected or identified.

Autonomous Geo-Location Heat Mapping

DTAP-GPS ™ is a specialized RF propagation modeling resource extension of our existing manually deployed | Tap Capture Plot (TCP) ™ | capability.

DTAP-GPS ™ provides a fully autonomous GPS enabled geo-location heat mapping process for ground mobile, air and space applications.

DTAP-GPS ™ can dynamically update interactively with a network enabled real-time moving map utilizing (Map Quest) technology, or can operate across an imported static reference map image or without a network connect during the collection process.

DTAP-GPS ™ is utilized to capture and plot a wide search Range of Interest (ROI) bandwidth based on our LDSA ™ capture technology of the ambient RF spectrum environment across any hardware Range of Interest (ROI).

The ability to include multiple bands of interest, such as control and talk channels, up-link and down-link spectrum blocks, is fully supported down to the channel level.

The ability to autonomously render a powerful geo-location heat mapping process across any captured bandwidth down to the channel level in both real-time and during post analytical analysis is now a reality with the optional DTAP-GPS ™ feature enabled.

Our operator centric control group simplifies the setup parameters and the field deployment of the DTAP-GPS ™ feature, allowing the capture process to be | PAUSED | and | RESTARTED | during the mission as required.

DTAP-GPS ™ | **One-Touch** ™ Technology

Once the DTAP-GPS ™ feature is programmed by the operator, our **OneTouch** ™ technology engages a fully autonomous collection process allowing the technical operator to provide 100% focus on walking (backpack), driving (mobile) or flying (airborne), totally hands-free and hands-off.

This is an essential feature to prevent distractions during operational deployment of the DTAP-GPS ™ platform.

The entire captured process can later be reviewed historically during post analysis, as all significant data is captured and written to storage in real-time during runtime.

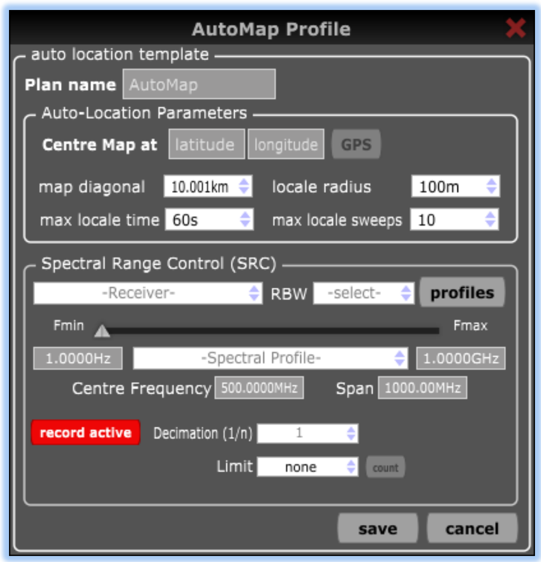
AutoMap Profile

The | AutoMap Profile | control group provides an interactive operator centric programming dialog window where the captured initial GPS coordinates become the center of a dynamically generated moving map that is pulled into the application via a mobile wireless 4G | LTE (recommended) network link.

The | AutoMap Profile | control group is accessed by pressing the | New DTAP Map | button within the | Antenna Locations TCP DTAP | window.

The technical operator can define a customized | AutoMap | plan name consistent and descriptive of the actual mission parameters or accept the default < AutoMap >.

GPS coordinates can be derived from a generic GPS Rx, some wireless modems and / or some SDR hardware that have GPS on-board capability.



AutoMap Profile | v1.40xx

Auto Location Template (Programming)

There are currently four (4) DTAP-GPS ™ programming parameters that will need to be considered and defined by the technical operator in preparation for field deployment.

These include | Map Diagonal | Locale Radius | Max Locale Time | and | Max Locale Sweeps |.

Map Diagonal | (Default 10 km) references the initial (width) of the dynamically generated network-based moving map rendered via (Map Quest) and is based on the current (active) GPS coordinates.

The | Map Diagonal | selection is a function of the intended mission parameters and should be setup for the resolution expectation of the technical operator.

If the mission should move off or outside of the defined | Map Diagonal | the map will automatically update based on the existing (initial) map diagonal settings.

Locale Radius | (Default 100 m) references the distance that must be made good with reference to the GPS coordinates before the next autonomous | AutoMap | location is automatically rendered, triggering a new location within the LDSA ™ module.

The center of each | Locale Radius | defines a fresh (non-overlapping) reference point based on the operator defined value initially set (or as ultimately modified) by the technical operator during deployment.

It is recommended that smaller | Locale Radius | values (such as 20 meters) be utilized for walk-about (backpack) deployment and for localized target areas.

However, it is essential to understand that GPS accuracy will likely have an impact on the capture process when set for 20 meters given localized GPS errors, selective availability and other possible signal metrics.

Max Locale Time | (Default 6o Sec) references the maximum time of collection relative to the current | Locale Radius | value selected by the technical operator and works in conjunction with the | Max Locale Sweeps | setting as defined by the technical operator to determine which limit achieves priority status to stop the current capture of spectrum data.

Max Locale Sweeps | (Default 10) references the maximum number of captured sweeps based on the | Locale Radius | value selected by the technical operator and works in conjunction with the | Max Locale Time | setting as defined by the technical operator to determine which limit achieves priority status to stop the current capture of spectrum data.

The value selected for the | Max Locale Sweeps | can have a significantly positive or negative effect relating to peak memory management and overall file size.

In reality, it does not take a lot of spectrum capture in many instances; for example, when heat mapping continuously active signals such as wireless down-links and broadcast related emitters, capturing 10 to 25 traces is likely more than sufficient for the intended purpose and should produce good geo-location heat mapping results.

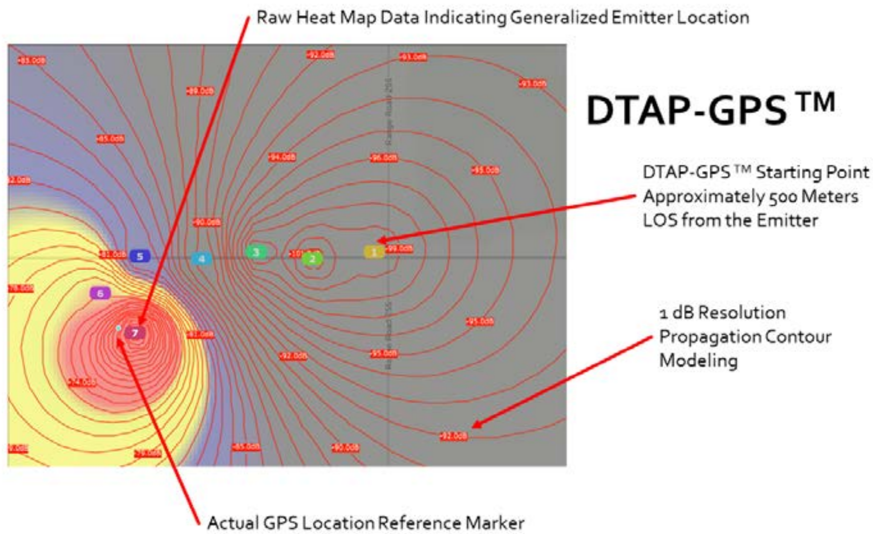
However, when the mission is to capture more illusive signal types or periodic emitters, such as possible interference sources, more trace capture and or capture time will likely be required to achieve a satisfactory result.

Auto Map | Reference Level Off-Set (RLO) ™

Our unique | Reference Level Off-Site (RLO) ™ | capability provides the means to radiometrically fine tune the displayed heat map.

This feature is an essential element in achieving a tight localization and heat map focus that is based on the raw spectrum data captured via the Location Differential Signal Analysis (LDSA) ™ module.

This capability is achieved by the technical operator defined | Reference Level Off-Site (RLO) ™ | capability.



AutoMap Geo-Location Heat Map | v1.40xx

This powerful resource is truly the heart beat of the DTAP-GPS ™ feature bringing absolute focus and clarity to the visualization process.

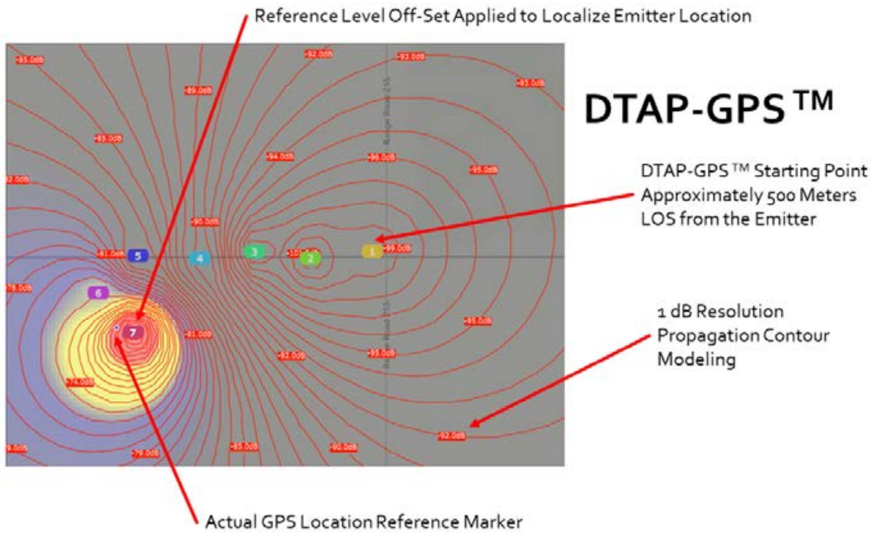
The technical operator can dynamically alter the < upper > and < lower > reference level values to better visualize rendered propagation modeling.

When the upper reference level (weakest signal level) value is moved from the maximum (software default) the effect removes the focus from the lowest dB levels displayed across the rendered heat map, which in turn gives enhanced focus to the (strongest signal level) localizations, pinpointing the anticipated emitter localization from a geo-location heat mapping perspective.

The effect of this action provides visual focus on the strongest instances of the Center-Frequency (CF) + Bandwidth (BW) under observation as defined by the technical operator.

The above image reflects the raw heat map data generated by the DPTAP-GPS ™ algorithm as initially displayed on the moving map.

It would be rather difficult to localize the emitter in an area that might prove to be a Kilometer square from a signal propagation perspective (or perhaps even larger) depending on terrain, emitter power level, and emitter elevation without the advantages of the | Reference Level Off-Site (RLO) ™ | feature.

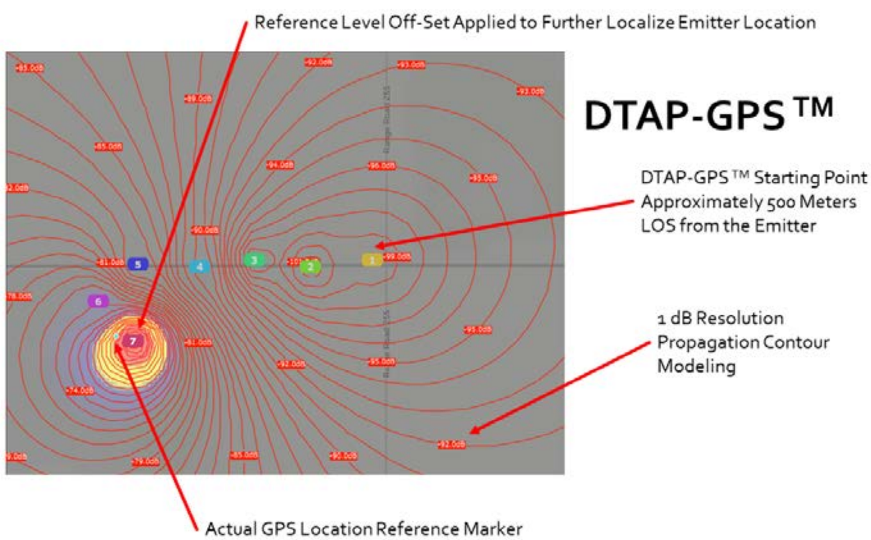


AutoMap Geo-Location Heat Map | v1.40xx

Utilizing the | Reference Level Off-Set (RLO) ™ | feature, it is possible to maximize the heat map focus to pin-point the most likely (strongest) signal emitter location.

The technical operator will need to determine the best RLO ™ settings relative to the mission parameters.

The above image illustrates the advanced capability to bring localization of the emitter to a representatively smaller geo-graphical area.



AutoMap Geo-Location Heat Map | v1.40xx

Utilizing the | Reference Level Off-Set (RLO) ™ | to localize the emitter even further is illustrated above, providing exceptional clarity as to the emitter location.

The current GPS coordinates are indicated by a | GPS Location Reference Marker | (mouse hover pop-up) displayed on the moving map overlay, which can be used to determine the actual position with reference to the emitter or signal source location.

Geo-Location Heat Mapping Analytics

Understanding how to correctly interpret the Kestrel TSCM ® Professional Software Single Radio Operation (SRO) ™ geo-location heat map and RF Visualizer (RFV) ™ technology is a relatively easy and straight-forward task assuming that the technical operator ensures that a sufficient number of | TCP ™ | or | DTAP-GPS ™ | < auto locations > are populated uniformly across the operator defined | Functional Target Area (FTA) ™ | of interest depending on which mode of operation is utilized.

However, operationally, this may pose a number of unique operational challenges due to the amount of time-on-target, actual area covered, target area accessibility and other occupancy-based isolation and propagation factors such as terrain and a wide range of propagation related factors, generally beyond the technical operator's control.

The same interpretive concepts equally apply to the geo-location heat mapping process associated with the | Dynamic Trace Autonomous Platform (DTAP-GPS) ™ | where physical barriers (natural and man-made) may impede or preclude operator assisted and autonomous capture of relevant spectral data.

An awareness of the likelihood of unanticipated propagation ambiguities is essential during the mission planning process and need to be taken into consideration at each step of the analytical process.

They don't call you a Spectrum Warrior for nothing!

Functional Target Area (FTA) ™

The | Functional Target Area (FTA) ™ | is new Kestrel ® terminology and representative of a modern moving target threat model standard, described as the symbiotic distance-focused < auto locations > that are uniformly and within reason, equally spaced across the entire internal occupied target area and by means of a baseline oriented external perimeter reference capture surrounding and adjacent to the target area, to the extent of any significant ambient RF influence relative to propagation modeling rendered.

In short, is the signal emanating from an external source or is the emitter internal when TCP ™ is the deployment mode of operation. If working on the ground floor, this rarely becomes and issue, however, how do you achieve external capture outside around a 45-story facility.

It is essential to remember that the FTA ™ is always larger than the technical operator defined target area.

When sufficient < auto location > coverage is obtained across the operator defined FTA ™, the resulting heat map and RF propagation modeling rendered, will be extremely accurate and easy to interpret visually and analytically.

However, where collection gaps exist across the FTA ™ < auto location > positioning dataset, the rendering of the heat map may include interpolated propagation modeling discontinuities, which will need to be interpreted by the professional technical operator or analyst.

This interpolation modeling is mathematically accurate; however, heat map interpretation may be required to avoid any apparent discontinuities present as a result of capture voids or an absence of a 360-degree ambient external spectrum baseline.

This interpretation process is more of an experience-based awareness on the part of the technical operator when certain identifiable regions of the geo-location heat map seem to be out of synchronization with the overall heat map rendering and will generally be obvious to the technical operator.

An example illustrating this interpretation requirement might be the result of an intermittent or time-periodic Signal of Interest (SOI) that does not appear consistently at all < auto locations > or equally across the geo-location heat mapping process.

A signal event might only appear once across the collection period, or at one (1) specific location, providing a heat map hot spot that may not necessarily be representative of the actual signal localization as indicated.

Even though the signal level and heat map are correct by the mathematical propagation modeling, the heat map may prove deceptive visually as represented on a high-contrast heat map and will need to be investigated further, and definitive conclusions will need to be reached by the exceptionally well-trained Spectrum Warrior.

This is a totally normal situation from an operational standpoint and therefore taking the time to define the FTA ™ prior to employment, is time well spend and realizes significant benefits.

In another similar situation that will require a level of interactive interpolation by the technical operator can occur when collection gaps exist across the captured < auto location > positioning data set.

This situation can occur when the technical operator does not have access to certain areas of the target facility or occupied space (including external space not occupied or controlled) by the client in order to obtain a uniform capture based on the | Functional Target area (FTA) ™ | methodology.

Practical Interpretation

The following geo-location heat map examples and contextual descriptive interpretations, provide analytical visualizations that form the foundation of both TCP ™ and DTAP-GPS ™ geo-location heat map plots as captured in a real-world operator defined Functional Target area (FTA) ™.

The geo-location heat map image below represents the captured distributed RF energy and propagation modeling across a 5 MHz bandwidth centered at 2.3262 GHz.

The current algorithm utilizes < Inverse Square Weighting > with a < 1 dBm > propagation contour modeling enabled.

A total of < 14 > TCP ™ < auto locations > represent the internal capture points across the < 9 kHz to 6 GHz > Range of Interest (ROI) with < 100 > traces captured at each of the < 17 > (internal and external) < auto locations > requiring approximate 23 seconds of capture time at each < auto location > reference point.

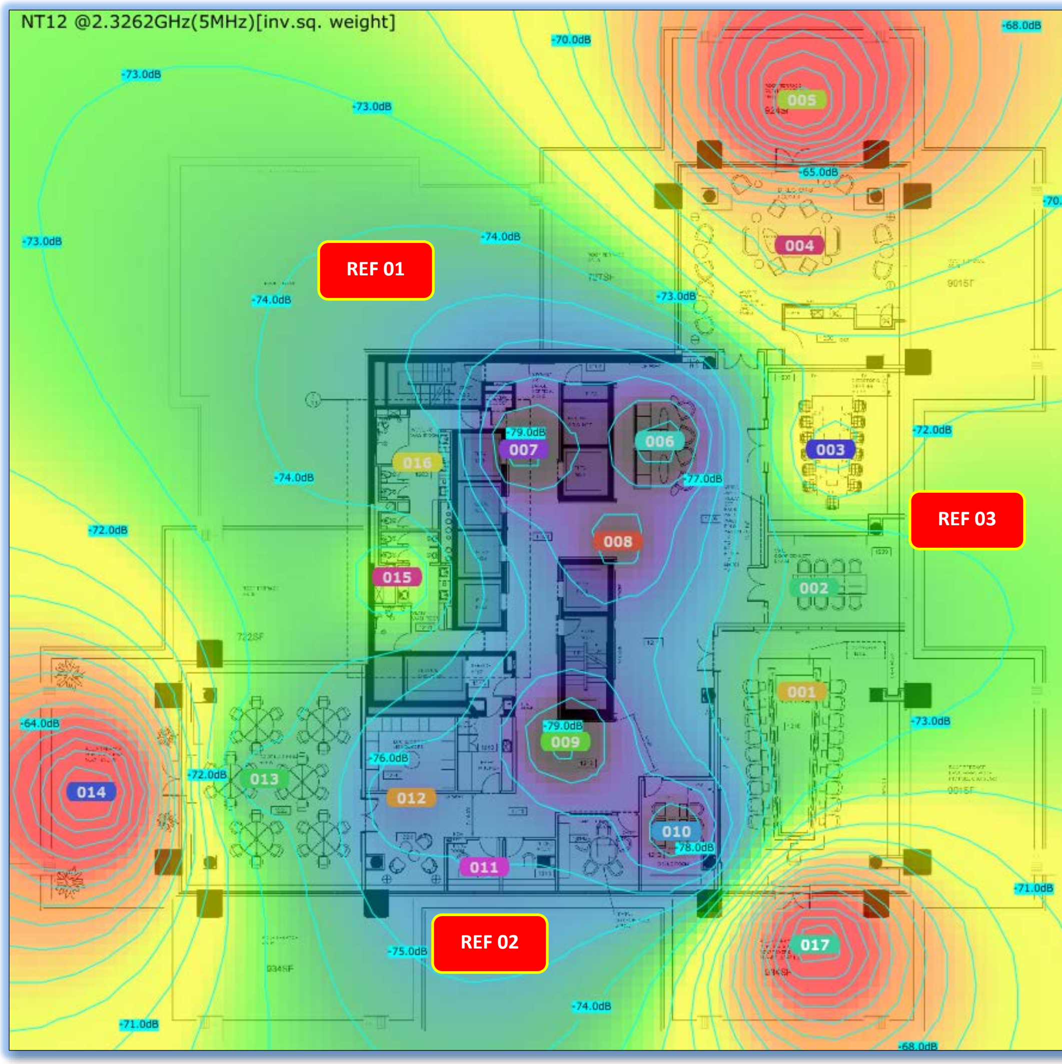
A total of < 3 > < auto locations > < 005 > < 014 > and < 017 > represent the external baseline capture reference plots, clearly showing the importance of plotting the energy patterns externally to the defined target area (occupied) space.

From an operator interpretation perspective, it is clear that the energy power levels are strongest for the externally captured < auto locations > with the strongest signal detected at < -59 dBm > at < auto location > < 005 >.

Clearly, the Signal of Interest (SOI) is emanating from this direction outside the facility and the emitter is in-fact external to the | Functional Target Area (FTA) ™ |.

Signal levels are consistently lower in realized power density within the core of the facility providing further evidence that this SOI is originating from outside of the facility.

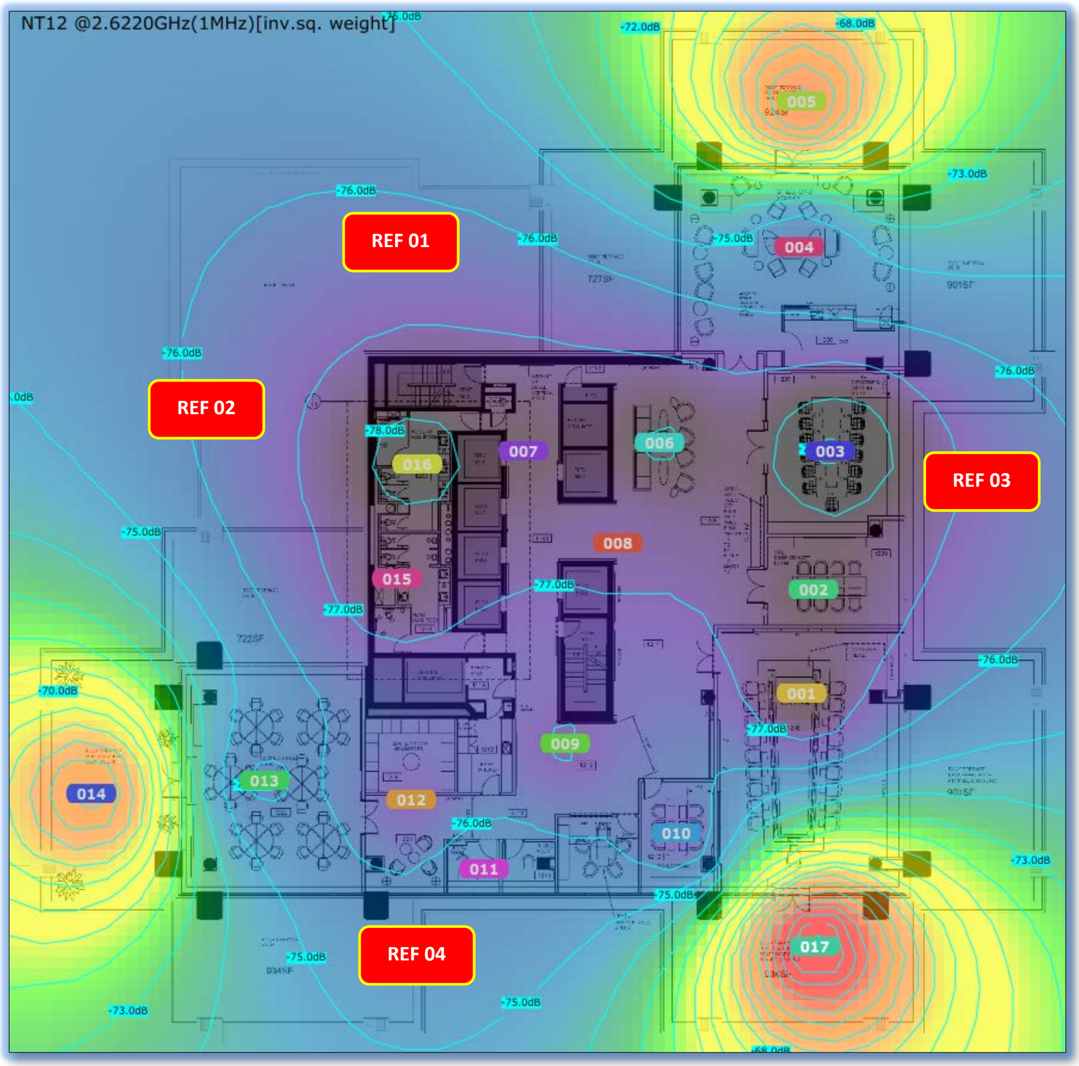
The added markers < REF 01 > < REF 02 > and < REF 03 > are external reference areas of the | Functional Target Area (FTA) ™ | that would have provided additional clarity to the geo-location heat map process had these locations been accessible to the operator during the TCP ™ capture process as illustrated in the heat map example below.



Heat Map | v1.40xx

The | Functional Target Area (FTA) ™ | is located on the 12th floor of the facility and in part is inaccessible to the collection process resulting in the need for technical operator interpolation of the visualization, and some analytical evaluation of the overall heat map rendering is required.

It was possible to capture spectrum outside of the immediate target area due to roof level terraces, indicating the immense value of capturing spectrum external to the operator defined target area as part of the | Functional Target area (FTA) ™ | methodology, as illustrated in the example below, similar to the first plot, but illustrates a Signal of Interest (SOI) centered at < 2.6220 GHz > across a < 1 MHz > bandwidth.



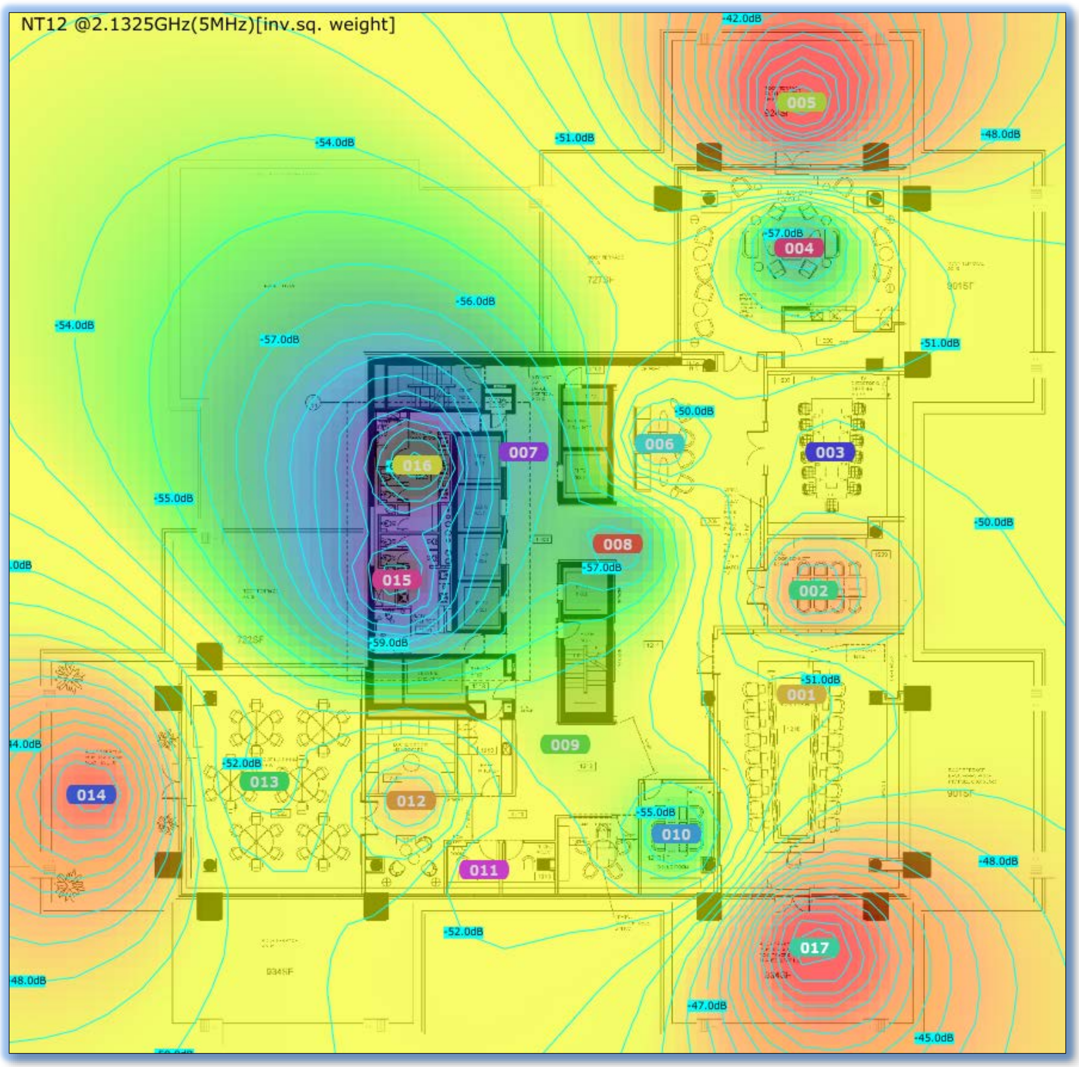
Heat Map | v1.40xx

It is clear that the SOI is originating from outside the facility given the distributed power levels at < auto locations > < 05 > < 14 > and < 017 >.

In this example | Reference Level Off-Set (RLO) ™ | technology was utilized by the technical operator to enhance the resulting geo-location heat map visualization and focus.

It should be understood that the noted signal is present within the operator defined target area at a lower power level than the perimeter of the target area and exterior collection < auto locations > at -78 dBm and therefore, from a wireless perspective is more than sufficient for a useable LTE DL signal.

The geo-location heat map visualization and focus described within this example, would benefit from additional external < auto location > capture positioning at the added markers < REF 01 > < REF 02 > < REF 03 > and < REF 04 > had these locations been physically accessible to the technical operator providing additional clarity across the heat map in the above image.



Heat Map | v1.40xx

In the above illustrated example, the geo-location heat map plot is centered at 2.1325 GHz across a 5 MHz bandwidth, representative of the internal and external propagation modeling in the presence and influence of a building level picocell (cellular base station repeater) such as a 4G | LTE repeater system.

Coverage is fairly uniform across the operator defined target area with the exception of the washrooms located behind the elevator shafts.

The < auto location > positioning for < 015 > and < 016 > are representative of a propagation void due to the lack of windows within the washrooms, which are also somewhat isolated away from the influence of a 4G | LTE Picocell repeater antennas and shielding effect of the elevator shaft structure.

The realized distributed RF power levels are definitively stronger at < auto locations > < 005> < 014 > and < 017 > as these are external capture points.

The in-building picocell repeater system is providing a relatively uniform representative power density across the | Functional Target Area (FTA) ™ | aside from the washroom and elevator structures, which are displaying more pronounced attenuation factors.

Had the operator been able to capture behind the washroom area, the visualization would have been refined to show the propagation void to the washrooms and the stairwell. The technical operator needs to understand the interpretive value of selecting the appropriate algorithm, displayed signal bandwidth, propagation contouring model and the use of | Reference Level Off-Set (RLO) ™ | values, to achieve the desired heat map visualization for the intended mission critical deployment objective.

The ability of the technical operator to utilize advanced visualization features to enhance the overall Probability of Detection (POD) is an essential practice within a modern moving target threat model as defined by the TSB 2000 (Technical) Standard ™.

DTAP-GPS ™ Real-Time Moving Map

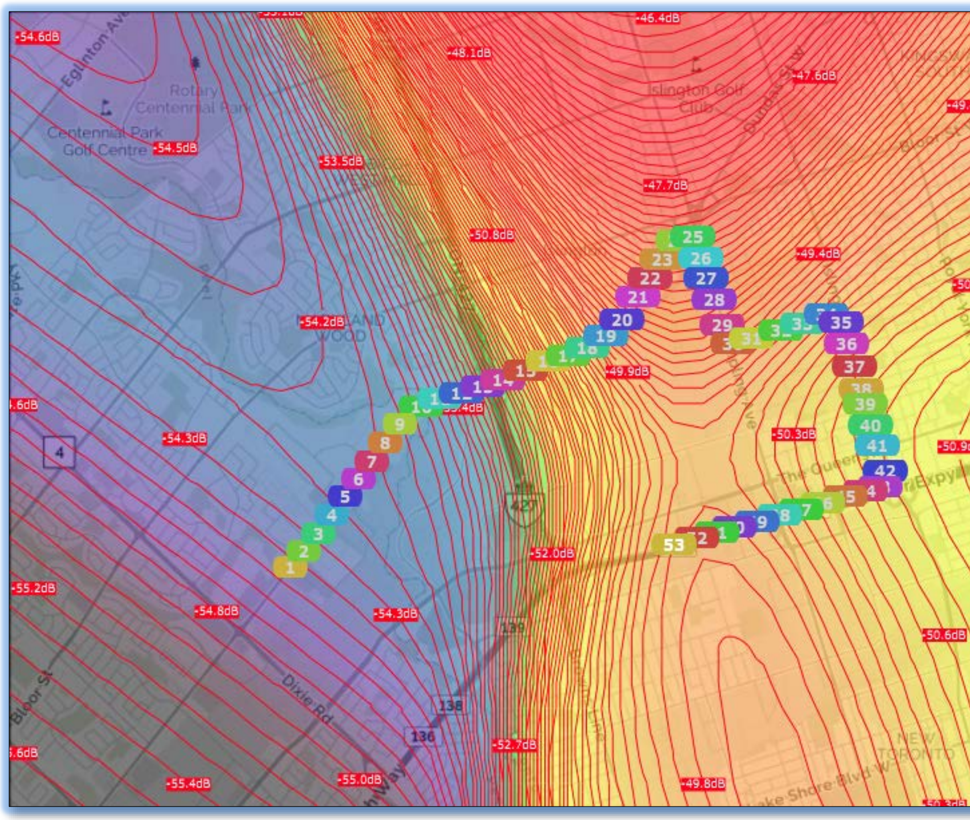
The next two (2) example includes the DTAP-GPS ™ propagation modeling across a wide geographical area, and clearly defines the 4G | LTE coverage pattern across two (2) separate bands.

The first geo-location heat map example below displays coverage with respect to a highway corridor and the second heat map plot represents the use of algorithmic variance to better represent the propagation modeling, and the third plot represents a more uniform wide area coverage in another band or frequency range.

The unique capability of the Kestrel TSCM ® Professional Software to capture complex spectrum data utilizing Single Receiver Operation (SRO) ™ across a wide | Functional Target Area (FTA) ™ | and wide frequency Range of Interest (ROI) with full support and integration within our existing | Location Differential Signal Analysis (LDSA) ™ | feature enhances every aspect of mission critical TSCM | SIGINT requirements.

Perhaps one of the most important aspects of the TCP ™ and DTAP-GPS ™ process is the powerful | RF Visualizer (RFV) ™ | propagation modeling display sensitivity, which can be operator defined, ranging from 10 dB all the way down to 1/10 dB over any size of geographical area.

Our innovative | Reference Level Off-Set (RLO) ™ | technology and ability to select any center frequency and analytical bandwidth provides never before realized capability.



DTAP-GPS ™ | v1.40xx

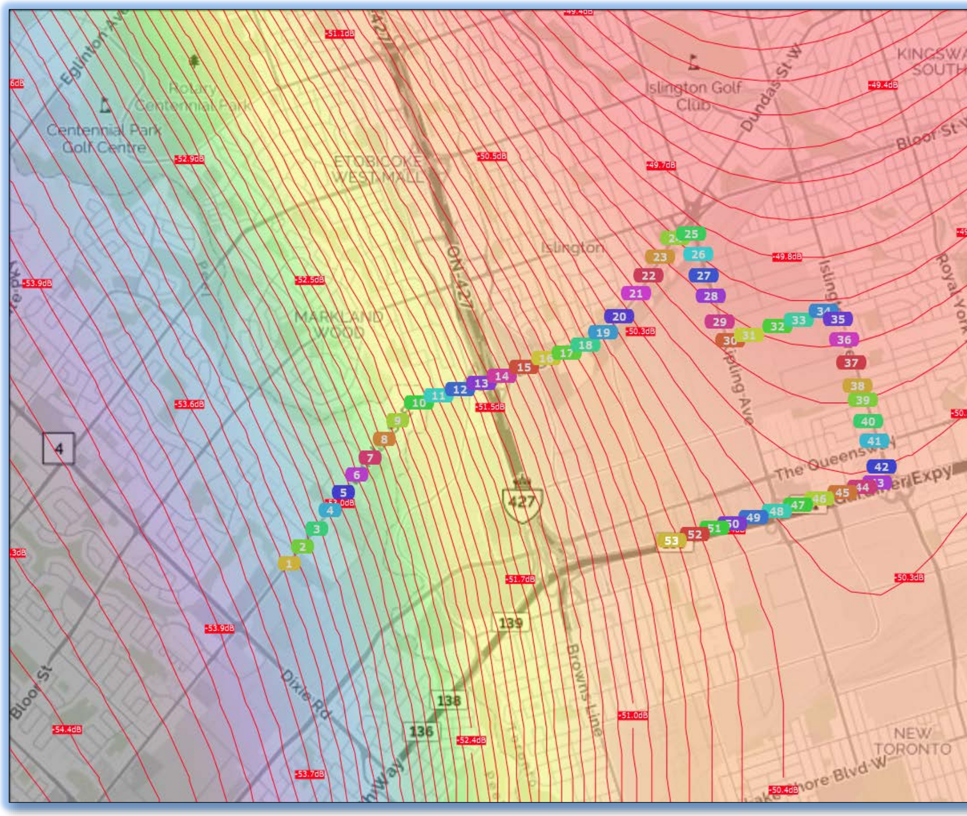
Our ability to visualize complex RF propagation modeling, interactively under the direction of the technical operator has disruptively advanced TSCM field deployment years ahead of competitive products.

Our commitment to new scientific research and an experienced-based approach to understanding the requirement for a modern approach to active threat modeling has resulted in innovative milestone achievements in new disruptive technology.

The Kestrel TSCM ® Professional Software is an advanced TSCM specific resource for professionals who recognize the limitations of general-purpose spectrum analyzers and are looking to significantly advance Probability of Detection (POD).

Powerful new functionality resulting from the | RF Visualizer (RFV) ™ | resource and exposed operator controls, allow the technical operator to take charge of the mission and the analytical process and for the first time, overcome years of by design-imposed limitations.

With Kestrel ® RF Visualizer (RFV) ™ technology the technical operator can finally see they have been missing.



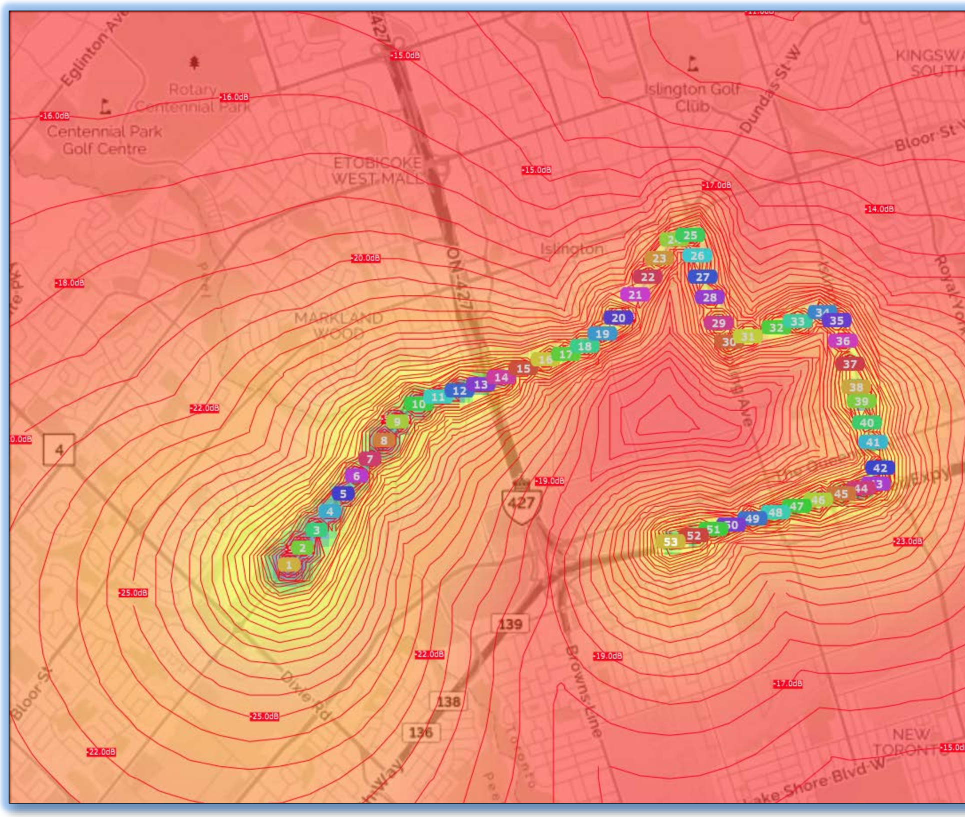
DTAP-GPS ™ | v1.40xx

The use of wide area algorithmic variance provides enhanced clarity for the geo-location heat mapping process across the DTAP-GPS ™ defined area, in combination with our advanced Reference Level Off-Set (RLO) ™ capability.

Our geo-location heat mapping feature can be deployed manually and autonomously as conditions and circumstances change during mission critical deployment.

Aside from the obvious TSCM and SIGINT applications, the telecommunications industry wireless carriers, spectrum regulatory entities, airport authority, municipal, provincial, federal and state government offices, military bases and facilities, special event coordination, interference analysis and localization, law-enforcement, tactical and protective operations, (defensive and offensive), all benefit from actionable RF intelligence captured and exploited by the national security apparatus under the **Kestrel-net ™** umbrella.

Whether the TCP ™ or DTAAP-GPS ™ system is backpack carried, vehicle, air, or space deployed, the ability to capture, the complete picture raw data for analysis is fully supported across a standards-based post capture analytical visualization process.

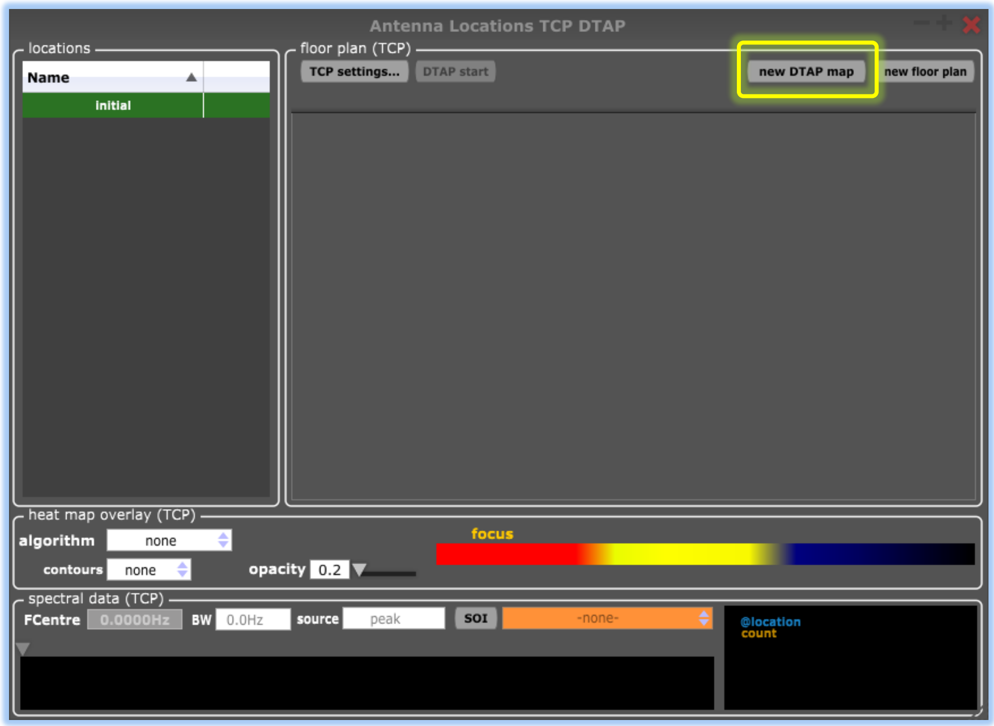


DTAP-GPS ™ | v1.40xx

The | Antenna Locations TCP DTAP | workspace provides full control of the setup and collection process and the operator need not venture away from this screen until the mission is complete.

The DTAP-GPS ™ setup process assumes that both an active GPS signal is present and a suitable wireless network connection are available.

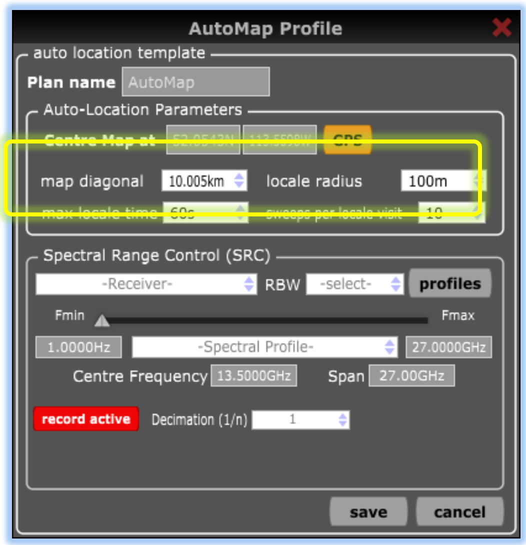
The setup wizard | Project Description | details is all that is required to begin the setup process.



Antenna Locations TCP DTAP | v1.40xx

The first step in the process is to select the | NEW DTAP MAP | button highlighted in the image above.

This action invokes the | AutoMap Profile | display as illustrated below so that the technical operator can input the necessary parameters.



AutoMap Profile | v1.40xx

There are two (2) essential components that need to be defined by the technical operator within the | Auto Location Template | once an optional | Plan Name | has been provided.

The | Auto Location Parameters | provides the DTAP-GPS ™ mission critical command and control criteria.

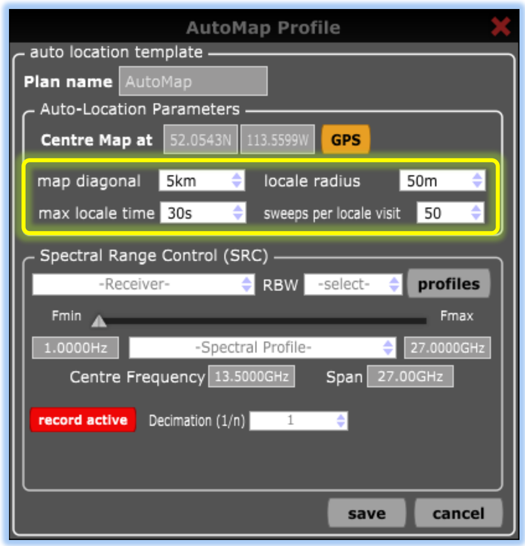
The | Spectral Range Control (SRC) | provides the ability to assign operator defined spectrum capture parameters.

The GPS button should be orange indicating that an active GPS signal is present and the Latitude and longitude will be displayed as invoked in the setup wizard.

The map will be centered at these coordinates as a starting position within the DTAP-GPS ™ process.

The technical operator can accept the defaults or define custom values for the | Map Diagonal |, | Locale Radius |, | Max Locale Time | and | Sweeps per Locale Visit |.

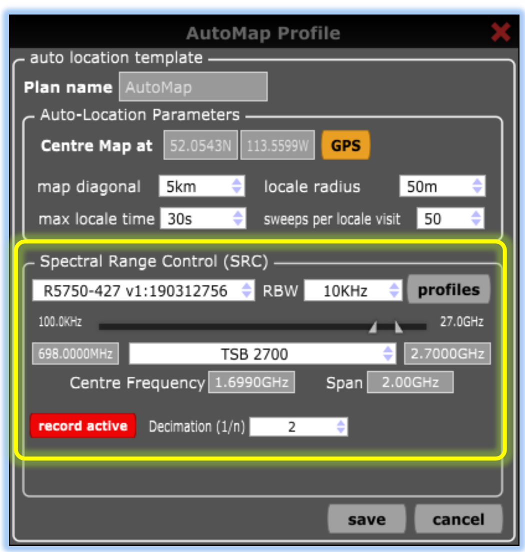
The defaults are illustrated in the above image and the operator defined values are illustrated in the image below.



AutoMap Profile | v1.40xx

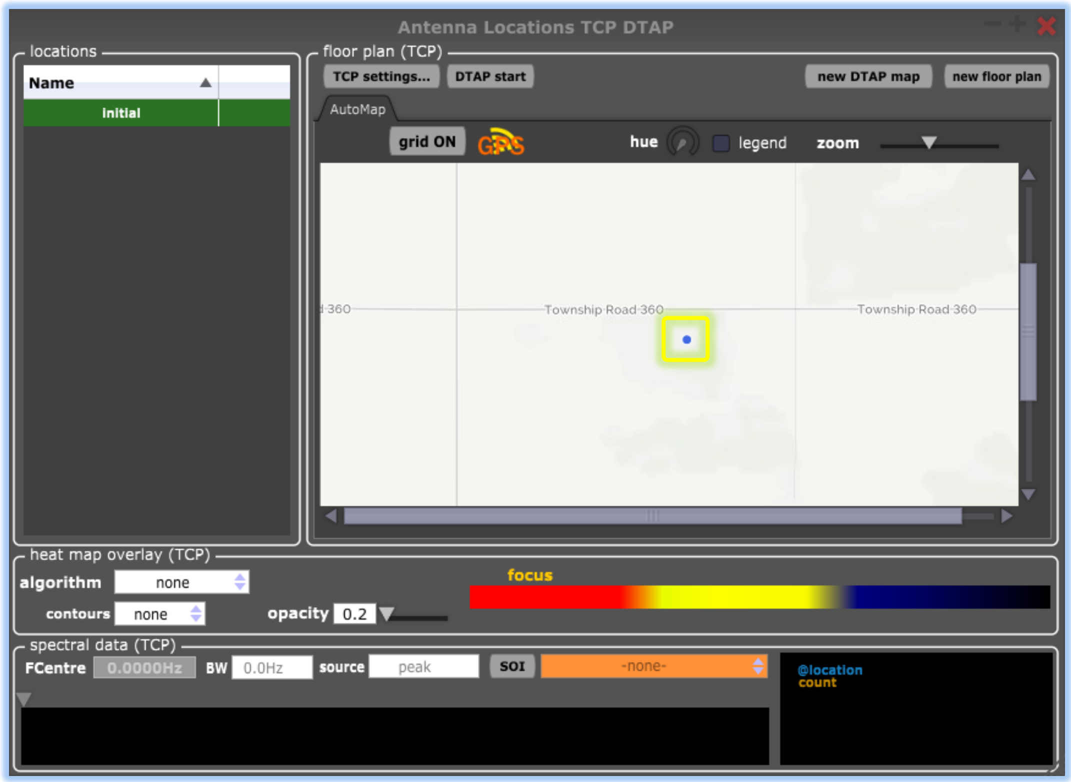
Next, define the SDR radio and spectrum capture parameters within the | Spectral Range Control (SRC) | as illustrated below.

This is the final setup step and once all settings are confirmed; the technical operator can press the save button to activate the | AutoMap | process.



AutoMap Profile | v1.40xx

The | AutoMap | will load and display, based on the GPS coordinates and other criteria as defined by the technical operator and a flashing (dot) marker will display indicating the current GPS location as highlighted below.



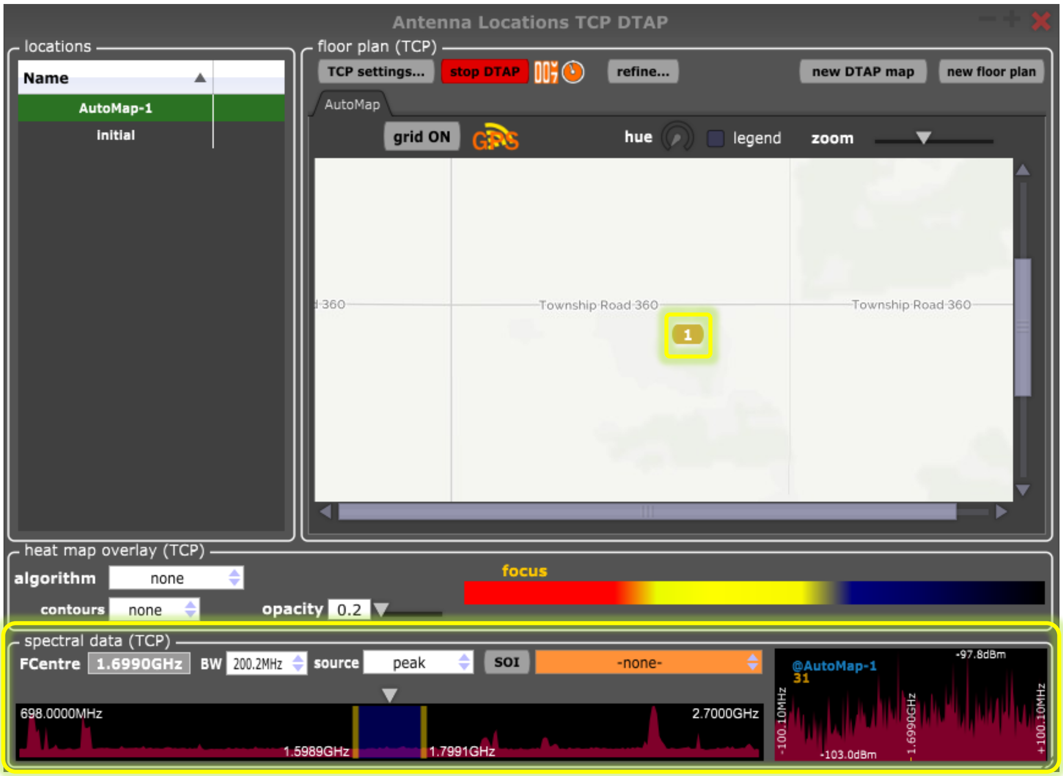
DTAP AutoMap Display | v1.40xx

Once the technical operator is positioned and ready to proceed with the actual deployment, the | DTAP Start | button can be pressed to create the first < AutoMap > location and initiate RF capture for the initial capture point.

From this point forward, the process is autonomous and will respond to the time and GPS coordinate based locale settings as established during the setup process.

Once the parameters are met, the RF capture will stop and wait for the next GPS coordinate-based trigger to create a new LDSA ™ location and begin a reference capture.

The image below illustrates the | AutoMap | style and the Spectral Data captured for the for the first assigned | AutoMap | location.



DTAP AutoMap Display | v1.40xx

DTAP-GPS ™ Mobile Network (4G|LTE)

An active wireless mobile network connection is required to render the live moving map (Map Quest) and allow the moving map to expand as required during the mission, based on the actual area covered and the initial operator defined | Map Diagonal | settings.

An active wireless mobile network connection also permits the technical operator to access the DTAP-GPS ™ host computer for the purpose of real-time analytics, and for command and control purposes of the RF surveillance platform.

However, the ability to capture a DTAP-GPS ™ runtime mission without a wireless mobile network connection or the real-time interactive moving map (Map Quest) is fully supported providing an active GPS signal is present during mission deployment.

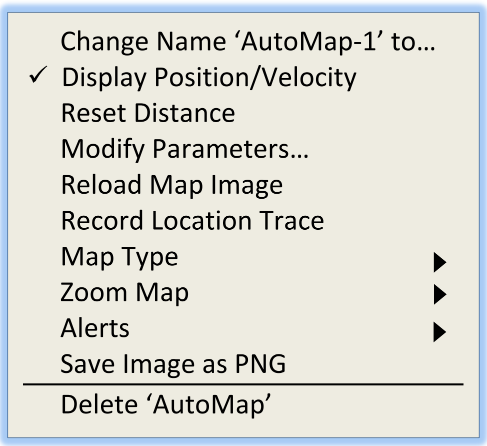
In this scenario, the moving map will not render or display relative to the DTAP-GPS ™ process, however, in all other respects the mission will be plotted and captured at the application level.

When the technical operator completes the intended mission parameters and returns to a location where a wireless mobile network or any other active network connection is available and can be established, the map image will automatically import and render into the historical project with respect to the GPS coordinates captured during the runtime mission.

The operator can utilize the mapping controls such as zoom in and out, or adjust the map type as desired for post analytics and report generation.

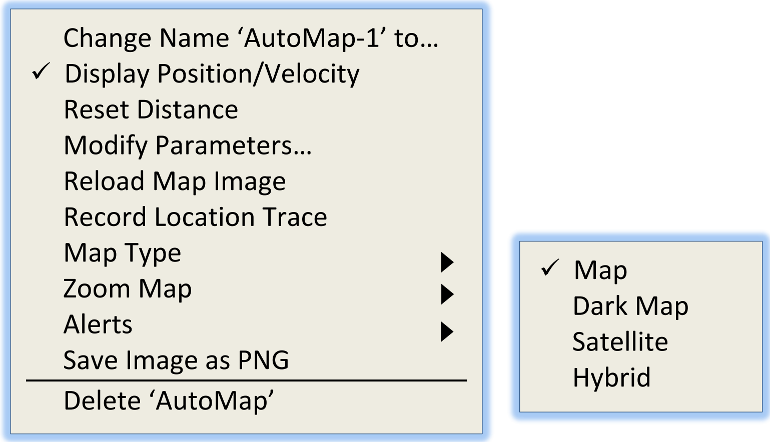
Map Display Menu (Pop-Up)

Once the | AutoMap | is defined there is a pop-up control menu is available with a left mouse click on the displayed | AutoMap | overlay, as illustrated in the following image.



DTAP AutoMap Menu | v1.40xx

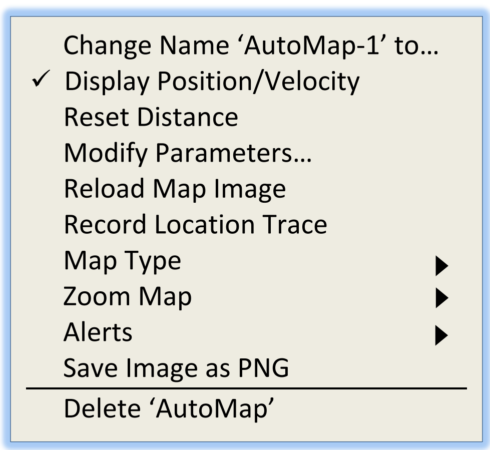
The | AutoMap | pop-up menu adds a number of very powerful display features that are accessible in real-time during deployment or during post analysis.

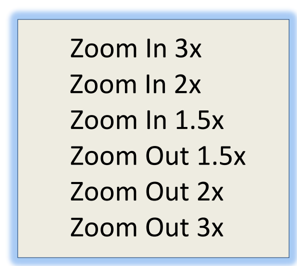


DTAP AutoMap Menu | v1.40xx

The ability to change the map type is fully support in real-time or post capture.

By default, the | MAP | renders and displays and the technical operator can manually select | DARK MAP | SATELLITE MAP | HYBRID (SATELLITE) MAP | as desired as illustrated in the image above.



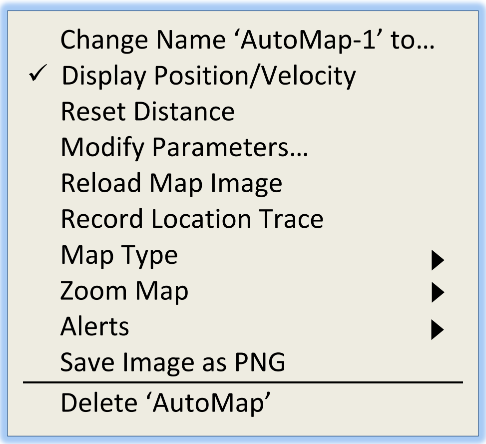


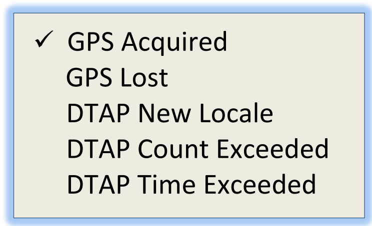
DTAP AutoMap Menu | v1.40xx

The moving map automatically renders and updates in real-time whenever a wireless mobile network connection is present even if the mission travels outside of the operator defined | Map Diagonal |.

The technical operator can invoke a manual zoom factor to expand the moving map perimeter by | 3x | 2x | 1.5x | both | ZOOM IN | and | ZOOM OUT | as might be required by the operator to accommodate propagation modeling when the area of interest on the existing map surface is along the edge or near a corner area.

This capability is supported during runtime collection during the mission and during post analytical review.



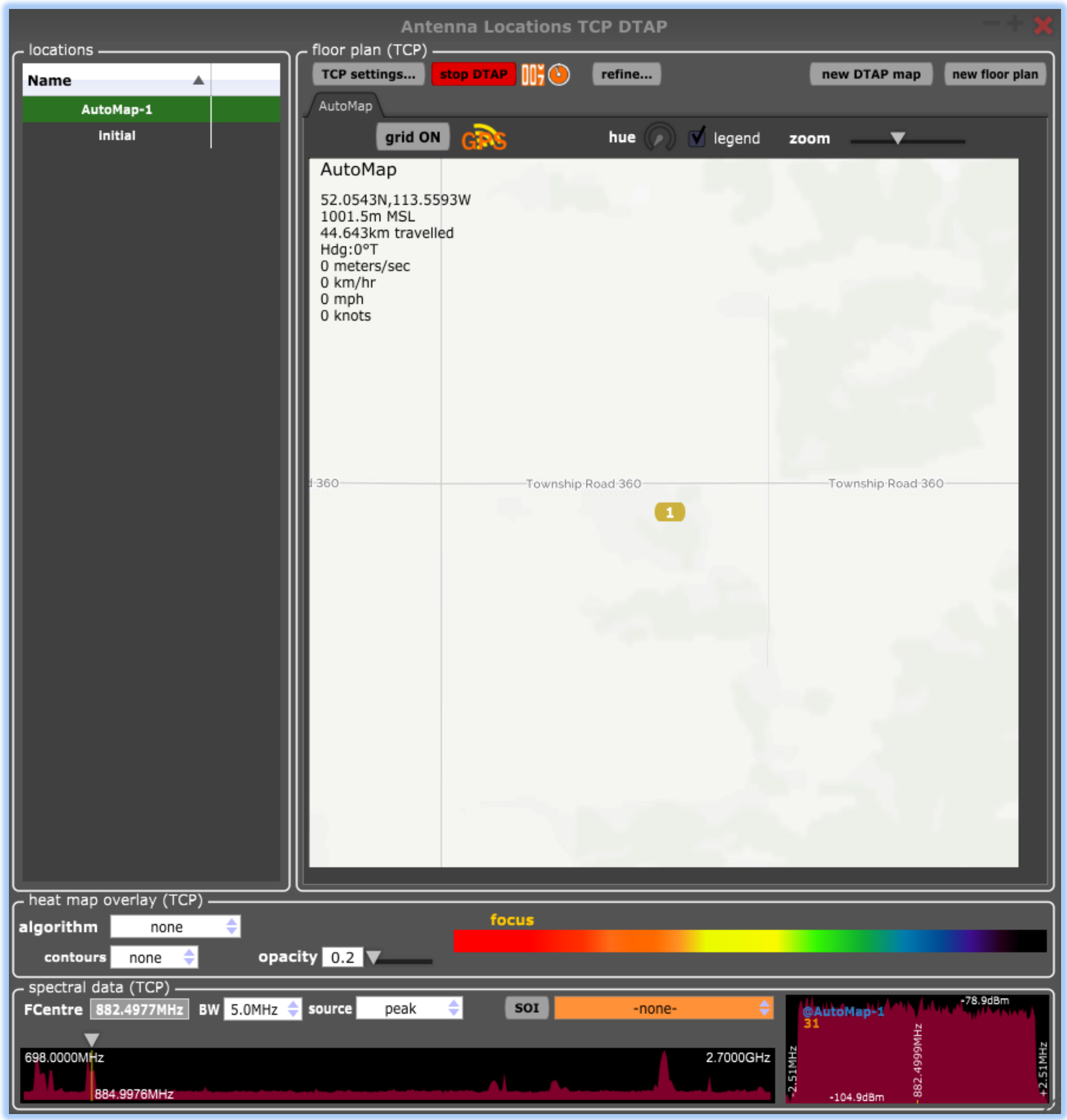


DTAP AutoMap Menu | v1.40xx

The ability to enable and / or disable audio alerts for critical mission parameters allows the operator to operate with enhanced situation awareness during a runtime environment.

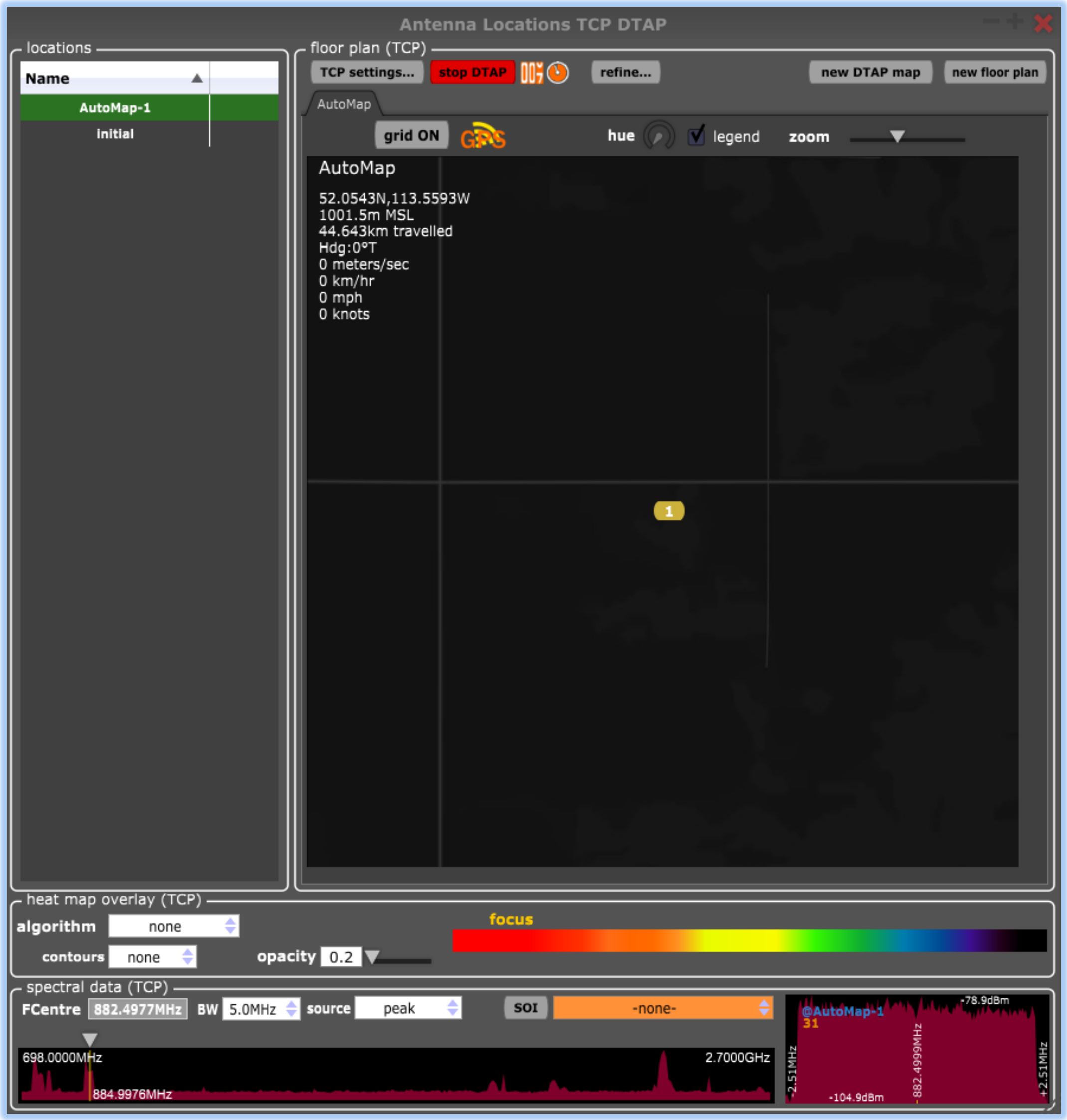
Operator defined | Audio Alerts | are supported for | GPS ACQUIRED | GPS LOST | DTAP NEW LOCALE | DTAP COUNT EXCEEDED | and | DTAP TIME EXCEEDED |.

The following images illustrate the Spectral Data captured for the | AutoMap | location and references the four (4) | AutoMap | types available for use during deployment based on the operator defined | Map Diagonal | setting as selected during the setup process of | 5 KM |.



DTAP AutoMap (Default Map) | v1.40xx

The above image represents a standard street level map that references the street, road, highway, towns and city names.

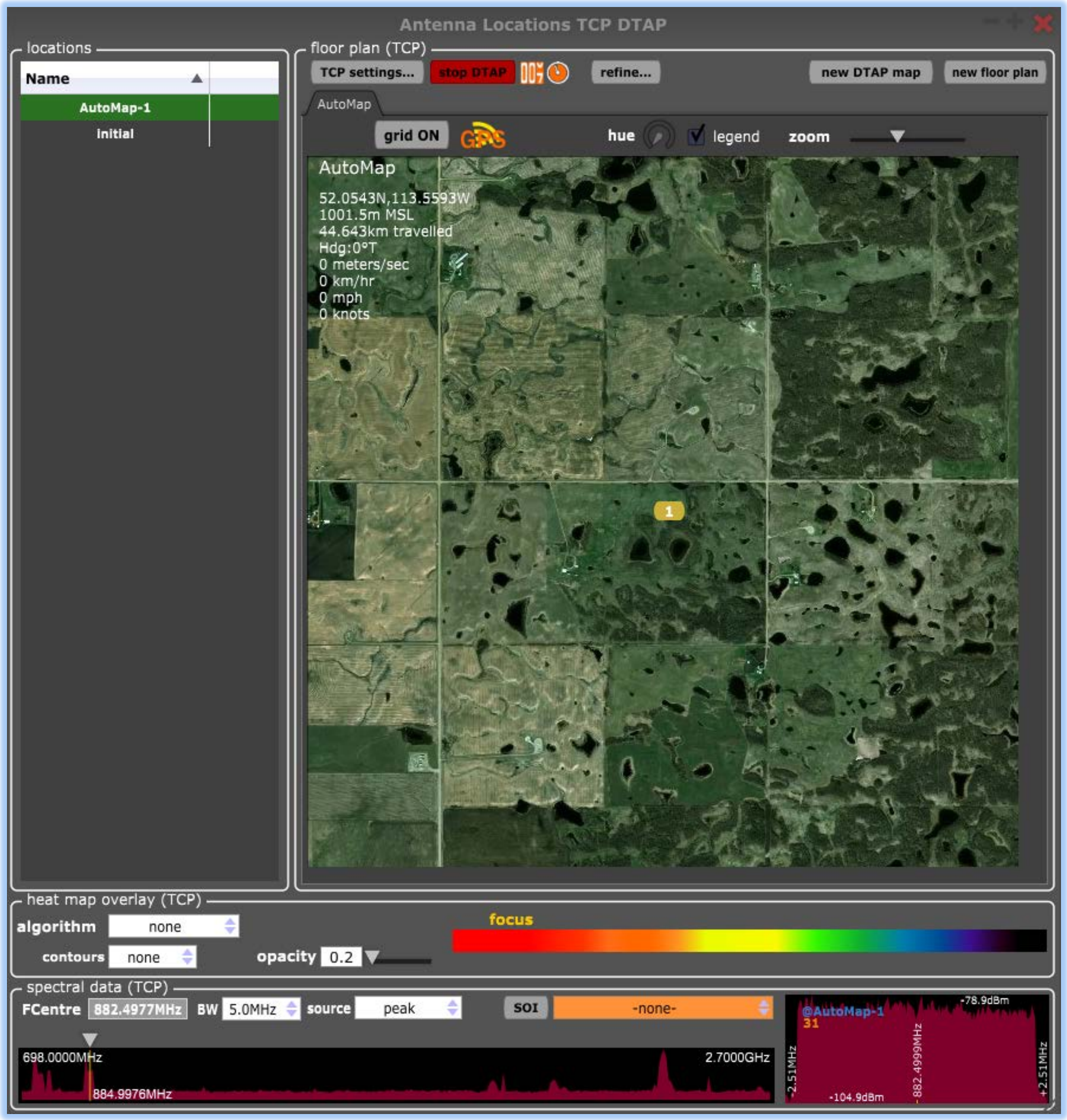


DTAP AutoMap (Dark map) | v1.40xx

The above image represents a standard street level map that does not reference the street, road, highway, towns and city names.

This | AutoMap | style is ideal for display at night to reduce the screen brightness and glare. The street, road and highway structures are displayed on a dark background reference map.

The | GRID | overlay provides a calibrated latitude and longitude grid and provides excellent visual contrast when this map type is utilized.

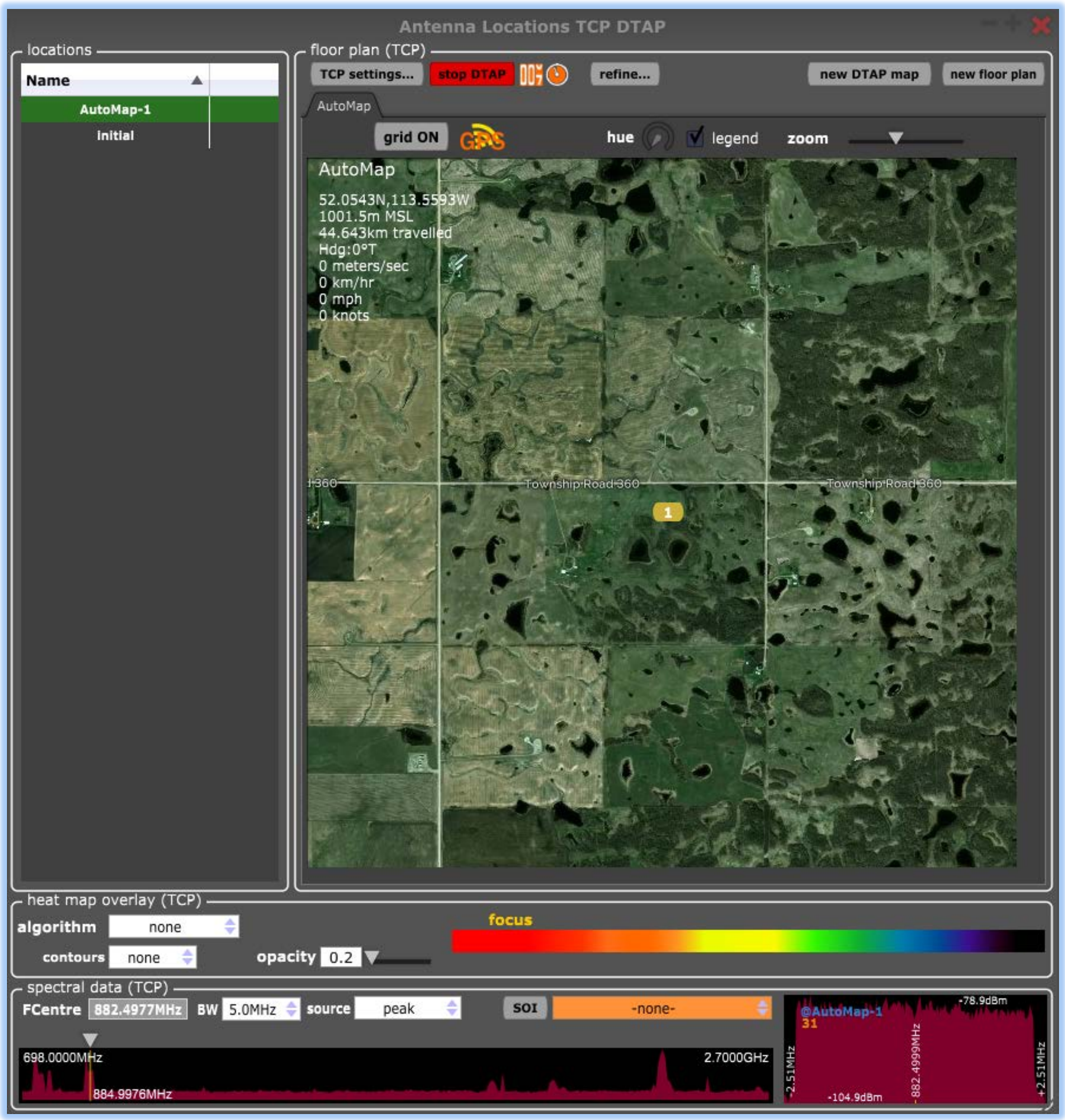


DTAP AutoMap (Satellite View) | v1.40xx

The above image represents a satellite view reference map that does not reference the street, road, highway, towns and city names.

This | AutoMap | style is ideal geo-graphical and terrain references are required. The street, road and highway structures are displayed as images and oftentimes will show access routes that are not considered official roads that may be essential to the mission.

The background is a darker, and provides some screen brightness reduction during night time deployment.



DTAP AutoMap (Satellite Hybrid) | v1.40xx

The above image represents a satellite (hybrid) view reference map that references the street, road, highway, towns and city names.

This | AutoMap | style is ideal geo-graphical and terrain references are required. The street, road and highway structures are displayed as images and oftentimes will show access routes that are not considered official roads that may be essential to the mission.

The background is a darker, and provides some screen brightness reduction during night time deployment.

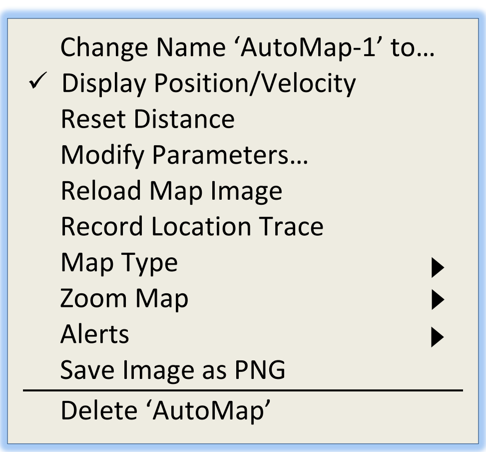
Map Zoom Factors

The initial | AutoMap | Map Diagonal | is set by the technical operator during the DTAP-GPS ™ setup process, and if during runtime capture, the actual GPS position moves off of the | AutoMap | area, the moving map image will reconfigure and expand as required by the value of the original | Map Diagonal |.

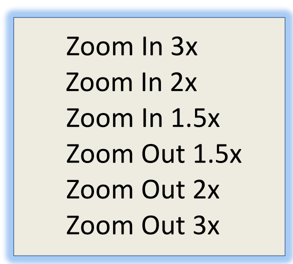
However, there will be instances where tracking along the edge of the map may prove significant from a geo-location heat mapping perspective, where the Kestrel ® RF Visualizer (RFV) ™ propagation modeling will not be visible off-map.

For this reason, we have provided a means to manually expand the map surface (Zoom In) by providing predefined zoom factors and also the ability of return the map to the original size (Zoom Out).

Please note that the | Zoom Control Slider | located on the map control window does not increase the | AutoMap | surface area and is designed only to adjust the map image size to fit the active display area.



DTAP AutoMap Menu | v1.40xx

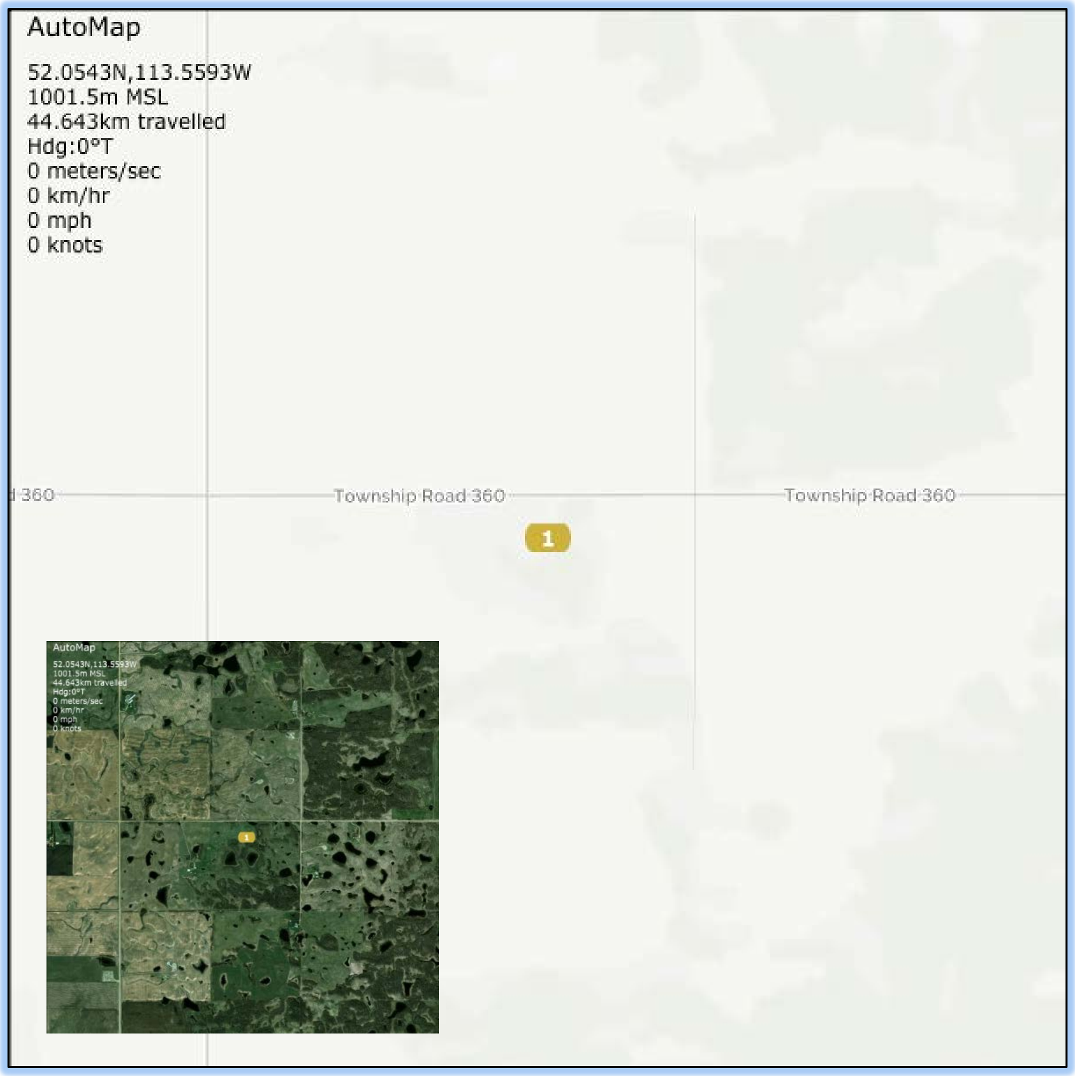


The following images depict the original 5KM | Map Diagonal | as set by the technical operator, and representative 2x and 3x zoom options.

Generally, the amount of reference detail displayed will vary depending on the zoom factor selected.

For example, the operator will need to zoom in to see detailed street names, and zoom out to see perhaps the main highway structure.

This is function of the mapping program and no specific control is possible.



5 KM Map Diagonal | v1.40xx

The inset | Satellite | map image above shows the difference between the default map and the satellite view.

Both of the map images are the same scale utilizing the operator defined | Map Diagonal | of 5 KM.

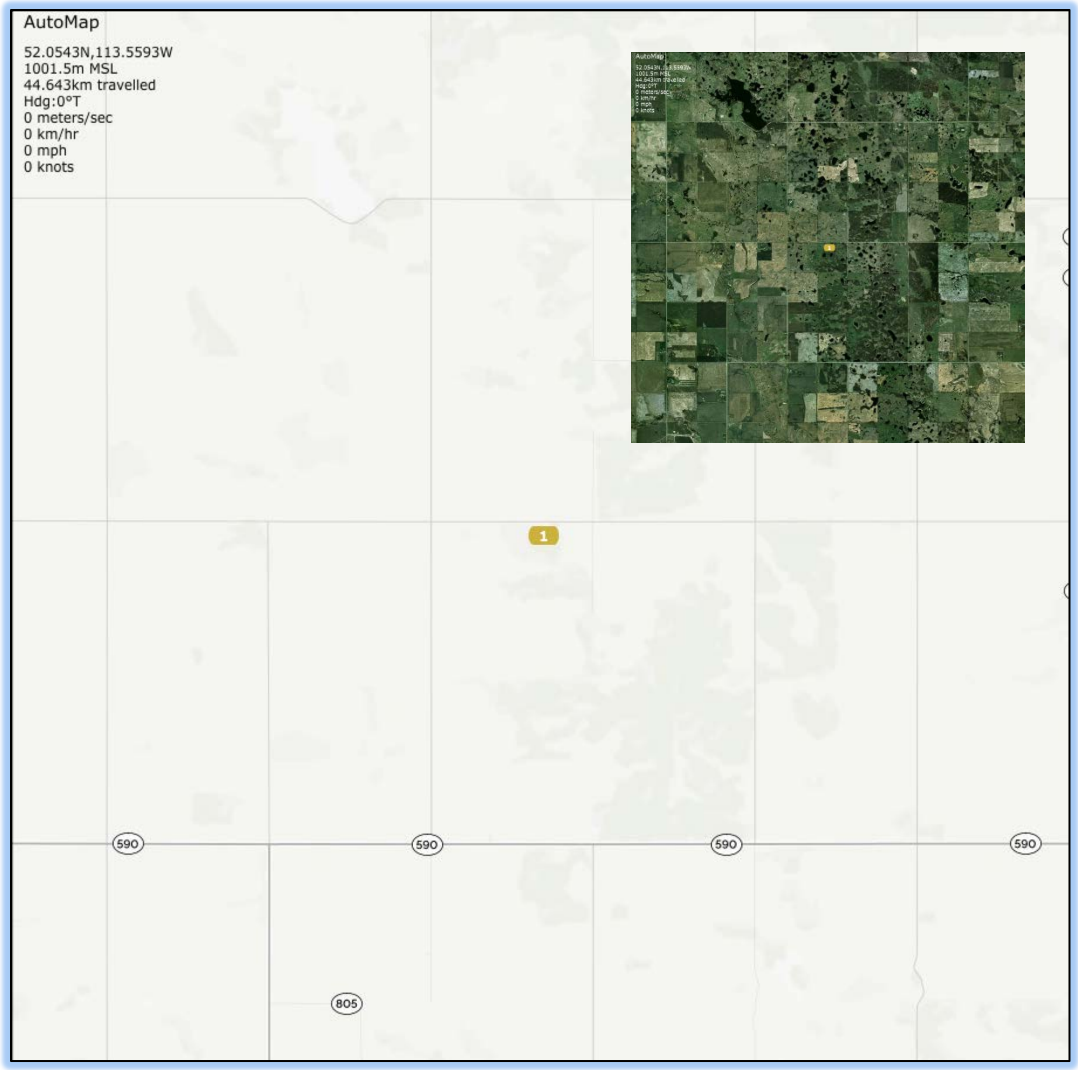
Street names are visible at this zoom factor.

2x Zoom | 10 KM Map Diagonal | v1.40xx

The inset | Satellite | map image above shows the difference between the default map and the satellite view.

Both of the map images are the same scale utilizing a 2x zoom factor.

Street names remain visible at this zoom factor.



3x Zoom Factor | 15 KM Map Diagonal | v1.40xx

The inset | Satellite | map image above shows the difference between the default map and the satellite view.

Both of the map images are the same scale utilizing a 3x zoom factor.

Street names are not visible, but main highways are displayed at this zoom factor.

AutoMap Navigation

The ability to navigate the | AutoMap | window during a zoom condition or when the map space is smaller than the map zoom factor is supported by the mouse wheel to navigate the map position vertically.

The ability to navigate the map both vertically and horizontally (X-Y) navigation and map repositioning is supported by a right mouse click and hold on the zoomed map surface area and dragging the mouse pointer to reposition the map.

Latitude and Longitude (Annotation)

The map surface is radio-metric and will display the | Latitude | and | Longitude | coordinates at any mouse pointer position across the map surface.

Latitude and Longitude Annotation | v1.40xx

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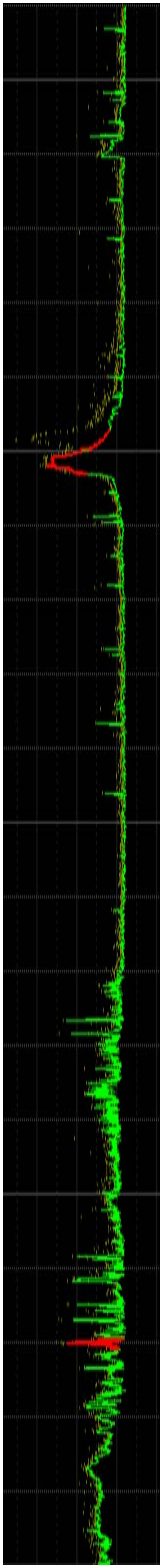
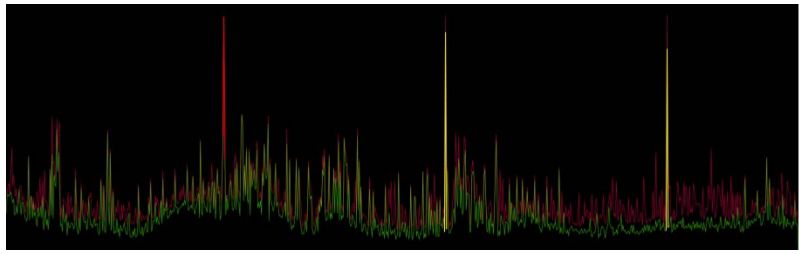
Intentionally Left Blank



Chapter 20

Autonomous Measurement and Collection System (AMCS) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Autonomous Measurement and Collection System (AMCS) ™ | OPT AMCS

Advanced features such as the Autonomous Measurement Collection System (AMCS) ™, powered by a TCP/IP Socket and a powerful Sub-System, deep within the Kestrel TSCM ® Professional Software application, allows the application to operate "headless" in an embedded computing environment, bringing with it significant operational and tactical advantages.

The AMCS ™ sub-system is perhaps described as one of the most powerful features ever developed for professional use, meeting a range of deployment requirements, and is configured from a custom, operator defined | Kestrel Configuration Script (KCS) ™ | file placed into the Kestrel TSCM ® Professional Software, | INSTALLATION | or | SETTINGS | directory.

The technical operator can easily define, build, edit, and save multiple, mission specific AMCS ™ | Kestrel Configuration Script (KCS) ™ | using a simple text editor, rendered with a (KCS) file extension.

The | KCS ™ | file is placed into the | INSTALLATION | or | SETTINGS | directory, and if present during the start-up and initialization process, the script will immediately begin a runtime environment consisting of all scripted bands and provide a | TCP/IP | "reporter" output streaming, in real-time.

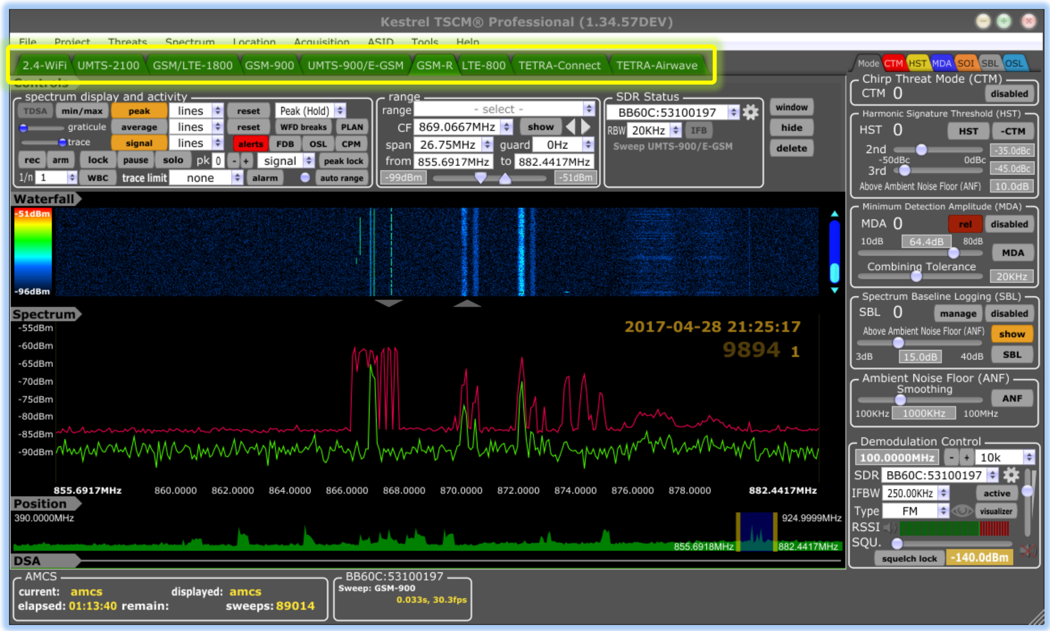
In this configuration, no data collection is appended to the host PC storage device, unless a | FILE | based "reporters" is also scripted.

The ability to stream live TCP/IP and write any number of bands to the local storage device, maximizes even the most demanding mission parameters.

TCP/IP "reporters" live stream call measurement parameters over the established network in plain text, as encrypted traffic, without saves scripted data to the local machine storage drive.

FILE "reporters" capture and saves the scripted data to the local machine, or network storage drive.

The ability to define additional parameters, such as triggers, and session control parameters is realized within a standard XML file format, making it possible to add new measurement, parameters, and session control commands, for autonomous operation.



AMCS Sub-System | v1.35xx

The above runtime environment illustrates the ability to visualize the bands and spectral activity within the | AMCS | TCP/IP data stream output, in real-time on the local machine.

Although, no spectra is available beyond the visualization of limited spectrum and waterfall data, remaining and available within the display buffer, visualization allows the technical operator to validate the band or channel activity.

The Kestrel ® application creates all the required background project file structure and necessary configuration, to be able to immediately begin runtime collection activity across a single, or multiple spectrum band allocations, when the application is started.

To assist in script validation, a TELNET application such as PuTTy can be configured to view the AMCS ™ TCP/IP output streaming process.

The AMCS ™ Software Development Kit (SKD), includes sample Kestrel Configuration Scripts (KCS) ™, a copy of the PuTTy configuration application, and a text file containing the required local machine configuration parameters, used to establish a TCP/IP session for testing and validation.

The Autonomous Measurement and Collection System (AMCS) ™ is an optional software component module | OPT AMCS ™ | and can be purchased with the original license, or at any time as a powerful add on capability.

The following image illustrates the TCP/IP visualization as configured and displayed in PuTTy, highlighting several typical parameters within the XML format.

AMCS ™ TCP/IP Streaming Example | v1.38xx

It is important to understand that no data is written to the local host computer storage drive, unless a FILE “reporter” is scripted in addition to the TCP/IP “reporter”, however, all spectrum bands are rendered in real-time on the local machine, for operator verification, based on the availability of a limited display buffer.

The above AMCS ™ streaming example, displays the typical live data output stream.

All AMCS ™ data consists of a live network-based TCP/IP data stream containing scripted measurements, parameters, and session control information, including a Kestrel “heartbeat” health status marker, as well as other user-defined parameters and measurements.

Client applications and interfacing may be connected to the Kestrel ® TSCM Professional Software via a TCP/IP socket interface connection, to obtain the extracted data stream, and basic configuration information from the Kestrel ® application.

A limited measure of session control is also provided to client applications.

The AMCS ™ comprises of a powerful sub-system deep within the Kestrel ® TSCM Professional Software application.

This AMCS ™ feature is an optional | OPT AMCS | component sub-system that is enabled when the Kestrel TSCM ® Professional Software is started, with a valid Activation Security Key (ASK) ™ that contains the AMCS ™ capability as provided by the Technical Support Group (TSG), in response to a valid Challenge and Response (CRC) Activation Security Key (ASK) request.

On initial connection of a supported hardware receiver to the Kestrel ® application, a license key request will be generated in the form of a Challenge and Response (CRC) ™ code string and presented to the technical operator for submission.

When the | CRC ™ | code is provided to the Technical Support Group (TSG) at Professional Development TSCM Group Inc., this will be converted into an Activation Security Key (ASK) ™ license, enabling the AMCS ™ capability, on the end-user’s system.

This Activation Security Key (ASK) ™ is then be installed into the | ACQUISITION | ADD ASK | menu, enabling that instance of the Kestrel ® TSCM Professional Software, to operate with the AMCS ™ capability.

Only one (1) receiver on a subject machine requires an Activation Security Key (ASK) ™ to enable AMCS ™ operation across all receivers operating with that (machine) instance of the Kestrel TSCM ® Professional Software.

The AMCS ™ sub-system allows Kestrel ® to be operated in a stand-alone fashion.

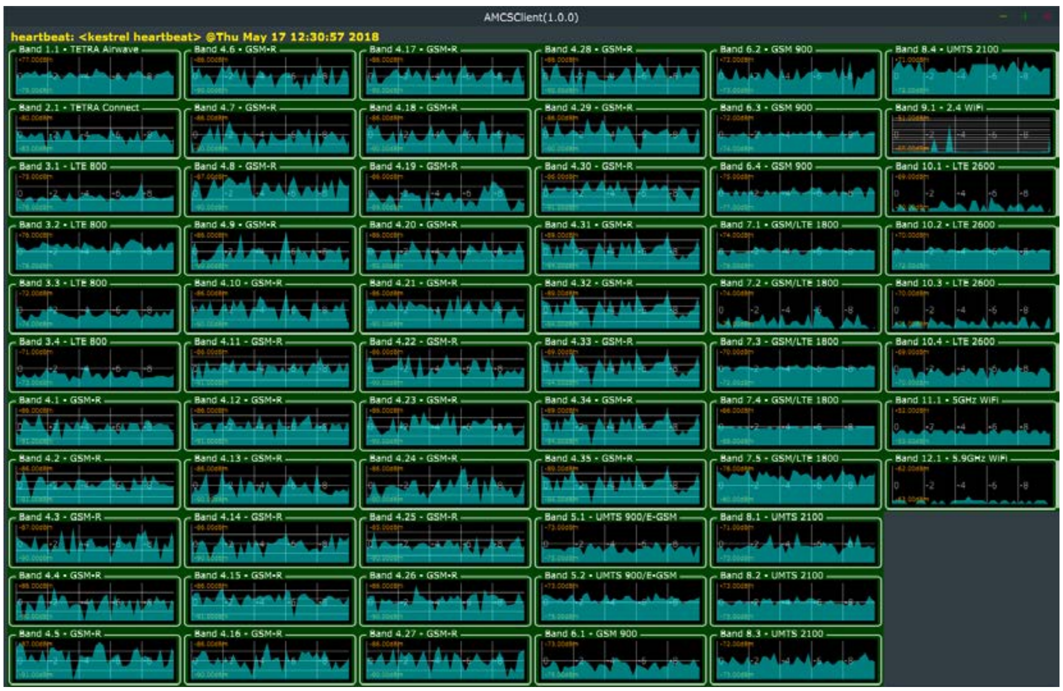
The | Kestrel Configuration Script (KCS) ™ | file allows autonomous collection to be set up and initiated, on application start, without the requirement of setting up a Kestrel Project File (KPF) ™ or establish any spectrum bands.

Kestrel ® Data Visualization Interpreter (DVI) ™

The DVI ™ is a TCP/IP streaming data output interpreter and graphical visualizer, allowing a TCP/IP connection to the AMCS ™ sub-system, and like PuTTy, provides a means of visualizing the streaming data.

The PuTTy application provides a means of visualizing the RAW TCP/ IP XML data stream to demonstrate, or validate the AMCS ™ functionality, or as an aid in the development of a working | Kestrel Configuration Script (KCS) ™ |.

The DVI ™ is included with the AMCS ™ Software Development Kit (SDK), and provides a visual interpreter, demonstration resource.



AMCS Client 1.0 | v1.38xx

End-user custom client applications can connect to the Kestrel ® TSCM Professional Software, via a TCP/IP socket connection, and obtain a continuous output of streaming measurement data, for the specified bands, or channels of interest.

Access to the output data stream provides for basic password protection, as an additional control, or security measure.

Once the AMCS ™ session is established, the | Data Visualization Interpreter (DVI) ™ | can be run as a standalone application.

Once running the DVI ™ application, the technical operator will need to input the | IP ADDRESS | PORT | and | PASSWORD | control elements, to initiate the DVI ™ runtime session.

The | PASSWORD | control element is only required, if a password credential was scripted within the Kestrel Configuration Script (KCS) ™, otherwise this dialog input is not required, and may be left blank.

Professional Development TSCM Group Inc., is developing additional capability and deployment techniques to extend the functionality of the AMCS ™ sub-system, to address geo-location and radio-direction finding capability, including integration with the Kestrel ® Heat Mapping Display (HMD) ™ module.

There are a significant number of mission specific deployment applications that can directly benefit when the AMCS ™ system is deployed as an integral component of a professional TSCM | SIGINT | RSSM ™ program implementation.

Remote Spectrum Surveillance and Monitoring (RSSM) ™

Mission specific RSSM ™ is often confused with the more limited capability of, in-place spectrum monitoring, which generally fails to address the complexities of a moving target threat model.

Setting up a Kestrel ® TSCM Professional Software instance and search receiver, at a remote location, permits a continuous monitoring (streaming) TCP/IP data feed, obtained from the remote site autonomously over a TCP/IP connection, and / or file based “reporters” on the local machine.

Precision measurements can be operator defined within a standard XML file format, in the form of a Kestrel Configuration Script (KCS) ™ file, maximizing efficiency of the TCP/IP stream, minimizing the bandwidth required.

When operating in this mode, the Kestrel ® TSCM Professional Software is suitable for operation on an embedded PC platform, providing an exceptionally low-cost, and very powerful remote monitoring solution.

Data Feed Integration

The remote feed configuration, utilizes an open | XML | format, allowing a simple means of integration with existing, or additional data feeds, to provide a powerful, fully integrated TCP/ IP data stream that offers the ability to synchronize multiple sources into a single data feed output for centralized analytical analysis.

Triggered Alarm and Alerting Integration

The integration of the AMCS ™ capabilities, with the standards based, unique alarm and alerting architecture currently existing within the Kestrel ® TSCM Professional Software, provides the capability of including and obtaining alerting parameters, when specific operator defined events of interest, occur within the ambient RF spectrum environment.

Alarms, alerts, and advanced triggering features, provide the operator with powerful, filtered, event and mission driven set of critical data, and can help reduce the overall transmission load, to better provide focus on advanced actionable RF intelligence relating to the TSCM | SIGINT | RSSM ™ process.

Distributed (Managed) Remote Spectrum Surveillance and Monitoring (RSSM) ™

Integrating multiple instances of the Kestrel ® TSCM Professional Software, with the AMCS ™ sub-system feature, and integrating the independent data feeds, means powerful RSSM ™ solutions can be easily implemented at the facility level, or across regional, national, and international geographical boundaries.

Black Box Data Integration

The ability to utilize RF spectra as a powerful sensory input to an existing black box architecture, or collection system, or to build powerful analytical solutions, can be realized, when the streaming AMCS ™ sub-system data feed, is combined with other sensory inputs, such as GPS coordinates, date and time stamping, speed, altitude, temperature, common RF interference triggers, and other mission critical sensor-based parameters.

The AMCS sub-system is ideal for deployment across aircraft, marine vessels, trains, and other transportation conveyances, to generate a picture of the ambient RF spectrum at any given point in time.

Fault Tolerant Recovery (FTR) ™

The ability to configure the Kestrel ® TSCM Professional Software running the AMCS ™ Sub-System, to automatically recover to a runtime environment is now a reality, and the AMCS ™ feature, provides a measure of fault tolerant, fail-safe operation, by returning to an operator defined, pre-determined state, on the host computer, upon recovery or reboot, without the need to manually re-establish a new project, or runtime environment.

For example, if the operating system reboots the host computer after an update, the AMCS ™ feature can be configured to self-recover, and resume live data streaming.

This capability is ideal for remote systems, located in inaccessible, or hostile locations or environments.

The software includes a | AUTO RESTART | button within the | ACTIVITY SCHEDULER | at the project level to facilitate a measure of fail-safe recovery in the event the host computer is forced to reboot, do to updates and crash conditions, including managed remote operator-initiated restarts.

There are several important steps to ensuring that the host computer is so-called reboot ready, including the requirement to place the current version of the Kestrel TSCM ® Professional Software into the Windows | START-UP | directory and enabling the | AUTO RESTART | feature at the runtime project level.

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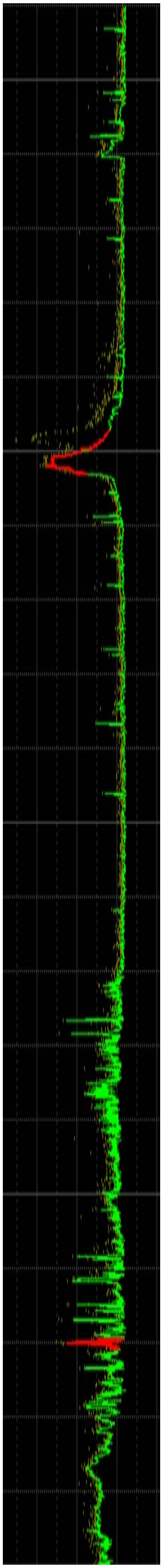
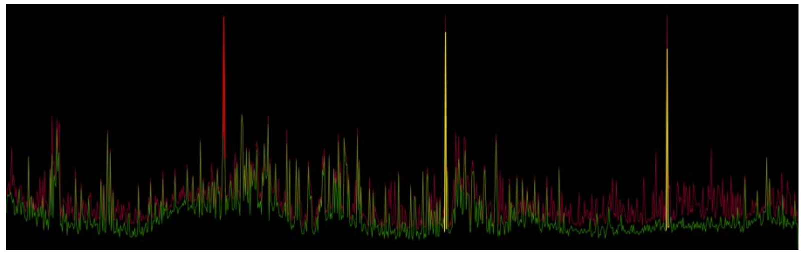


Chapter 21

Remote Spectrum Surveillance and Monitoring (RSSM) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Remote Spectrum Surveillance and Monitoring (RSSM) ™

RSSM ™ is a powerful new tool from deployment within a modern moving target threat model, pioneered by the Kestrel TSCM ® Professional Software advanced core methodology.

Time-on-target, budget considerations, facility operations, visitor escort availability, and a wide range of operational factors, including the reality of hybrid modulation, frequency agile and time periodic Technical Surveillance Device (TSD) technology are just some of the most limiting factors that alone or collectively, tend to have a negative impact on the success of an any defensive TSCM program when it comes to conducting live operational deployment of electronically assisted RF technical sweeps of the target area or facility.

The Kestrel TSCM ® Professional software does a lot more than simply display the RF spectrum for the technical operator, as with many obsolete single box solutions, and provides a sophisticated means to overcome the above-mentioned limiting factors by extending the typical operator attended collection and / or analysis period with pre-deployment, and / or post-deployment collection activities.

The RSSM ™ methodology also provides an opportunity to engage continuous 24/7/365 monitoring and surveillance of the RF spectrum that ultimately extends the quantity and quality of meaningful Signal of Interest (SOI) event data and therefore adds significant spectral intelligence for post event analysis and review by a qualified technical operator.

The ability to significantly enhance the Probability of Intercept (POI) and Probability of Detection (POD) can mean the difference between less than 1% POD and 99.9% POD by continuously monitoring the target environment.

There are many significant factors in determining true POI and POD in real world deployment scenarios, however, time-on-target and receiver sweep speed and powerful SDR feature sets are certainly essential priorities.

Many technical operators have been misled about POI and POD across the vast majority of TSCM products by design to further the sales agenda or simply because they simply do not understand the operational side of the industry.

In realistic terms, it is not uncommon for the technical operator to deploy an active RF analysis system for only a limited period of time during each successive inspection, often in the dark of the night, or when the facility is shutdown or otherwise operating at a somewhat limited human capacity.

This typical and oftentimes limited RF spectral review is problematic on a number of levels during the deployment process, given the sophistication and operational characteristics of modern threat technologies and the wide Scope of Work (SOW) other than RF that must be accomplished during a properly conducted technical inspection, all in a relatively short period of “time-on-task”.

These critical limiting factors amount to little more, than a brief operational “snap-shot” style capture of what is perhaps, currently operating within the target area, facility, or geographical area adjacent to, or surrounding the immediate target area.

In today’s modern moving target threat model as defined under the TSB 2000 (Technical) Standard ™, a new approach to the analysis of the ambient RF spectrum environment is required, and the complexities associated with the Probability of Intercept (POI) and Probability of Detection (POD), attributed to highly-evolved modulation methods and smart technology that adapts to the congested spectrum demands a different approach to the problem.

Oftentimes, instantaneous or periodic signal events will not be observed or captured by the technical operator for a variety of real-world operational deployment reasons, including the fact that the signal of interest may not occur during the limited “time-on-task”.

When the technical operator utilizes the advanced functionality of the Kestrel TSCM ® Professional Software, the Remote Surveillance and Monitoring (RSSM) ™ principle, extends the active collection well beyond the typical limitations that are generally imposed at the direction of the client, such as the fact that the typical sweep is oftentimes limited to outside of normal business hours.

The Kestrel TSCM ® Professional Software allows the technical operator to unobtrusively deploy a powerful collection process in a suitable and secure location, within the target area, or at relevant multiple locations, or even at a single collection location within the target area over time.

The monitoring system can be easily moved to any number of specific locations within the target facility over an extended period of time, as defined by the technical operator, leading up to, or immediately following the actual RF sweep phase of the assignment and left behind after high-level sweeps have been completed.

RSSM ™ | Advance Deployment (Short Term)

As an example, consider the following recommended deployment for an inspection scheduled for Friday night at 1900 hours.

The technical operator has covertly deployed the software in advance of the pending sweep for a period of time ahead of the scheduled inspection. This may be 24 hours, 48 hours, or 72 hours as illustrated in the following table.

Upon arrival, on-site to conduct a full TSCM inspection, the technical operator will have already collected up to a full 72 hours (or more) of spectrum activity for review and comparative analysis, covering up to three (3) full business days and associated over night spectral activity patterns.

The technical operator in the following example chart deployed the software for an additional six (6) hours during the on-site inspection process utilizing additional advanced features and functionality of the Kestrel TSCM ® Professional Software.

Pre-Deployment | Remote Spectrum Surveillance and Monitoring (RSSM) ™ Table			
72 Hours |Prior to Inspection	Tuesday to Friday	1900 Hours	72 Hours | RSSM ™
48 Hours | Prior to Inspection	Wednesday to Thursday	1900 Hours	48 Hours | RSSM ™
24 Hours | Prior to Sweep	Thursday to Friday	1900 Hours	24 Hours | RSSM ™
Scheduled (On-site) Inspection	Friday	1900 Hours	6 Hours | Operator Assisted Collection
Total Collection Time | POD Enhanced by up to 72 Hours			Up to 78 Hours

RSSM ™ | v1.39xx

RSSM ™ | Post Inspection Deployment

As another example, consider the following RSSM deployment following an operator assisted inspection scheduled for Friday night at 1900 hours.

The technical operator will covertly deploy the software at the end of the on-site inspection for either, 24 hours, 48 hours, or 72 hours as illustrated in the following table.

Upon departure from the site, the technical operator will allow for a full 72 hours of spectrum activity to be collected for analysis, covering three (3) full days and associated night time activity patterns.

The technical operator in the following example deployed the software for six (6) hours during the initial inspection process utilizing additional advanced features and functionality of the Kestrel TSCM ® Professional Software.

Post-Deployment - Kestrel Defined Monitor (KDM) Table			
Scheduled | On-site Inspection	Friday	1900 Hours	6 Hours | Operator Assisted Collection
24 Hours | Post Inspection RSSM ™	Friday to Saturday	1900 Hours	24 Hours | RSSM ™
48 Hours | Post Inspection RSSM ™	Friday to Sunday	1900 Hours	48 Hours | RSSM ™
72 Hours | Post Inspection RSSM ™	Saturday to Monday	1900 Hours	72 Hours | RSSM ™
Total Collection Time | POD Enhanced by up to 72 Hours			Up to 78 Hours

Kestrel Defined Monitor (KDM) | v1.39xx

This unique ability permits unprecedented functionality and not only allows the technical operator to collect spectral data during specific periods of interest, but also streamlines and better focuses the collection process and minimizes the collection file size that must be eventually be analyzed by the technical operator.

So why RSSM? The rationale is simple and can be summarized in terms of efficiency by maximizing the quality and quantity of analytical data and significantly enhancing the Probability of Detection (POD), while minimizing the amount of complex spectrum data that needs to be reviewed.

A comparative review and analysis of the following spectrum plot example, clearly indicates the amount of spectrum activity captured over a longer period of time within the target area that might otherwise be over-looked during a limited “time-on-task” deployment.

The Kestrel TSCM ® Professional Software, RF Spectrum Display (RSD) plots clearly illustrates this concept, when spectral plots are compared at various date / time stamps during the collection process.

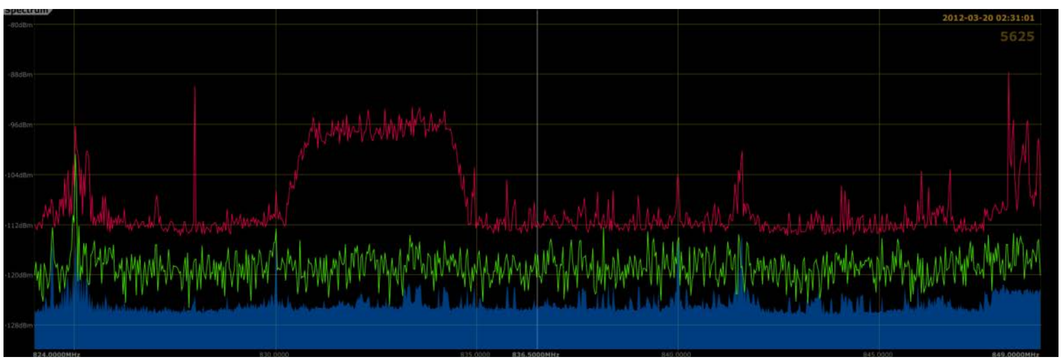
The following spectral plots represent a short-term analytical rendering consisting of the Peak Envelope Capture (PEC) trace for a 1 hour, 6-hour, 12-hour, 18-hour and 24-hour period.

The process can easily be repeated for 10-days, 30-days, or longer depending the mission requirements.

Advanced collection and analytical tools allow the technical operator to apply write compression and time period-based analysis, alerting and reporting.

Active Collection (1 Hour) Typical Deployment

The Probability of Detection (POD) is a significant and critical deployment factor in detecting burst, periodic and intermittent signal events over an extended period of time.

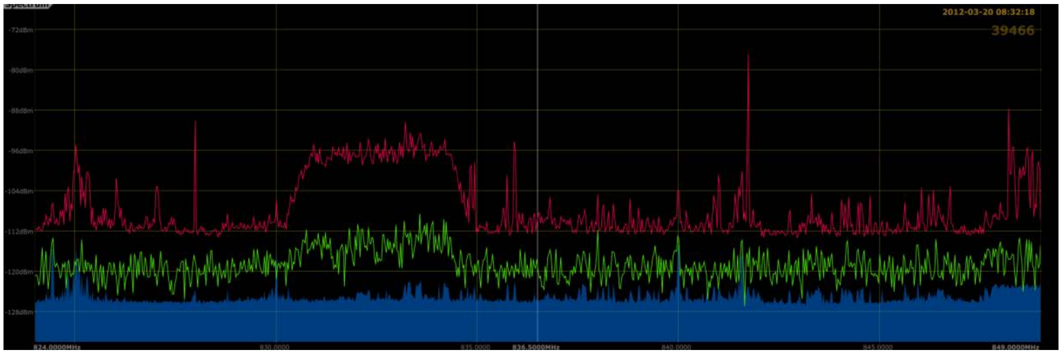


Kestrel Defined Monitor (KDM) | v1.39xx

The above RF Spectrum Display (RSD) plot is representative of the (824 MHz - 894 MHz) GSM UL spectrum allocation and displays the activity at the end of a one (1) hour collection period.

Active Collection (6 Hour) KDM Deployment

The Probability of Detection (POD) is a significant and critical deployment factor in detecting burst, periodic and intermittent signal events over an extended period of time.

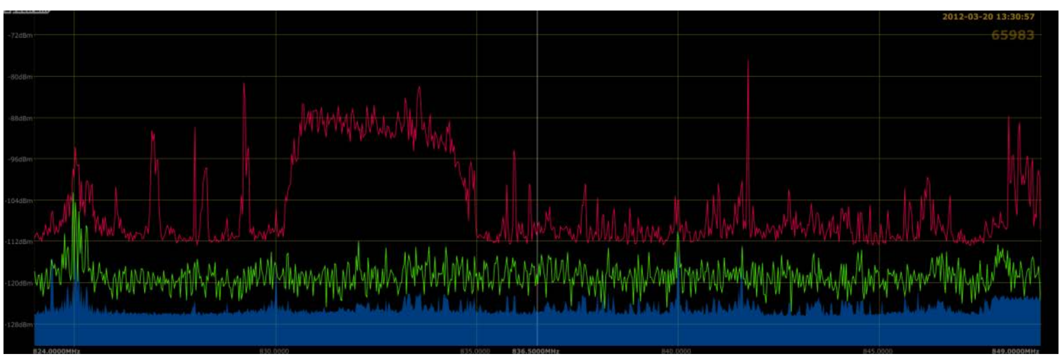


RSSM ™ | v1.39xx

The above RF Spectrum Display (RSD) plot is representative of the (824 MHz - 894 MHz) GSM UL spectrum allocation and displays the activity at the end of a six (6) hour collection period.

Active Collection (12 Hour) Typical Deployment

The Probability of Detection (POD) is a significant and critical deployment factor in detecting burst, periodic and intermittent signal events over an extended period of time.

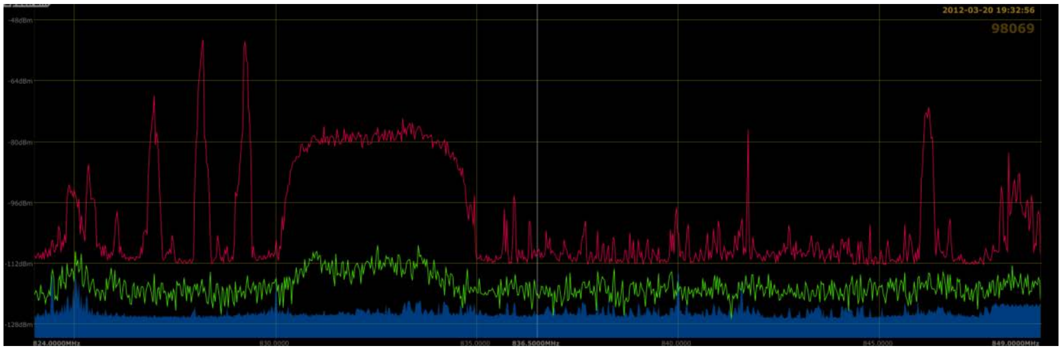


RSSM ™ | v1.39xx

The above RF Spectrum Display (RSD) plot is representative of the (824 MHz - 849 MHz) GSM UL spectrum allocation and displays the activity at the end of a twelve (12) hour collection period.

Active Collection (18 Hour) KDM Deployment

The Probability of Detection (POD) is a significant and critical deployment factor in detecting burst, periodic and intermittent signal events over an extended period of time.

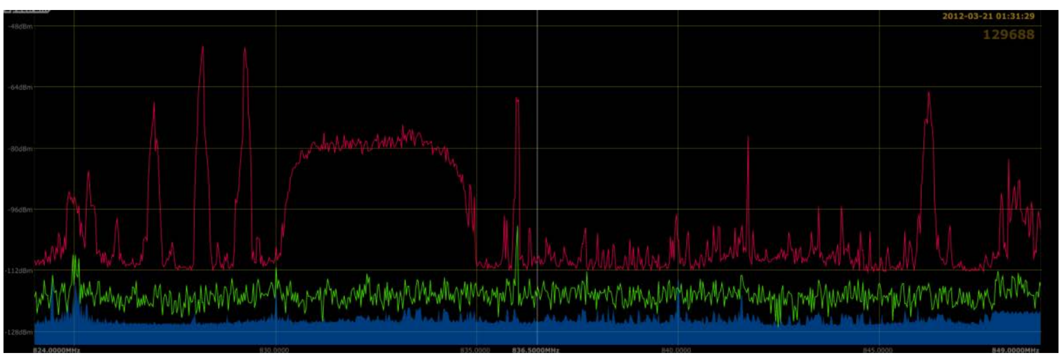


RSSM ™ | v1.39xx

The above RF Spectrum Display (RSD) plot is representative of the (824 MHz - 849 MHz) GSM UL spectrum allocation and displays the activity at the end of an eighteen (18) hour collection period.

Active Collection (24 Hour) KDM Deployment

The Probability of Detection (POD) is a significant and critical deployment factor in detecting burst, periodic and intermittent signal events over an extended period of time.



Kestrel Defined Monitor (KDM) | v1.39xx

The above RF Spectrum Display (RSD) plot is representative of the (824 MHz - 849 MHz) GSM UL spectrum allocation and displays the activity at the end of a twenty-four (24) hour collection period.

The peak trace | WRITE | HOLD | BUILD | allows the technical operator to see evidence of signal events that have appeared over a 24-hour period.

The use of Time Differential Signal Analysis (TDSA) ™ technology offers significant advantages over the | WRITE | HOLD | BUILD | peak trace alone.

Technical Operation and Deployment

The Kestrel TSCM ® Professional Software is designed for use by professional Technical Security Specialists (TSS) and is specific to the Detection, Identification and Location of RF based Technical Surveillance Devices (TSD) utilizing Near-Field signal characterization principles.

Professional Development TSCM Group Inc., has designed the Kestrel TSCM ® Professional Software to permit considerable deployment flexibility for experienced and knowledgeable technical operators tasked with the responsibility of conducting a wide variety of RF based technical security inspections of a specific target area, facility, site, or geographical location.

The Kestrel TSCM ® Professional Software may be operated in many different ways to achieve a wide range of results while taking into consideration the amount of "time-on-task", financial budget, operational threat level and many other factors typically involved in conducting the RF spectral analysis phase of a technical inspection.

The Kestrel TSCM ® Professional Software may be operated in a totally automated search, collection and recording mode, or under the full manual control of the technical operator to achieve satisfactory results across complex and demanding spectrum conditions.

However, the best results are likely to be achieved and realized when a combination of automated signal collection and manual operator review and analysis are combined at an appropriate level, based on the identified, or perceived threat level involved.

Possible Scenario

You have been tasked with the responsibility of conducting an electronic sweep of the ambient RF Spectrum in advance of a sensitive business meeting taking place within the client's boardroom facility.

You have discussed with the client and have been granted approval for deploying the Kestrel Defined Monitor (KDM) ™, referred to as Remote Spectrum Surveillance and Monitoring (RSSM) ™ for a 30-day period to cover a series of on-site meetings during the proposed 30-day period.

The various meetings are scheduled for specified time periods and has requested that Remote Spectrum Surveillance and Monitoring (RSSM) ™ be accomplished starting prior to the commencement of the series of meetings with the intent of identifying potential Technical Surveillance Devices (TSD).

A KestrelPod I ™ (Ceiling Mount) antenna has been installed in the dedicated meeting area and the RSSM ™ system has been placed within a secure area and connected to a network connection for both on-site and off-site remote access.

TIP: The balance of this example tutorial assumes that all other operational elements of the inspection either have or will be completed in due course leading up to the scheduled meeting and that a suitable method of communicating and potential compromise during the meeting has been agreed upon with the client or his / her representative.

RSSM ™ Deployment Considerations

The following procedure is an example of how the Kestrel TSCM ® Professional Software | Signals Intelligence Support System (SISS) ™ might be deployed to accomplish the requested technical inspection of the ambient RF signal environment.

Phase I | RSSM ™

The deployment of Remote Spectrum Surveillance and Monitoring (RSSM) ™ is now considered an essential recommended practice and, in the scenario, described above would best be accomplished beginning in advance of the client's meeting schedule for a period of at least 72-hours and extend across the required 30-day period.

In actual practice, it is recommended that pre-event monitoring be accomplished for a period of 72-hours prior to the technical inspection of the target area or the meeting event, based on the perceived threat level and other factors assessed by the Technical Security Specialist (TSS) ™ and client.

When a large event is planned and requires several days to setup and organize the venue, a 72-hour advance RSSM ™ collection is recommended to capture the spectrum on a 24/7 basis.

For the above described assignment, the Kestrel TSCM ® Professional Software is deployed by the technical operator in an unattended collection mode, 72 hours in advance of the schedule sweep inspection.

The technical operator will have a full 72-hours of captured RF spectrum activity on file for comparative analysis when arriving to complete the technical and physical sweep inspection of the target area and during the various meeting and non-meeting periods.

Phase II | Target Area Technical Inspection

Due diligence and best practice considerations, include a full on-site physical and electronically assisted technical security inspection and formal counter-intelligence review and assessment of the target area.

The Scope of Work (SOW) is based on the perceived threat and risk level perceived by the Technical Security Specialist (TSS) ™ in consultation with the client.

Phase III | Geographical Area Review (GAR)

It is recommended that the technical operator conduct a Geographical Area Review (GAR) ™ consistent with the perceived threat level identified and as described in the TSCM Operational Standard | Policy and Procedure Guideline (OS-PPG) ™ and TSB 2000 (Technical) Standard ™.

The Kestrel TSCM ® Professional Software Differential Signal Analysis (DSA) ™ feature can be utilized to collect and compare GAR TM spectral data at one (1) of more locations external to the target facility for direct comparison by the operator with spectral data collected from within the target area or facility.

The Kestrel TSCM ® Professional Software Differential Signal Analysis (DSA) ™ can be utilized to collect and compare RF spectral data at several key strategic locations within the target facility, adjacent to, above and below, or in the vicinity of the identified target area, for direct comparative analysis by the technical operator.

It is also recommended that the technical operator deploy the Kestrel TSCM ® Professional Software, utilizing the Spectral Baseline Logging (SBL) feature within the target area to capture a clean signal event list of the ambient RF spectrum environment.

Spectrum Baseline Logging (SBL) is considered to be a so-called “non-alerting” mode that allows the technical operator to collect Real-Time Event (RTE) and Waterfall Display (WFD) data and develop a clean signal list for active real-time, or post event analysis.

TIP: "Non-Alerting" is a relative term that is oftentimes greatly misunderstood in reference to a TSCM related inspection. The possibility of hard-wired microphones and other extremely sensitive audio based surveillance technology combined with various alerting technologies such as motion detectors and / or other sensors, make it impossible to conduct a truly “Non-Alerting” inspection. Room audio-based devices will pick up the activity of the operator entering the facility or target area and will likely be sensitive enough to hear the operator breathing or a door opening long before the operator identifies any potential compromise, particularly outside of normal business hours. In short, there is no such thing as “non-alerting” beyond perhaps implementing 24-7 remote spectrum surveillance and monitoring routine.

It is essential that the Kestrel TSCM ® Professional Software technical operator manually review the SBL data for possible hostile signal events. Often, but not always, these will be characterized as the strongest signal events, which suggests that they are originating from within the target area or facility.

Automated collection and signal analysis technology such as the Kestrel TSCM ® Professional Software, make deployment easier and often take the guess work out of the collection process, however, the technical operator must manually review the data and make an informed decision as to the friendly or hostile nature of every Signal of Interest (SOI) identified.

Phase IV | RSSM ™

The Kestrel TSCM ® Professional Software can be deployed in several ways to accomplish RTM leading up to and during the actual meeting or event.

The technical operator can deploy the Kestrel TSCM ® Professional Software in an operator assisted monitor and capture mode and review the spectral and waterfall data for any new or intermittent signals of a potentially hostile nature in real time during the meeting or event.

The operator can deploy the Kestrel TSCM ® Professional Software to collect and analyze the target environment by installing or placing a suitable antenna concealed in the meeting area or boardroom, covering the full range of the search receiver or analyzer hardware.

The technical operator can deploy the Kestrel TSCM ® Professional Software in a Multiple Receiver Operation (MRO), across multiple display monitors, while sweeping any number of active spectrum band allocations or Ranges of Interest (ROI) to accommodate the ability to monitor numerous bands or signals and demodulate any Signal of Interest (SOI) without interrupting the collection process.

Comparative trace data from the pre-event, Remote Spectrum Surveillance and Monitoring (RSSM), Geographical Area Review (GAR) and the actual TSCM RF sweep may all be imported into the current operational project during the live monitor of the meeting, or event.

Automatic Export Control (AEC), and our Dynamic Alert Annunciator (DAA) may be deployed to enhance the value of the analytical data captured leading up to the inspection and during the actual meeting event.

Kestrel Fail-Safe (KFS) ™ Runtime Operation

The Kestrel TSCM ® Professional Software can be deployed for extended periods of time measured in weeks or months and is more likely to be affected by host computer crashes, application instability, power-failures, OS updates and automatic reboots, etc.

It might also be necessary to initiate an operator invoked power cycle for routine maintenance or to correct low memory conditions.

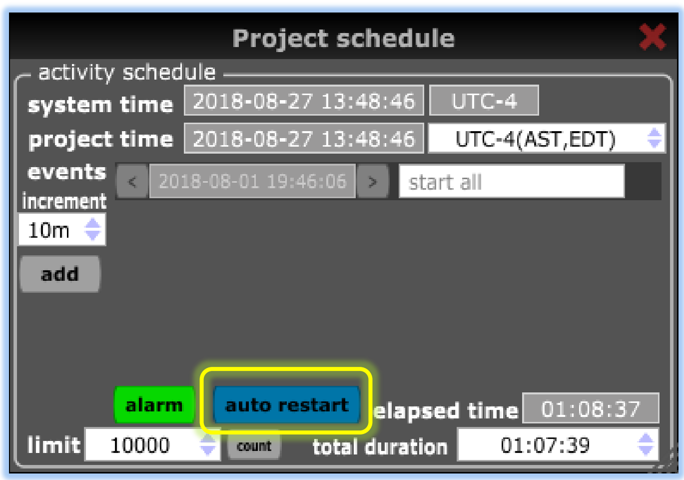
The above noted runtime scenarios require that one or both of the following | *KFS* | protocols be established to assist in automatic boot recovery and runtime Kestrel Project File (KPF) ™ runtime status allowing the software to essentially reboot, re-initialize, open the existing runtime project, and continue recording data.

Kestrel | Auto Restart

There is a | AUTO RESTART | button included as part of the | ACTIVITY SCHEDULER | when enabled within the current runtime project environment can be utilized to invoke the selected Kestrel Project File (KPF) ™ at the application level to attempt an automatic initialization of the connected radio, and restart the existing Kestrel Project File (KPF) ™ back to runtime status where the | AUTO RESTART | feature has been invoked.

This process assumes that the fault condition initiated a machine level reboot on its own, or an operator-initiated reboot is accomplished.

An example of this might be a condition where the machine operating system reboots the computer following an update.



Auto Restart | v1.39xx

There is always a danger that the radio does not initialize following a reboot in which case operator intervention will likely be required to restore the system back to runtime status.

It is therefore essential that the operator manually restart the machine in the | AUTO RESTART | mode to ensure that the initialization process is possible on the machine as not all computers allow devices to be connected to USB ports during start up for both security and other default setting reasons.

Assuming the computer automatically or manually reboots; the radio initializes, and the technical operator has previously selected the | AUTO RESTART | button and as met the following conditions, the Kestrel Project File (KPF) ™ should automatically begin runtime collection.

By default, the main installer will establish the runtime event as this holds the application file association.

In the event of a restart where v1.39-32 (beta drop file) is utilized a restart condition will attempt to open the installer version v1.39xx as the associated installer level default rather than the drop file and if this version does not contain the | AUTO RESTART | feature, runtime will not be established.

It is possible to change the file association as required to respond to the correct application release.

Host Computer

There are also several BIOS driven security policies and settings that can for example recover that host computer from a remote site power failure which has in effect.

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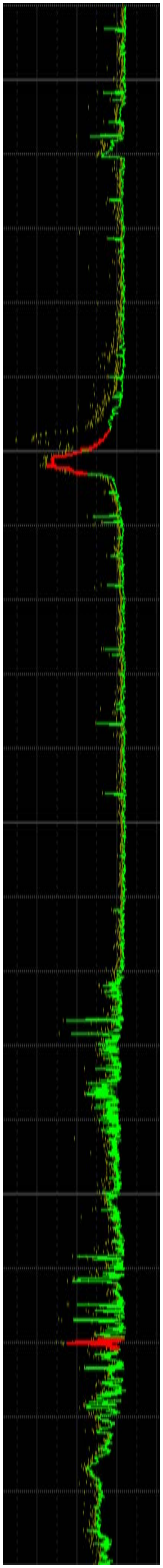

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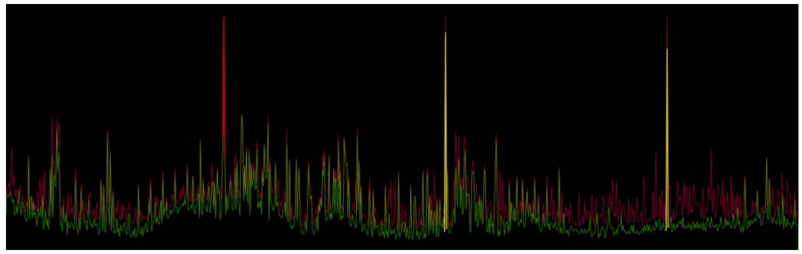

Remote Network Operation

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Remote Network Operation

The ability of the Kestrel TSCM ® Professional Software to support a wide range of select search receivers and spectrum analyzer connectivity types is a key software development milestone.

The Kestrel TSCM ® Professional Software fully supports High Speed USB 2.0, USB 3.0, Local Area Network (LAN), and Fiber-Optic remote connectivity.

The type of direct connection and / or remote connection capability is determined by the type of connections available for each supported search receiver or analyzer type, or the ability to utilize (optional) supported media transfer conversion devices.

Kestrel LAN Remote (KLR)

The Kestrel LAN Remote (KLR) ™ hardware module provides a virtual USB 2.0 / LAN link connection between multiple search receivers or analyzers and the local host computer, over an existing or dedicated LAN connection infrastructure.

The ability to create a private Cat 5e, or Cat 6 (recommended) virtual link connection allows the technical operator to provide remote location and operation of the Signal Hound ™ High Speed USB 2.0 receiver or other analyzers over a virtual LAN connection.

The Kestrel LAN Remote (KLR) is a high-performance USB Device Server with an astounding 800 MHz of on-board processing power.

Our USB Virtual Link technology allows the technical operator to connect High Speed USB 2.0 search receivers making them network visible as a virtual USB 2.0 device, seamlessly, just as if they were connected directly to the host computer.

The KLR is 10 / 100 / 1000 Base Ethernet port enabled and provides two (2) Hi-Speed USB 2.0 ports supporting up to one (1) amp of combined USB bus power at the remote location.

The KLR fully supports High Speed Isochronous, USB transfer for demanding streaming applications.

When Cat 6 is utilized for 10 / 100 / 1000 BASE Ethernet, the maximum deployment cable length is 100 meters or 333 feet.

Deployment typically consists of 90 meters (300 feet) of solid cabling between the patch panel and the wall jack, plus 10 meters (33 feet) of stranded patch cable between each jack and the attached device.

Since stranded cable has higher attenuation than solid cable, exceeding the 10-Meter limit of patch cable will reduce the permissible length of the overall cable installation.

Cat 6 cable runs must be properly installed and terminated to meet qualification specifications.

The cable must not be kinked or bent too tightly and the bend radius should be at least four (4) times the outer diameter of the cable.

Kestrel Fiber-Optic Module (KFM) ™

Our Technical Research and Standards Group (TSRG) ™ has approved a new Multi-Mode Duplex Fiber-Optic solution for use with the Signal Hound (BB60) series USB 3.0 Real-Time Spectrum Analyzer and RF Recorder.

The Kestrel Fiber-Optic Module (KFM) ™ is an optional capability that extends the normally limited USB 3.0 cable connectivity length from just a couple of meters to significantly greater distances (50 meters) supporting a wide range of Signals Intelligence (SIGINT) and Communication Security (COMSEC) applications.

Data transfer security is significantly enhanced as is the extended working range.

The Kestrel Fiber-Optic Module (KFM) ™ is yet another important development milestone permitting extended high-speed data transfer, command and control connectivity between the host computer running the Kestrel TSCM ® Professional Software and remotely deployed Signal Hound (BB60) series high speed (up to 24 GHz per second at 10 kHz RBW) search receivers.

Fiber-Optic communication is an ideal solution for managed remote spectrum surveillance and monitoring services for facility wide technical security requirements.

Deployment working distances of 50 meters (164 feet) are possible, without the limiting USB 3.0 voltage drop the is typical beyond just 2 or 3 meters.

Fiber-Optic Basics

Fiber-Optic cable consists of an optical core and a non-optical cladding layer, designed for internal reflection due to the difference in the refractive index between the two (2) layers.

The cladding is usually coated with a layer of acrylate polymer.

This coating protects the fiber from damage but does not contribute to its optical waveguide properties.

Individual coated fiber typically has a resin buffer layer.

Several layers of protective sheathing, depending on the application, are added to form the finished fiber-optic cable.

Remote Desktop Operation (RDO)

The ability to establish remote command and control connectivity, manage software setup and programming, provide remote computer maintenance, conduct real-time and on demand remote signal event analysis and review is fully supported utilizing TSB approved third party Remote Desktop Software (RDS).

The ability to access any number of remote Kestrel TSCM ® Professional Software installations and conduct real-time collection is fully supported utilizing an active Internet connection or across a private Local Area Network (LAN).

Team Viewer ™ License

There are additional third-party Remote Desktop Software (RDS) applications available, however, we recommend purchasing a commercial or corporate license for Team Viewer™, when Remote Spectrum Surveillance and Monitoring (RSSM) and operator analysis is required.

Team Viewer ™ provides the technical operator with the ability to install any number of remote client installations and is fully supported by the Kestrel TSCM ® Professional Software features and functionality, including remote audio demodulation.

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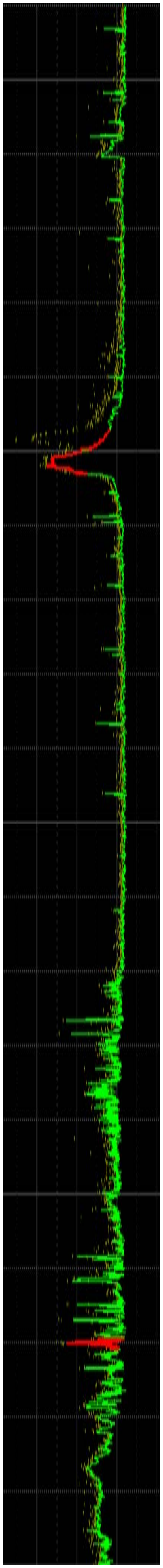
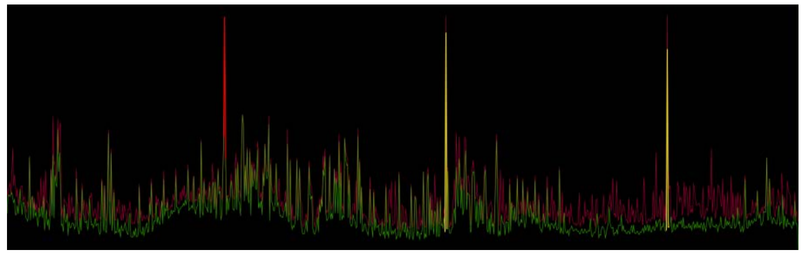


Chapter 23

End User License Agreement (EULA)

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

End User License Agreement (EULA)

Professional Development TSCM Group Inc. (PDTG)

"Innovation is Simply the Beginning..."

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The Key you purchase and receive is valid only for the specific receiver or spectrum analyzer, provided during the activation process. The Software will not function with a different receiver without a new Activation Security Key (ASK).

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End-users are required to contact Professional Development TSCM Group Inc., for specific transfer of technology restrictions outside of North America.

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If any provision of this EULA shall be held by a court of competent jurisdiction to be contrary to law that provision will be enforced to the maximum extent permissible and the remaining provisions of this Agreement will remain in full force and effect.

The Software and this EULA may be updated, with important changes being identified on our website at www.pdtg.ca or www.kestreltscm.com, which you should regularly review, together with providing Professional Development TSCM Group Inc., with current email contact information so that updates and new information can be emailed to you in a timely manner.

The end-user agrees that the Kestrel TSCM ® Software will not be utilized contrary to the laws of Canada or another jurisdiction. The end-user accepts all responsibility to comply with laws and regulations relating to the interception, collection, decoding and monitoring of radio communication signals.

Should you have any questions concerning this EULA, or if you desire to contact Professional Development TSCM Group Inc., for any reason, please contact the authorized Kestrel TSCM ® Software distributor serving your country, or contact:

Mailing Address:
Professional Development TSCM Group Inc.
Technical Security Branch (TSB)
5 - 4104 Fairview Street
Burlington, Ontario
Canada L7L 4Y8

Telephone: 647-293-7384

Email: pdturner@pdtg.ca

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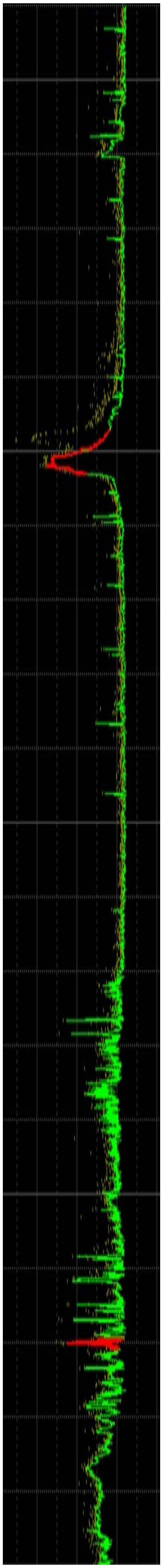

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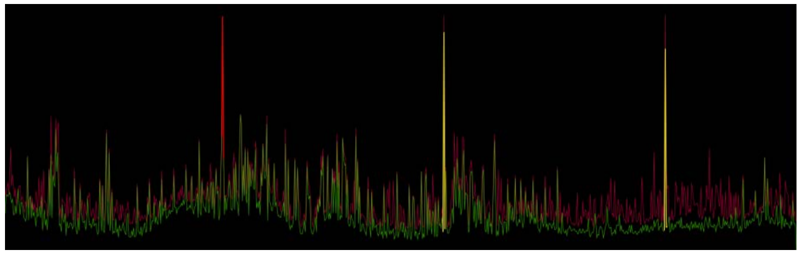

Technical Support Group (TSG) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Technical Support Group (TSG) ™

The appropriate level of technical support is an essential element in the design and development of any highly-advanced software product.

Our Technical Support Group (TSG) is always available to assist licensed end-users of the Kestrel TSCM ® Professional Software should there be any difficulties with the installation, or operation of the software.

Given the symbiotic relationship between the host computer, SDR hardware, and the Kestrel TSCM ® Professional Software, we do our best to provide technical support and trouble-shooting across the various components.

Please visit the official Kestrel TSCM ® Professional Software; Technical Support Group (TSG) website at www.pdtg.ca or www.kestreltscm.com for software sales; training; and technical support options.

Professional Development TSCM Group Inc.

Technical Security Branch (TSB)

5-4104 Fairview Street, Suite 319 Burlington Ontario Canada L7L 4Y8

Telephone: 647-293-7384   Email: support@pdtg.ca

Web Site: **www.pdtg.ca** or **www.kestreltscm.com**

Contact: Paul D Turner, TSS TSI

Before contacting the Kestrel TSCM ® Professional Software; Technical Support Group (TSG), please take a moment to collect the following information to assist the Technical Support Group (TSG) in providing the required level of support.

There is no charge for email based technical support.

Telephone support may be provided at the discretion of the Technical Support Group (TSG) in special circumstances.

It is strongly recommended that users download and install TeamViewer for advanced technical support sessions.

Please take a moment to collect the following information before contacting technical support.

Generally, technical support is provided for the latest installer release, so please be sure to update your system prior to requesting technical support.

Technical Support Request | Contact Details

✔ | Search Receiver or Analyzer Type | Rx Firmware

Understanding which receivers are being used and the firmware version is essential to determining whether the issue is Rx specific, or firmware related. It is the operator's responsibility to ensure that the firmware is maintained at the current release level. Technical support cannot update the hardware firmware remotely.

✔ | Host Computer Type + Operating System Particulars

The host computer is an essential component of the system and is oftentimes the primary reason for technical support issues. It is essential that the operator ensure all host computer updates and patches are installed on the machine. Please have the machine particulars available, if needed.

✔ | Kestrel TSCM ® Professional Software | Release Control Number

Periodic software installers, and Beta drop (exe) files are released on a regular basis and the operator is encouraged to download and install the latest software, prior to requesting technical support. The latest full installer release is required for any posted drop files.

✔ | Detailed Description of the Problem Encountered

It is essential to understand the sequence of events that led to the condition where technical support was required, including any crash reports generated and operator observations. This information can assist in determining whether the issue is software or hardware related. Please submit all crash report, they are a vital part of the bug fix process.

✔ | Sequence of Events or Actions Leading to the Problem Encountered

The technical operator is encouraged to attempt to duplicate the crash, or instability issue before contacting technical support. Oftentimes, things simply go wrong when hardware, software, firmware, and a human are all interacting together. Please confirm if the condition can be duplicated.

✔ | Actions Taken to Resolve the Problem Encountered

If any action was taken to successfully mitigate the crash, bug, or condition, please provide this to technical support. Sometimes, little details can identify the problem area of code structure, or module affected. We consider the software always a work in progress and constant improvements are an essential part of the process.

Technical Support | v1.39xx

Troubleshooting

Our Technical Research and Standards Group (TRSG) have completed extensive operational and stability testing of the Kestrel TSCM ® Professional Software.

However, there will no doubt be runtime bugs and other minor issues identified during the early stages of each new software release, or subsequent release control, or maintenance update.

Many of the advanced features and functionality are being defined and refined with each new release and additional maintenance update releases will be made available to authorized Kestrel TSCM ® Professional Software licensed end-users from time to time.

A new release will often include new features and functionality, often with initially limited functionality during the early development and qualification phase of the release, these features will continue to be developed with additional functionality and updates periodically.

Your comments, experiences, sample data and ideas are greatly appreciated as we refine the Kestrel TSCM ® Professional Software.

TeamViewer Client

We have partnered with TeamViewer ™ to bring an enhanced level of remote access and technical support for windows-based host computer hardware installations and assist licensed technical operators with software and hardware configuration support issues.

TeamViewer is free and may be downloaded from www.teamviewer.com

Running TeamViewer generates a unique | CLIENT ID | and a one-time rolling | PASSWORD | each time the application is run.

Simply provide the unique | CLIENT ID | and the one-time | PASSWORD | to technical support for the purpose of allowing our technical support personnel access to your Kestrel TSCM ® Professional Software desktop and associated file structure.

Technical support will be able to provide direct technical support for your installation and quickly determine the nature of the support problem and provide a solution or fix.

Kestrel ® | Terms of Reference

The following pages describe some of the generic and software specific terminology relating to the features and functionality of the Kestrel TSCM ® Professional Software, Signals Intelligence Support System (SISS) ™.

"New Technology Requires New Methodology…"

"New Technology Requires New Terminology…"

We have included additional common and perhaps familiar industry-based terminology as a working reference.

Those entries marked with our trademark ™ are specific to the Kestrel TSCM ® Professional Software, Signals Intelligence Support System (SISS). ™

Acronyms

There are many terms of reference and acronyms associated with the Kestrel TSCM ® Professional Software that will be somewhat familiar to the experienced technical operator.

However; there are a significant number of new concepts and therefore, new terminology that applies not only to a wide range of unique features and / or functionality, but also relating to the technical operation of the Kestrel TSCM ® Professional Software.

A -

AAS	Automatic Antenna Switch
ACARS	Aircraft Communications Addressing and Reporting System
ACP	Alarm Control Panel
ACP ™	Advanced Chirp Procedure
ACR ™	Annual Certification Review
AEC ™	Automatic Export Control
AGC	Automatic Gain Control

AOD ™	Audio Oscilloscope Display
AM	Amplitude Modulation
ANF	Ambient Noise Floor
APD ™	Antenna Placement Distance
ART ™	Auto Range Trigger
ASID ™	Advanced Signal Intelligence Database
ASK ™	Activation Security Key
ARD ™	Analog RSSI Display
ARL	Amplitude Reference Level
ATL ™	Automatic Threat List
ATS	Active Tone Sequence
ATSC	American Television Standards Committee

B

BW	Bandwidth

C

CCF ™	Correlation Confidence Factor
CCM ™	Continuous Collection Mode
CDMA	Code Division Multiple Access
CF	Centre Frequency
CLP ™	Command Line Programming
COFDM	Coded Orthogonal Frequency Division Multiplex
CPM	Channel Profile Mask
CPR ™	Chirp Pattern Recognition
CRC ™	Challenge and Response Code
CRM ™	Communication Receiver Mode

CSV	Comma Separated Values
CTA	Canadian Telecommunication Act
CTL ™	Chirp Threat List
CTM ™	Chirp Threat Mode
CW	Continuous Wave

***D* -**

DAA ™	Dynamic Alert Annunciator
DAB	Digital Audio Broadcast
DCM	Domestic Countermeasures
DCP	Data Collection Process
DCS	Default Control Settings
DDT ™	Drag and Drop Technology
DFC ™	Demodulation Frequency Control
DMC ™	Differential Mapping Control
DRO ™	Dual Receiver Operation
DRS ™	Dual Receiver Synchronization
DSA	Discrete Signal Analysis
DSM	Delayed Start Mode
DSS	Discrete Signal Search
DSSS	Direct Sequence Spread Spectrum
DTAP ™	Dynamic Trace Autonomous Platform
DTM	Differential Trace Math
DVP	Data Viewing Parameters

***E* -**

ECM	Electronic Countermeasures

ELF	Extremely Low Frequency
ELT	Emergency Locator Transmitter
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge
ETOC ™	Equipment Training and Operator Certificate
EULA	End User License Agreement

F -

FAM ™	Fast Analysis Mode
FDB ™	Frequency Database
FDC	Frequency Display Control
FFT	Fast Fourier Transform
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
FNC	File Naming Convention
FOR	Fiber-Optic Remote
FTA ™	Functional Target Area
FW	Firmware

G -

GAR ™	Geographical Area Review
GBC ™	Guard Band Control
GPRS	General Packet Radio Service
GSM	Global System for Mobile
GSS	Geographical Site Survey
GUI	Graphical User Interface

H -

HDTV	High Definition Television
HF	High Frequency
HSI	Hostile Signal Identification
HST ™	Harmonic Signature Threshold

I -

ICT ™	Image Capture Tool
IF	Intermediate Frequency
ISE ™	Ignore Signal Event
ITU	International Telecommunication Union
IQD ™	IQ Display

K -

KDM ™	Kestrel Defined Monitor
KEM	Kestrel Error Module
KGA ™	Kestrel Graphics Adapter
KGM ™	Kestrel Graphical Mapping
KLR ™	Kestrel LAN Remote
KPF ™	Kestrel Project File
KRC ™	Kestrel Report Cache
KSA ™	Kestrel Spectrum Analytics
KSM ™	Kestrel Stealth Mode
KSS	Known Sound Source
KST ™	Kestrel Super Trace
KWR ™	Kestrel Wave Recorder

L -

LDSA ™	Location Differential Signal Analysis
LF	Low Frequency
LNA	Low Noise Amplifier
LO	Local Oscillator
LOR	Local Oscillator Radiation
LPA	Low Power Amplifier
LSB	Lower Side Band
LVA ™	Live View Analysis

M -

MBD ™	Multiple Band Deployment
MDA ™	Minimum Detection Amplitude
MDC	Microwave Down-Converter
MDO ™	Manual Demodulator Operation
MHz	Megahertz
MKM	Multiple Key Management
MLM	Multiple Licence Management
MRO ™	Multiple Receiver Operation

O -

OFDM	Orthogonal Frequency Division Multiplexing
OSL ™	Operator Signal List
OS-PPG ™	Operational Standard - Policy and Procedure Guideline

P -

PAT	Peak Amplitude Threshold

PDF	Portable Document File
PDTG ™	Professional Development TSCM Group Inc.
PEC ™	Peak Envelope Capture
PLB	Personal Locator Beacon
PM	Phase Modulation
POD	Probability of Detection
PSM ™	Peak Seeking Marker
PTL	Perceived Threat Level
PZF ™	Positional Zoom Factor
PZC ™	Positional Zoom Control

Q -

QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
QSG	Quick Start Guide

R -

RDK	Rapid Deployment Kit
RDPS	Restricted and Denied Party Screening
ROI	Range of Interest
RDSA ™	Receiver Differential Signal Analysis
RBW	Resolution Bandwidth
RDS	Remote Desktop Software
RFI	Radio Frequency Interference
RHD	RSSI History Display
RID	Remote Intrusion Detection
RNS	Remote Network Setup

RSD	RF Spectral Display
RSSI	Relative Signal Strength Indicator
RSSM ™	Remote Spectrum Surveillance and Monitoring
RTL ™	RSSI Tone Locator
RTC ™	Resident Training Centre
RTE ™	Real Time Event
RTM	Real-Time Monitoring

S -

SAL	Signal Alarm List
SAM	Signal Alarm Mode
SAM	Signal Analysis Mode
SAM	Slow Analysis Mode
SAMR	Spectrum Analyzer and Measuring Receiver
SAR	Search and Rescue
SAT	Spectral Average Trace
SBC ™	Spectrum Baseline Clipping
SBL ™	Spectrum Baseline Logging
SCA	Sub-Carrier Audio
SCT ™	Signal Combining Tolerance
SDG ™	Software Development Group
SDR	Software Defined Radio
SFDR	Spurious Free Dynamic Range
SHC	Spectral Harmonic Calculator
SHF	Super High Frequency
SIC ™	Spectrum Image Control
SISS ™	Signals Intelligence Support System ™

SLF	Super Low Frequency
SOI	Signal of Interest
SOW	Scope of Work
SPE ™	Spectral Profile Editor
SRC ™	Spectral Range Control
SRG ™	Session Report Generator
SRO ™	Signal Receiver Operation
SRM ™	System Resources Monitor
SSB	Single Side Band
SSM	Spectrum Surveillance and Monitoring

***T* -**

TAA	Tactical Antenna Array
TCP ™	Tap Capture Plot
TDA ™	Threat Detection Algorithm
TDC ™	Threat Detection Criteria
TDSA ™	Time Differential Signal Analysis
TLC ™	Threat Level Criteria
TLP ™	Threat Level Programming
TDMA	Time Division Multiple Access
TMC	Trace Math Calculator
TRSG ™	Technical Research and Standards Group
TRM ™	Trace Reference Marker
TSH	Technical Security Hazard
TSD	Technical Surveillance Device
TSB ™	Technical Security Branch
TSCM	Technical Surveillance Countermeasures

TSS ™ Technical Security Specialist

U -

UHF Ultra High Frequency

ULF Ultra Low Frequency

UMTS Universal Mobile Telecommunications System

USB Upper Side Band

UTC Universal Time Coordinated

V -

VFO Variable Frequency Oscillator

VHF Very High Frequency

VLF Very Low Frequency

VOX Voice Operated Switch

W -

WFD ™ Waterfall Display

WLAN Wireless Local Area Network

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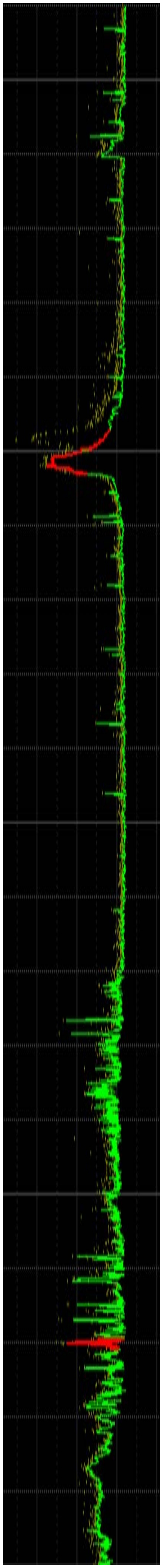

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 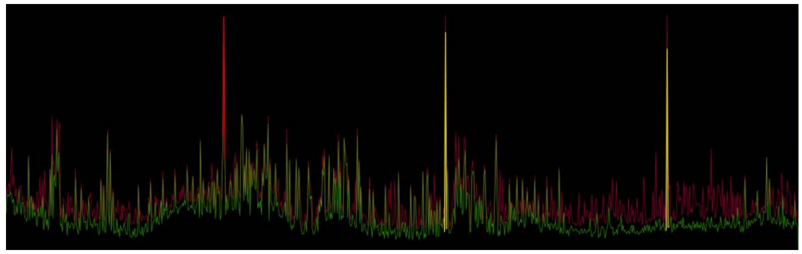

Kestrel TSCM ® Professional

Software Training

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Kestrel TSCM ® Professional Software Training

Kestrel TSCM ® Professional Software, operator familiarization, and advanced certification training is available from Professional Development TSCM Group Inc., in several training formats.

Certified Technical Operator (CTO) ™ | 5 Days

Our Technical Research and Standards Group (TRSG) ™ provides a 5-day, Kestrel TSCM ® Professional Software | Certified Technical Operator (CTO) ™ | and | Certified Government Technical Operator (CGTO) ™ | program for both new and experienced technical operators.

The cost of the program is just $2,250.00 + $292.50 (HST) = $2,542.50 CAD and includes accommodation, daily refreshment breaks and meals on-site.

The tuition is subject to change without notice, please contact our office to confirm training fees, dates and venue.

Participants may purchase the Kestrel TSCM ® Professional Software during the training at a discounted rate. Contact our office for details.

Our Resident based program is a five (5) full day format conducted at the Technical Security Branch (TSB) ™ | Resident Training Centre (RTC) ™ in Cornwall, Ontario, Canada or as a non-resident program at our Red Deer Training Centre (RDTC) ™ in Alberta.

Participants will be issued with a Certified Technical Operator (CTO) ™ certification and Technical Analysis Certification (TAC) ™ upon the successful completion of this program.

Our Resident based program meets the mandatory Annual Certification Review (ACR) ™ requirements of the TSB Technical Security Specialist (TSS) ™ Designate Certification program.

Tuition includes 4-nights of accommodation and meals on-site.

Additional nights of accommodation can be arranged to satisfy travel planning, should participants need to arrive the day before, or depart the day after the training.

The cost of extra nights or accommodation, includes meals for the extra days at $225.00 CAD per night + 13% HST ($29.25) = $254.25 CAD as part of the training package.

Please contact our office for a copy of the latest version of training agenda.

Certified Technical Operator (CTO) ™ | 7 Days

Our Technical Research and Standards Group (TRSG) ™ provides a 7-day, Kestrel TSCM ® Professional Software | Certified Technical Operator (CTO) ™ | and | Certified Government Technical Operator (CGTO) ™ | program for both new and experienced technical operators.

The cost of the program is just $2,950.00 + $383.50 (HST) = $3,333.50 CAD and includes accommodation, daily refreshment breaks and meals on-site.

The tuition is subject to change without notice, please contact our office to confirm training fees, dates and venue.

Participants may purchase the Kestrel TSCM ® Professional Software during the training at a discounted rate. Contact our office for details.

Our Resident based program is a seven (7) full day format conducted at the Technical Security Branch (TSB) ™ | Resident Training Centre (RTC) ™ in Cornwall, Ontario, Canada or as a non-resident program at our Red Deer Training Centre (RDTC) ™ in Alberta.

Participants will be issued with a Certified Technical Operator (CTO) ™ certification and Technical Analysis Certification (TAC) ™ upon the successful completion of this program.

Our Resident based program meets the mandatory Annual Certification Review (ACR) ™ requirements of the TSB Technical Security Specialist (TSS) ™ Designate Certification program.

Tuition includes 7-nights of accommodation and meals on-site.

Additional nights of accommodation can be arranged to satisfy travel planning, should participants need to arrive the day before, or depart the day after the training.

The cost of extra nights or accommodation, includes meals for the extra days at $225.00 CAD per night + 13% HST ($29.25) = $254.25 CAD as part of the training package.

Please contact our office for a copy of the latest version of training agenda.

Technical Security Specialist (TSS) ™ Designate Certification Program

Our | Technical Security Specialist (TSS) ™ | Designate Certification Program consists of 120 hours (14 days) at our | Resident Training Centre (RTC) ™ | and is divided into three (3) specific training phases.

Our TSS Designate Certification Program is run in a full-time resident format and includes all meals, private accommodation, training, and excellent course materials delivered on a Netbook computer.

Participants have the opportunity to work with both analog and digital telephone systems; and sophisticated electronic countermeasures equipment resources from nearly all of the major manufacturers.

The cost of the all inclusive TSS ™ Certification program is just $7,950.00 + $1,033.50 (HST) = $8,983.50 (CAD) and includes all on-site meals, private accommodation, and electronic course materials are provided.

The cost is subject to change without notice. Please contact our office to confirm tuition costs.

Participants may purchase the | Kestrel TSCM ® Professional Software | during the training at a discounted rate. Contact our office for details.

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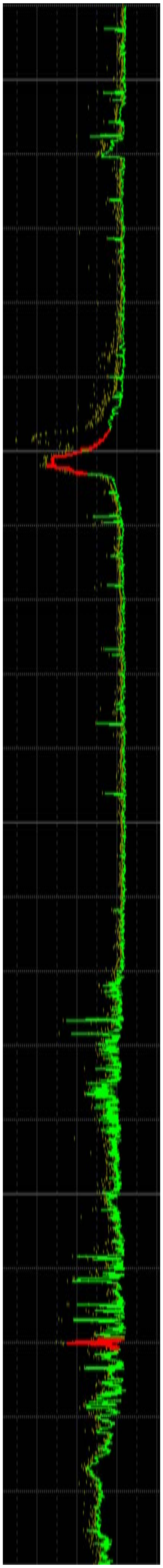

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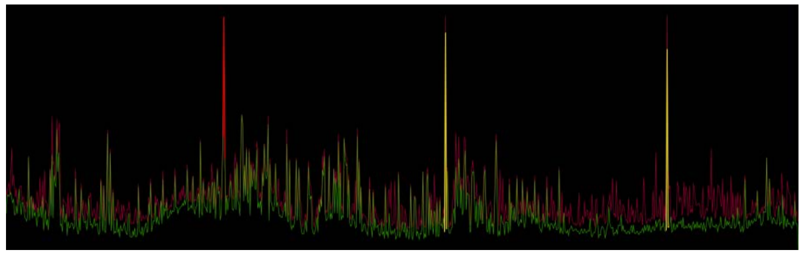

Quick Start Protocols (QSP) ™

Innovation is Simply the Beginning...

Review and Revision: 2020-02-29

Quick Start Protocols (QSP) ™

Our QSP ™ is a set of feature level step by step deployment protocols that are mission specific and based on the recommended practices for most technical operator deployment requirements.

In it essential to note that mission specific deployment activities vary significantly across end-user responsibilities, as will experience level of the technical operator.

Therefore, operators may focus on the QSP ™ protocols of specific interest to his / her immediate deployment needs and mission focus.

The QSP ™ are not a substitute for proper operator training or an excuse not to read the rest of the | Software Programming and Operator Manual (SPOM) ™ |.

Hardware Setup

The hardware configuration and setup will differ widely across each deployment and subject to system or platform components available.

1 | *Ensure the host computer is powered and ready.*

2 | *Connect one or more radios to the host computer via the hardware defined | USB 2.0 | USB 3.0 | USB 3.1 | LAN |, or other connection type. Devices such as Fiber-Optic remotes may also require additional device specific set up and configuration.*

3 | *Verify that powered components are in-fact powered and ensure power supplies are positioned away from the receiver and antenna components.*

4 | *Connect a suitable antenna to each radio via an | SMA | or | N | type connector as required by the radio and antenna system. Position the antenna cables and antennas away from the host computer, power cords and switching power supplies.*

5 | *Confirm antenna connectors are hand snug, but do not over tighten connectors, and never use pliers or other tools to tighten antenna and cable connectors.*

Software Initialization

Assuming the latest software release is properly installed on the host computer, and the computer operating system, dependencies and support files are all up to date reliably results in smooth trouble-free deployment.

Software, firmware, drivers are all issues that need to be addressed on a regular basis, referred to a "system maintenance" and most definitely not something that is attended to during field deployment!

This QSP ™ assumes that the required licence has been set for the platform, if no licensed are installed, please review the | Activation Security Key (ASK) ™ |, QSP ™ for detailed information on this process.

1 | *Locate the software desktop shortcut and open the application.*

2 | *Once the application is open, confirm the correct software version. This information is located within the application banner at the top center of the user interface.*

3 | *The software user interface and | ANALYZER CONTROL | will display. Assuming one or more connected, supported and licensed radios were found and initialized, the radios will display | GREEN |, if not ready | RED |.*

Splash Screen

During the software initialization process the application splash screen displays briefly and the audio sub-system provides confirmation of the host computer to render audio.

1 | *During the display of the splash screen, the technical operator can disable the splash screen audio by unchecking the | SPLASH AUDIO | checkbox during the start-up process to disable the | SPLASH AUDIO | capability, until manually restored in the future, by checking the | SPLASH AUDIO | checkbox.*

2 | *The application splash screen can be manually displayed by accessing the | HELP | ABOUT | menu option, to disable the | SPLASH AUDIO | capability, until manually restored in the future, by checking the | SPLASH AUDIO | checkbox.*

3 | *Confirmation of the software version can be viewed and confirmed by the technical operator.*

Analyzer Control Group

There are several settings that need to be confirmed, set or updated prior to defining a project in order to meet the intended mission specific deployment requirements.

It is strongly recommended that the operator attend to this step as a verification, as often times other operators may have altered or changed critical settings for previous mission specific requirements.

The | ANALYZER CONTROL | group will display once the software has initialized and will display all discovered radios, providing a starting point for determining the status and readiness of the hardware and software.

It only takes a few seconds to review and if necessary, update the settings.

1 | *When one or more radios are initialized, each will be listed in table format within the | ANALYZER CONTROL | displaying | GREEN | if a valid Activation Security Key (ASK)™ is present, and | RED | if no valid licence is found.*

2 | *If connected radios are not displayed in the | ANALYZER CONTROL |, either the manufacturer or model is not supported, or the hardware drivers are not properly installed, or the hardware was not ready when the application is started.*

3 | *Initialized radios will display a default | NAME | consisting of the | MODEL | and | SERIAL NUMBER | and a pop-up menu permits a radio | FRIENDLY NAME | to be defined by the operator by selecting the | EDIT NAME | from the menu. This is an important consideration when multiple radios are deployed.*

4 | *Confirmation of the | SPECTRUM | DEMODULATE | ANALYSIS | table elements allow the technical operator to define the authorized functionality of each radio availability, in the | SDR | and | DEMODULATION | control groups. Only a single receiver may be defined as an analysis radio.*

5 | *When multiple radios are assigned, it is possible define and invoke Receiver Differential Signal Analysis (RDSA) from within the | ANALYZER CONTROL |. Defining a unique | LOCATION | for each radio, removes the location lock and allows each RDSA radio to act independently. The pop-up menu permits a radio | LOCATION NAME | to be defined by the operator by selecting the | EDIT LOCATION | from the menu.*

6 | *The pop-up menu | CONFIGURE | option invokes a setting configuration dialog window for each radio, permitting radio specific setting such as gain, attenuation and other available options.*

7 | *There is another important pop-up menu option | LICENSE RENEWAL KEY | that allows renewal keys to be installed prior to the expiry date of an existing key and provides a method of activating optional software modules.*

8 | *Once the operator has reviewed the various settings and radio configuration settings, the | ANALYZER CONTROL | can be closed.*

New Project | Set-Up Wizard

The technical operator must define a | NEW PROJECT | that sets an independent project | DIRECTORY |, containing the Kestrel Project File (KPF) and all associated data.

There are a number of options in this regard, such as defining a | NEW PROJECT | OPEN PROJECT TEMPLATE | OPEN EXISTING PROJECT |.

1 | *Selecting the main menu | FILE | NEW PROJECT | NO TEMPLATE | opens the | SET-UP WIZARD | permitting the operator to define mission specific project parameters.*

2 | *Setup requires that the operator define and enter a unique | PROJECT DESCRIPTION | consisting of a | PROJECT NAME | LOCATION NAME | and | TECHNCAL OPERATOR | reference. If a GPS receiver is connected and ready, pressing the | GPS | button captures the current coordinates. Alternatively, the operator can enter the | LATITUDE | and | LONGITUDE | manually in decimal format (43.8634 N | 79.1284 W), for example. It is strongly recommended that a well-defined and consistently utilized | FILE NAMING CONVENTION | be utilized for project definition, as this information ports through to other parts of the application, including the | SESSION REPORT GENERATOR (SRG)™ |.*

3 | *Minimal programming is required by default for the | ACTIVITY SCHEDULE | section of the | SETUP WIZARD |. It is essential that the technical operator confirm that the host computer system date and time | SYTEM TIME | are correct and if necessary, select the | PROJECT TIME | when working in a different time zone.*

4 | *Universal | EVENT | programming is possible across all radios and all bands within the | ACTIVITY SCHEDULE | using the | ADD | control.*

5 | *Defining the runtime | LIMIT | based on the number of | TRACES | or | TIME | can be set by the technical operator. This feature is useful when multiple locations need to be swept within a defined period of time. The default setting is | NONE | meaning there is no limit set. The associated | EVENT ALARM | provides an audio alert for all programmed events, when enabled. The total duration control can be used to define an absolute limit at which time the application will stop collection and cease all activities. By default, the | TOTAL DURATION | control is set to | CONTINUOUS MODE |. If 10-days of runtime collection is required for unattended operation, defining | 10D | or | 240H | will set the | TOTAL DURATION | accordingly.*

6 | *Operator definition of one (1) or more | ANTENNA LOCATIONS | is required for normal runtime operation. This dialog window is not populated for | RDSA | operator, as the | LOCATION NAMES | were defined within the | ANALYZER CONTROL | in preparation for | RDSA | operation.*

7 | *One (1) or more | SPECTRUM BANDS | must be defined within the | SETUP WIZARD |. This is accomplished by selecting a collection | RANGE OF IINTEREST (ROI) | or using a previously defined | SPECTRUM PROFILE FILE (SPF) |. Invoking the | ADD SPECTRUM BAND | opens the | ADD SPECTRUM | SPECTRAL RANGE CONTROL (SRC) | dialog window. Any number of bands can be defined across any number of radios, along with unique | RUNTIME COMPRESSION | referred to as | DECIMATION | and unique | TRACE LIMIT | or | TIME | settings.*

8 | *Invoking the | CREATE NEW PROJECT | button starts the runtime collection process.*

Spectrum Display and Activity (SDA) TM

Once runtime operation has been established based on the parameters defined within the | SETUP WIZARD |, the operator can change and displayed spectra in a wide variety of ways depending on the mission parameters and requirements.

Display related controls do not affect runtime collection but allow the operator to select the optimal visualization for viewing and report generation.

1 | *The | MIN-MAX | button provides a background fill trace representing the minimum and maximum signal activity range. The | PEAK | button provides the option to display a peak trace represented by | LINES | POINTS | and background | FILL |.*

2 | *The ability to manually | RESET | the peak trace calculation is provided and there is a | PEAK (HOLD) | option menu to change the default from peak hold to | ECHO (SLOW) |, | ECHO (MEDIUM) | and | ECHO (FAST) | allowing the selection of a peak persistence decay. The | AVERAGE | button provides the option to display an average trace represented by | LINES | POINTS | and background | FILL |. The | RESET | button permits the average trace calculation to be reset and also display the count calculation in the current | AVERAGE | trace. The | SIGNAL | button provides the option to display a | REAL-TIME EVENT | trace represented by | LINES | POINTS | and background | FILL |.*

3 | *The | GRATICULE | slider control allows the operator to remove the spectrum display reference grid. The | TRACE | slider control allows the operator to globally dim the all displayed traces. When the displayed traces are dimmed, focus is given to any displayed | MDA | CTM | HST | SBL | SOI | OSL | spectral flags.*

4 | *The | TDSA | button is only active and available when the | Time Differential Signal Analysis (TDSA) | feature is enabled. When the technical operator selects the | TDSA | button, a time periodic peak trace is displayed, which resets at a rate equal to the | TDSA | control | PERIOD | defined by the technical operator.*

5 | *The | WFD BRK | button provides a means of displaying a waterfall display reference marker line representing discontinuity in the waterfall due to activity scheduler processes, runtime stop / start activities, which can be a matter of seconds, minutes, hours, or days. The | PLAN | button invokes the antenna locations floor plan display. The | LEGEND | button provides a means to display a contextual colour trace display reference legend. The | ALERTS | button allows the operator to display / hide the | DYNAMIC ALERT ANNOUNCIATOR (DAA) | alert zones, without effecting runtime detection.*

6 | *The | FDB | button displays the | ADVANCED SIGNALS INTELLIGENCE DATABASE (ASID) | database spectrum display overlay. The | OSL | button invokes the operator defined | OPERATOR SIGNAL LIST (OSL) | spectrum display overlay markers for all signal entries within the current | OSL | database. The | CPM | button invokes the display of operator defined and selected | CHANNEL PROFILE MASKS (CPM) | as a display overlay.*

7 | *The | REC | and | ARM | buttons provide the ability to control the data recording process and provide the ability to arm the record process based on operator defined triggering. This process allows runtime to be maximized and data storage requirements to be minimized.*

8 | *The 1/n write compression value, where 1/1 = real-time and 1/50 for example compresses the data, reducing the file size by 50x without losing any peak data, reducing the active file storage requirement significantly. The | WBC | button removes all unsaved | WFD | data, displaying only the saved compressed data.*

9 | *The | LOCK | RESTART / PAUSE | button combination allows band level spectrum bands to be paused, locked and restarted manually. This functionality is also controlled automatically, when the trace | LIMIT | or trace | TIME | is defined by the operator. The activity scheduler settings also control runtime operation. The trace limit | ALARM | button enables a definable audio alarm event. The | PROJECT | menu | SCHEDULE ALARM SOUND | allows the operator to define a custom audio file.*

10 | *The | AUTO RANGE | checkbox provides automatic reference level updating when the signal environment exceeds the visual spectrum display area. The | AUTO RANGE | button is used by the technical operator as a manual reference level update.*

Spectral Range Control (SRC) ™

The application provides exceptionally powerful dynamic zoom and range display controls that can be initiated by the technical operator from within the | SRC ™ | control group, and directly from the | WFD | RSD | PZC | and | DSA | user-interface displays.

SDR Status

The SDR status control group is a uniquely powerful feature permitting the operator to dynamically hand-off any runtime band or spectrum range across any available radio.

The Resolution Bandwidth (RBW) can be adjusted on-the-fly and is independent across each band or spectrum range.

The IFB ™ mode is also accessed within the | SDR STATUS | control group.

This feature permits operation up to the maximum hardware Intermediate Frequency (IF) bandwidth.

1 | *The primary function of the | SDR STATUS | control group is to display all available receivers and analyzers for spectrum hand-off. The selection box menu provides a list (type and Serial Number or Friendly Name) for each receiver as assigned to a particular band, or presently not assigned to any current band. Dynamic hand-off is accomplished by simply selecting any available receiver from the list when the focus is on a particular band of interest. Dynamic hand-off is instantaneous and provides the ability to define multiple bands across multiple receivers. For example, it is possible to assign several bands to a single receiver or divide several bands across multiple receivers or different types or at different collection locations.*

2 | *Due to the many user specific deployment configurations the current location is displayed for each receiver as defined by the technical operator. In normal runtime operation, all receivers are assigned to the same location. If deployment advantages the Receiver Differential Signal Analysis (RDSA) ™ capability, the collection location with be different for each assigned receiver and display for situational awareness.*

3 | *The system ICON provides direct access to the currently selected and displayed radio configuration dialog window. Each receiver type will have different configuration setting available. It is always a good idea to confirm the setting in the | ANALYZER CONTROL | during the initialization process for each radio.*

4| *The resolution bandwidth control provides the technical operator with a wide range of settings necessary for the analysis of the modern threat environment and is not found on some competitive products significantly limiting runtime capability. The ability to open and define multiple bands or spectrum ranges and assign unique RBW settings is fully supported. The | RBW | can be changed on the fly by the technical operator.*

5 | *The application | IFB ™ | feature allows the technical operator to advantage the real-time bandwidth of the hardware. Invoking | IFB ™ | allows the application to operate in a modified zero span mode, up to the real-time bandwidth limitation of the hardware. For example, the Signal Hound BB60C has a real-time IF bandwidth of 27 MHz and the SM200A has a real-time IF bandwidth of 160 MHz. The current displayed band or spectrum range must be at or below the hardware IF bandwidth, to enable this feature.*

6 | *If the existing band or spectrum range is too large, the operator can focus the signal or spectrum range of interest by zooming into a displayed range of less than the maximum hardware IFB and select the | OPEN RANGE AS NEW BAND (SOLO) | to create a new band that meets the required IFB hardware limitations. The band will immediately be give fully runtime priority and the IFB button will be selectable, allowing the operator to run in IFB at a very narrow RBW. Exiting SOLO mode will cause the runtime focus to revert to the original band.*

7 | *The status of each radio is sequentially display for the runtime session at the bottom of the | SDR STATUS | control group.*

Band Control

The band control consists of a | WINDOW CONTROL | HIDE BAND CONTROL |, and a | DELETE BAND CONTROL |.

1 | *Application | WINDOW CONTROL | is utilized to extend the any number of bands and receivers across additional display monitors. Each windowed band becomes an independent spectrum display from a control perspective.*

2 | *Application | HIDE BAND CONTROL | temporarily removes the selected band from the user interface without effecting the runtime operation of the band. The hidden band can be displayed again manually at any time by selecting the band from the | SPECTRUM | SPECTRUM SET | display menu.*

3 | *Ability to delete a band from the project is supported by the | DELETE BAND CONTROL | that removes the selected band data from the project. Using this feature permanently removes the data, which cannot be restored or recovered, and operators are advised to use caution when invoking features that remove spectrum data from the project.*

Side Bar Control Group

The | SIDE BAR CONTROL GROUP | provides access to several essential and commonly utilized deployment features, including access to the Automatic Threat List (ATL) ™.

Chirp Threat Mode (CTM) ™

The deployment of the CTM ™ feature is target area alerting and should not be deployed within an occupied area or when OPSEC is a strict requirement. The CTM ™ mode is designed as a wide area detection resource <u>only</u> for analog audio transmitters.

Harmonic Signature Threshold (HST) ™

The HST ™ mode is an add-on feature to the CTM ™ module and can flag harmonic event associated with signal events for which positive confirmation of room audio is detected.

Minimum Detection Amplitude (MDA) ™

As suggested by the title the MDA ™ mode is an operator defined detection threshold limit for which any signal exceedance event will alert, log, and display.

1 | *There is a | REL | or "relative mode" calculated against the | AMBIENT NOISE FLOOR (ANF) | averaging to produce a contour profile that essentially tracks the | SPECTRUM AVERAGING TRACE (SAT) | for the purpose of threshold alerting.*

2 | *There is a second mode |ABS | or "absolute mode" which is strictly operator defined relative the | AMBIENT NOISE FLOOR (ANF) |.*

3 | *MDA ™ is the threshold detection control for the | CHIRP THREAT MODE (CTM) ™ | detection. When the technical operator enables | MDA ™ | CTM ™ | and | HST ™ | result in an automated runtime exceedance capture, demodulate, and analyze capability to log and characterize potentially hostile signal events.*

4 | *MDA ™ can also be utilized as a standalone threshold exceedance tool to log all vents meeting or exceeding an operator defined threshold.*

5 | *MDA ™ is fully integrated with the | AUTOMATC EXPORT CONTROL (AEC) ™ | OPT AEC for | TIME PERIODIC | and | TRIGGERED | events.*

Spectrum Baseline Logging (SBL) ™

Spectrum Baseline Logging (SBL) can be utilized standalone or in conjunction with Location Differential Signal Analysis (LDSA) to established a list of | EXCEEDENCE | based Signals of Interest (SOI) across.

Ambient Noise Floor (ANF)

Spectrum display information can be confusing and misleading for the technical operator, as it is often assumed that the Ambient Noise Floor (ANF) is equal to the Real-Time Event (RTE) trace.

Enabling the | *ANF* | display provides the technical operator with a better indication of the actual noise floor level across the spectrum.

Demodulation Control Group

Text.

Waterfall Display (WFD)

Text.

Real-Time Spectrum Display (RSD)

Text.

Positional Zoom Control (PZC)

Text.

Differential Signal Analysis (DSA) ™

The DSA control group is a multiple use display feature that is contextually mode dependent based on dynamically selected mission specific parameters.

Shared space UI modes include | *LDSA* | *TDSA* | *DSA COMPARATIVE (A-B | B-A) TRACE MATH* | and | TRACE IMPORT COMPARATIVE | functions.

Project Status

Text.

Receiver Status

Text.

Automatic Export Control (AEC) ™ | OPT AEC

Text.

Command Line Programming (CLP) ™ | OPT CLP

Text.

Time Differential Signal Analysis (TDSA) ™

Time Differential Signal Analysis (TDSA) is accessed under the | *PROJECT* | *TIME DSA (TDSA)* | menu and profiles a unique analytical profiling of extended single location runtime collection, or across multiple locations.

Master Automatic Threat List (MATL) ™

Text.

Channel Profile Masks (CPM) ™

Text.

Spectrum Profile Files (SPF) ™

Text.

Dynamic Alert Annunciator (DAA) ™

Text.

Operator Signal List (OSL) ™

Text.

Advanced Signals Intelligence Database (ASID) ™

Text.

Harmonic Calculator

Text.

System Resource Monitor (SRM) ™

The | *SRM* | provides a number of host computer metrics such as real-time processor and active memory demands during runtime collection.

The | *SRM* | provides the host computer available storage and the ability to set a low storage | WARNING | and set a | MAXIMUM | runtime write to storage limit that prevent the storage drive from completely potentially preventing the host computer from restarting or access to the storage drive.

Geo-Location Heat mapping

Text

RF Visualizer (RFV) ™

Text

Tap Capture Plot (TCP) ™

Text

Dynamic Trace Autonomous Platform (DTAP-GPS) ™

Text

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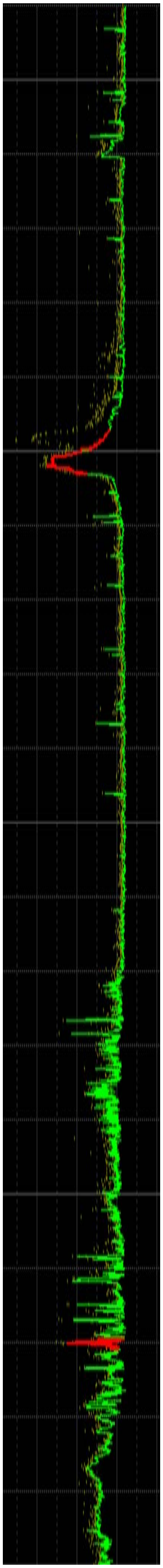

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 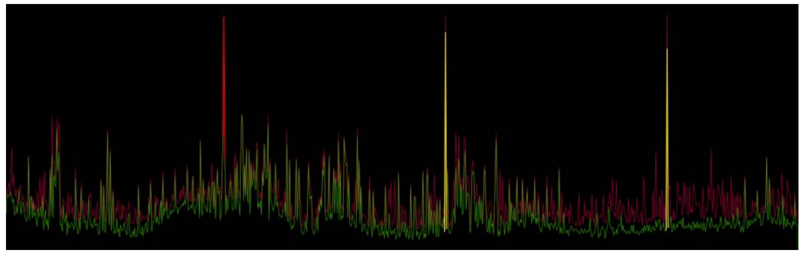

Key Reference Index

Innovation is Simply the Beginning...

Review and Revision: 2020-03-30

Key Reference Index

The | Key Reference Index | provides direct references to key words and phrases found throughout the Software Programming and Operation Manual (SPOM) to allow the technical operator to find reference material quickly.

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