CRFS

SPECTRUM INTELLIGENCE SYSTEMS

RFeye®

CRFS pioneered the concept of remote real-time software-defined networks of intelligent spectrum sensors to provide continuous 24/7 monitoring of the RF environment. We developed the RFeye® to help improve the efficiency of modern-day spectrum usage, resolve complex interference issues and provide cyber security for critical buildings and installations.

Key features

- Remote distributed networks of intelligent and cooperative sensors
- On-node data processing and analysis for fast, dynamic and backhaul-efficient system
- Multi-user access, multi-mission configuration
- Large bandwidth signals capture and analysis, real-time alarms and transmitter geolocation
- Excellent RF specification with very high probability of signal intercept
- Direct interaction with nodes from anywhere in the world over TCP/IP
- Dynamic local license checking and push/pull to central databases
- Simple plug and play installation, autonomous and self-maintaining
- Open API for custom applications
- Robust, cost effective, high performance

CRFS

RFeye Secure

Continuous real-time TSCM and cyber security
for sensitive buildings and secure facilities

RFeye®

Key features

- ✓ Network of fully configurable RFeye Nodes
- ✓ Fixed in-building installations for continuous monitoring
- ✓ Portable systems for establishment of Temporary Secure Working Areas
- ✓ Wideband 10 MHz to 6 GHz receiver with 20 MHz RTBW
- ✓ Frequency extension to 18GHz with Block Down Converter
- ✓ Outstanding RF performance and sensitivity
- ✓ Ceiling tile mounting kits and antennas for discreet in-building deployment
- ✓ Proprietary SyncLinc™ system for high accuracy network synchronization
- ✓ Easy low-cost installation
- ✓ Integrated RFeye Site software for real-time security and surveillance
- ✓ Advanced network status monitoring
- ✓ Real-time spectral displays in multiple formats
- ✓ Fully programmable synchronized sweeps and time captures
- ✓ Fully programmable alarms and alerts
- ✓ Advanced mapping including 3D building displays
- ✓ Geolocation of transmitters using Power on Arrival measurements
- ✓ Data recording and playback
- ✓ Automatic signal recognition plug-in option

Introduction

RFeye Secure from CRFS is a continuous real-time TSCM and cyber security system for sensitive buildings and secure facilities.

Counter espionage and cyber security threats

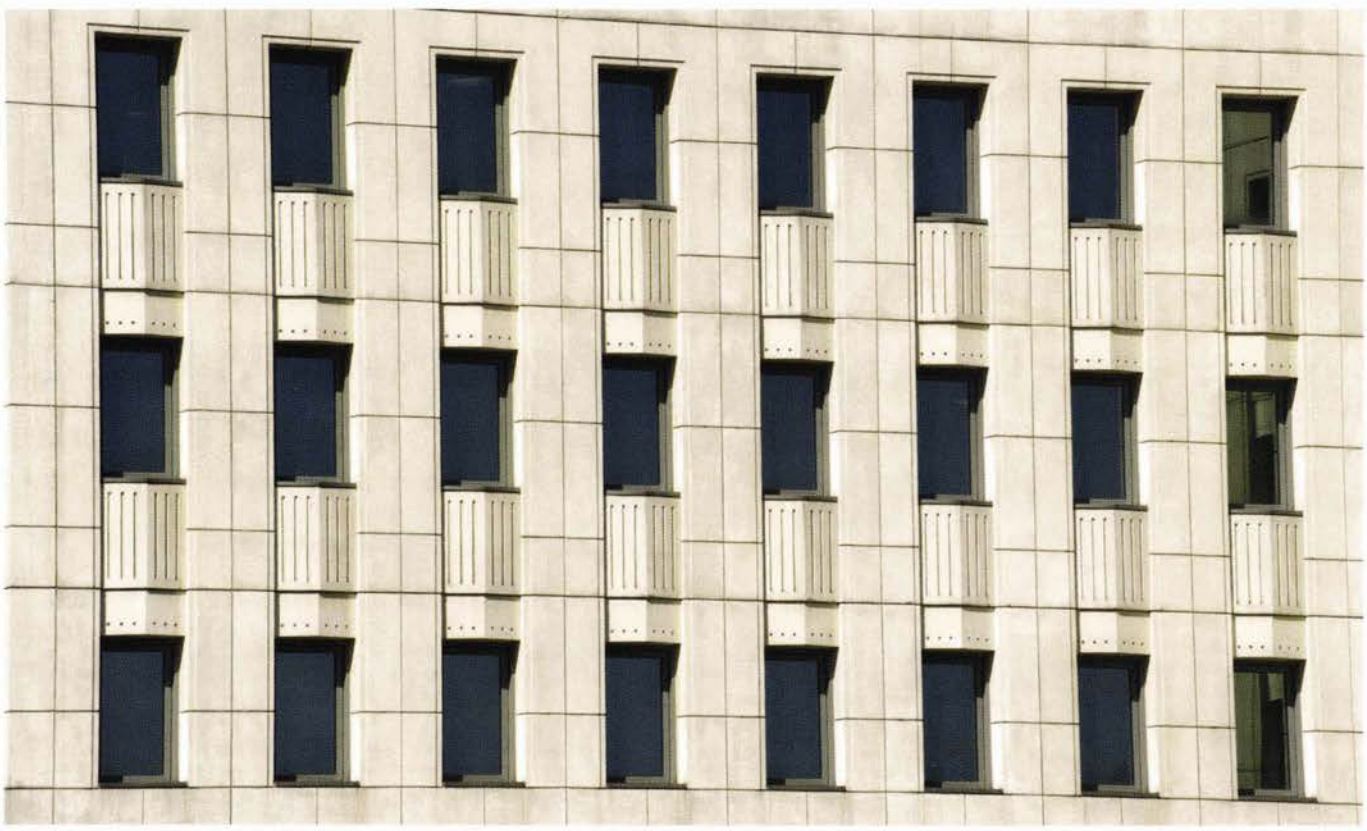
RFeye Secure is a fully integrated in-building monitoring solution for sensitive or protected buildings or designated secure areas inside such buildings. It is designed to counter the increasing security threats posed by the latest sophisticated bugging devices or by the presence of unauthorized communications devices in secure areas. A wired distributed network of RFeye Nodes, together with state-of-the-art RFeye Site software, gives uninterrupted 24/7 surveillance and awareness of the RF environment up to 18GHz. Easy to install and cost-effective, it provides an assured level of security for the most sensitive areas, both commercial and non-civilian. The system can be discreetly deployed as a fixed installation for continuous monitoring or as a portable installation for establishment of Temporary Secure Working Areas.

Not all spectrum sensors are the same

The RFeye Node makes other sensors in its class appear "deaf" by comparison. It has an outstanding noise figure, typically an order of magnitude better than its peers across its frequency range. Similarly, for internal spurious and LO re-radiation, the RFeye is in a class of its own. All this means that it is an extremely sensitive receiver and can reliably detect even very low power signals close to the noise floor. It is also very fast and can intercept even the very short burst transmitters used by sophisticated bugging devices.

Network of intelligent, cooperative and synchronized sensors

Each RFeye Node in the network is accurately synchronized with all others to enable synchronous spectrum sweeps of the building or area. Each Node has its own in-built Linux processor which performs local data processing and analysis and interacts intelligently with the other network Nodes. This makes the whole system fast and dynamic, as well as capable of continuing operation in the event of failure or compromise of the central server. Background spectrum usage is set as a mask and any mask breakages by suspicious or unauthorized transmissions trigger alarms and automated geolocation of the transmitter using the Power on Arrival technique which is ideally suited to in-building environments



Use scenarios

- X-listed operations rooms
- Sensitive Compartmented Information Facilities (SCIF)
- Secure Working Areas (SWA)
- Special Access Programmes (SAP)
- Foreign embassies
- Government and state department buildings
- Security agency buildings
- Military HQ buildings
- Prisons and correctional facilities
- Corporate boardrooms and meeting rooms

Customers

- Counter-espionage services
- Cyber security services
- TSCM providers
- Embassy security managers
- Corporate security managers
- Correctional security managers

Missions

- 24/7 continuous security monitoring from anywhere in the world
- Masks, automated triggers and alarms
- Real-time signals intercept and analysis
- Signals classification and demodulation
- I/Q recording and playback
- Transmitter geolocation using Power on Arrival measurements

Deployments

RFeye Secure is modular and scalable and can be deployed in networks ranging from a handful of Nodes for a single secure area, up to extensive networks for full coverage of very large facilities.

CRFS can advise on the placement and density of Nodes required for any given building or area. Standard deployments are for 10MHz to 6GHz frequencies and these are seamlessly extendable to 18GHz with the use of the Block Down Converter (BDC). Ceiling tile mounting kits and discreet antennas are available for both standard and extended bandwidths.

Installation

The installation is simple and cost-effective. The RFeye Node, BDC and ceiling antennas are easy to mount to a standard ceiling tile using the custom mounting kit provided. The Nodes are networked using wired Ethernet which can provide both power and data connection. In addition, all Nodes are frequency locked and synchronized to a common reference using CRFS's proprietary SyncLinc™ synchronization system. This is easily installed using dedicated cable runs in the ceiling voids. SyncLinc gives better than 25ns synchronization and avoids any of the performance degradation issues that result from using standard shared network switching hardware.

Operation

Initially, the building or secure area is "swept" by the RFeye network and the measured spectrum is captured to create a mask which represents the background spectrum usage in each area. Any unusual features or events will be highlighted and can be investigated prior to determining the appropriate mask levels. Once the mask has been set, any measured power at any frequency that breaks the mask will trigger an alarm in real-time to the RFeye Site software. The alarm can also be messaged by SMS to notify the relevant security personnel. Mask breakages can be set to automatically trigger a time capture of the event for subsequent playback and analysis. The criteria for mask breakage (levels, duration, frequency of occurrence) can be set and fine-tuned to eliminate false positives and the mask can be periodically reset to reflect any spectrum use changes in the area.

Geolocation of unauthorized transmitters

When a suspicious signal is detected, the nearest group of 3 or more Nodes to the signal seeks to radio-locate the source using Power on Arrival (POA) amplitude comparison. POA measures the relative power of the signal as it is received at each of the Nodes and software algorithms calculate the probability of the location of the source. These probabilities are plotted on a plan of the building or area and can be shown as 2D heat maps or even in 3D spatial resolution. This mapping makes it easy for security personnel to physically investigate the designated areas for unauthorized transmitters.

Software

RFeye Site is a state-of-the-art Windows application for detecting and analysing suspicious signals and geolocating their source.

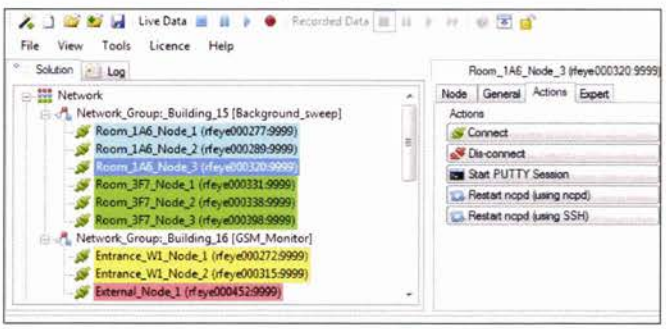
RFeye Site has been developed and configured to support the requirements of continuous 24/7 in-building monitoring. It allows networks of RFeye Nodes to be managed and controlled and multiple different tasks and missions to be performed with simple button and mouse control. It has latest .Net tools to provide a uniquely configurable and powerful visual interface with full object-orientated command and control, real-time spectral displays in multiple formats and advanced mapping capabilities, including 3D displays.

Each individual RFeye Node or all Nodes in the network can be assigned tasks from a large configurable menu, allowing the user to control all aspects of the system. This includes setting automated spectrum sweeps, creating RF background masks and trigger conditions, alerts from mask breakages, performing advanced signal classification and geolocating suspicious or unauthorized transmitters.

Depending on the level of expertise of the user, the GUI can be provided as fully configurable by the user or pre-configured with simple controls. RFeye Site also comes with a user-friendly configuration tool to allow users to create their own custom configurations. With different access levels, it is designed to be easy to use and intuitive for operation by non-specialists whilst allowing full flexibility for set-up and programming by expert users.

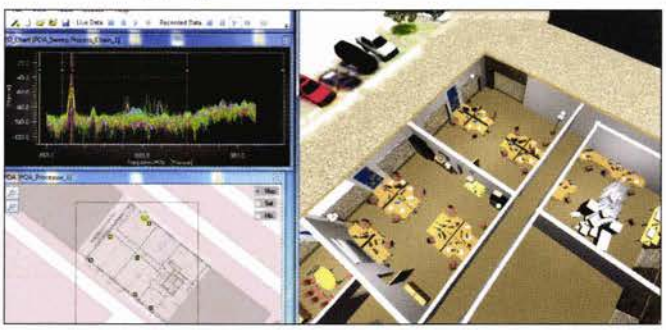
Key capabilities

Network status monitoring



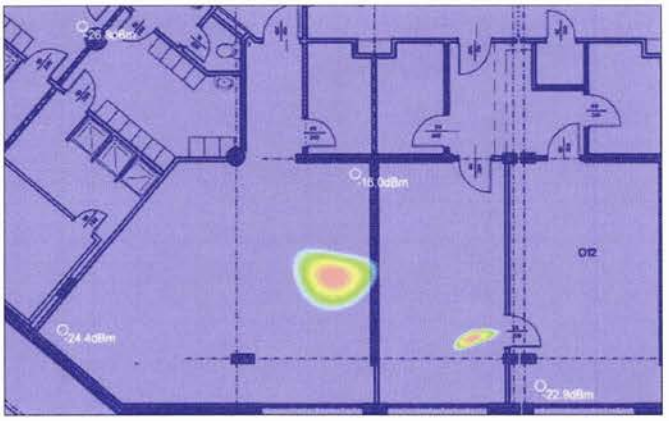
RFeye Nodes are organised into network groups within RFeye Site enabling missions to be assigned according to building and room groups, or to single out individual zones for focussed missions. Nodes can be shared across network groups for useful differential measurements, for example comparing signals received from in-building Nodes to external or perimeter Nodes. Mission configurations can be quickly dragged and dropped between different network groups for instant switching and sharing of the monitoring tasks in different building areas. The interface for status monitoring and network control simplifies the management of extended RFeye Secure in-building networks.

Advanced mapping



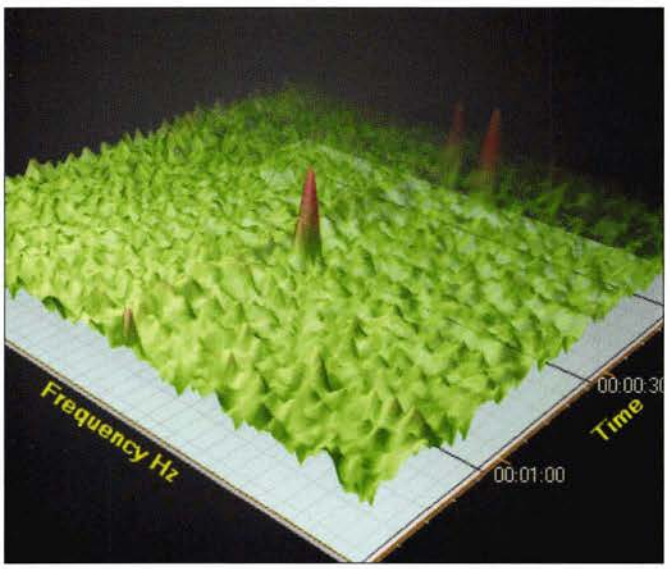
The location of all RFeye Nodes in the network together with their unit information is displayed in RFeye Site via a range of mapping interfaces from 2D maps and topographical data including SRTM, to 3D rendered building models for in-building RFeye Secure networks. The geolocation results including POA and TDOA probability heat maps and real time AOA vectors can be overlaid on the map interface to enable target localization. When combined with the 3D building model display for RFeye Secure, this visualization of the geolocation results provides an unrivalled means of tracking signal location in real-time.

POA geolocation of transmitters



Power on Arrival is an amplitude comparison radiolocation technique that is effective over the short distances involved with in-building monitoring, due to the initial rapid drop-off in received signal power with distance from the target transmitters. It is well suited to the multitude of potential signal types that are sources of interference or indicators of covert activity, as the principle is independent of signal bandwidth or modulation type. The proprietary SyncLinc™ system from CRFS avoids the need for (or vulnerability from) re-radiating GPS indoors for synchronization between RFeye Nodes, and instead offers a dedicated, purpose designed and robust synchronization technique that enables highly effective localization of detected transmitters.

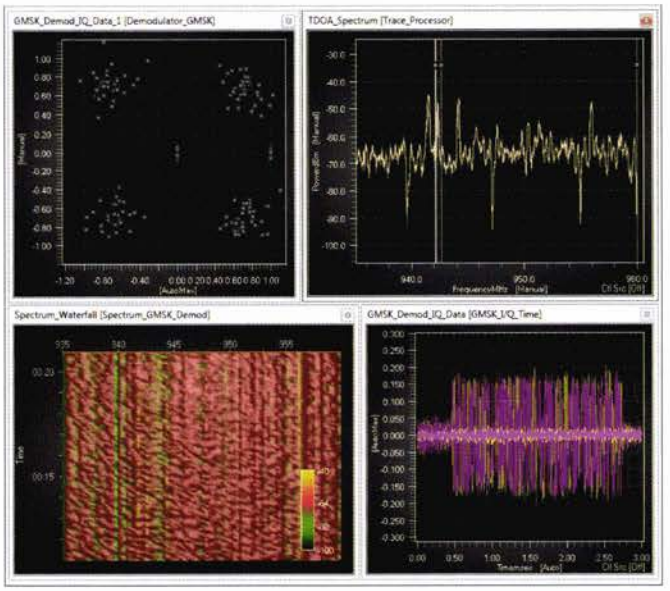
Sweeps and time captures



The software can provide a familiar and simple spectrum analyser interface for each connected RFeye Node, with real-time frequency and time domain spectra with constellation diagrams and 2D or 3D waterfall displays. Each Node in the RFeye Secure network can be output to individual displays, or displays can be combined and overlaid for more powerful analysis options with selectable data processing modules.

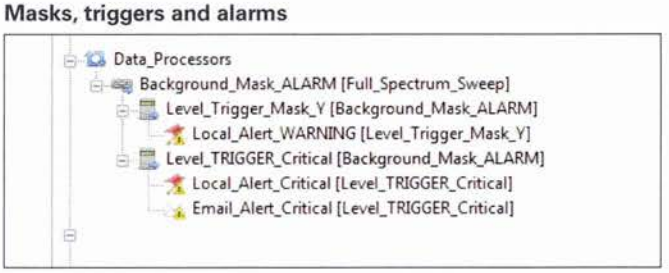
Individual elements of a more complex mission can be controlled and configured per-Node, for example after obtaining a POA geolocation result using a synchronised RFeye network, an individual Node can be selected based on proximity to the signal for targeted time captures and further detailed analysis.

Signals analysis and recognition



Extensive and powerful data processor modules and process chains in RFeye Site can be combined and customized to provide in-depth signals analysis data that can in turn be fed into notifications, alarms and reports. Modules can filter and recognise signals including modulation type and channelized data, which is valuable for decision-making on spectrum events and policy in security critical environments.

Masks, triggers and alarms



RFeye Site can be configured to issue alarms via the local system, to log files, SMS and email from user defined triggers and spectrum masks. Simple mask break scenarios can be useful for triggering alarms when any signal exceeds an expected background spectrum of known signals, or more advanced modules allow notifications on events such as detection of certain modulation types and channel identification.

RFeye Node technical specifications

Receiver Performance	
Frequency range	10 MHz to 6 GHz (18 GHz with Block Down Converter)
Receiver noise figure	8 dB typical (10 MHz – 4 GHz) 11 dB typical (4 GHz – 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz oset -110 dBc/Hz at 200 kHz oset typical, at 2 GHz* (*low noise synthesiser)
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

Sweep and triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: userdefinable masks, user-definable action when mask exceeded

Signal analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Operating system and software development options	
Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Frequency reference	
Selection	Internal, GPS or External
External ref. input	Via expansion port, 10 MHz ± 1 kHz
Reference output	Via expansion port, 10 MHz

Internal frequency reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Timing reference	
GPS	35 ns RMS accuracy typical
RFeye SyncLinc	< 10 ns RMS accuracy typical

Mechanical	
Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]

Environmental	
Operating temp.	-30 to +55°C (-22 to 131°F)
Storage temp.	-40 to +70°C (-40 to 158°F)
Envrn. protection	IP67 (with environmental cover fitted)

Interfaces	
RF input	SMA (X 4)
DC power	10 - 48 VDC
DC power input	Direct to node or via Ethernet
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
Expansion ports	2, congurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

For more information

To find out more or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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RFeye Detect

Wide area dynamic spectrum and signal monitoring networks

RFeye®

Key features

- ✓ Network of fully configurable RFeye Nodes
- ✓ Rugged, compact, lightweight, IP67 rated
- ✓ Wideband 10 MHz to 6 GHz receiver with 20 MHz RTBW
- ✓ Frequency extension to 18GHz with Block Down Converter
- ✓ Outstanding RF performance and sensitivity
- ✓ On-board GPS for accurate positional and time stamping
- ✓ Multiple antenna options – omnidirectional and directional
- ✓ Full mounting kits for easy installation
- ✓ Site surveys for optimal Node distribution
- ✓ Fixed or mobile RFeye Arrays for augmented geolocation
- ✓ Integrated RFeye Site software for real-time connection to network of Nodes
- ✓ Advanced network status monitoring
- ✓ Real-time spectral displays in multiple formats
- ✓ Fully programmable synchronized sweeps and time captures
- ✓ Fully programmable alarms and alerts
- ✓ Advanced mapping capability including 3D displays
- ✓ Time Difference of Arrival, Power on Arrival, Angle of Arrival measurements
- ✓ Data recording and playback
- ✓ Automatic signal recognition plug-in option
- ✓ Support for license data formats (Pub 7/8 and SMADEF) and MANCAT file format

Introduction

RFeye Detect is the state-of-the-art solution for wide area dynamic remote spectrum and signals monitoring. It sets a new standard in terms of performance, capability, versatility and cost effectiveness.

Remote real-time distributed networks

CRFS pioneered the concept of remote real-time networks of spectrum sensors to meet the challenges of modern day spectrum usage and efficiency requirements and of managing complex interference issues. RFeye Detect is based on networks of RFeye Nodes configured for specific site requirements together with RFeye Site, the most advanced spectrum monitoring software on the market. Simple to deploy, operate and maintain. "Fit and forget".

Not all spectrum sensors are the same

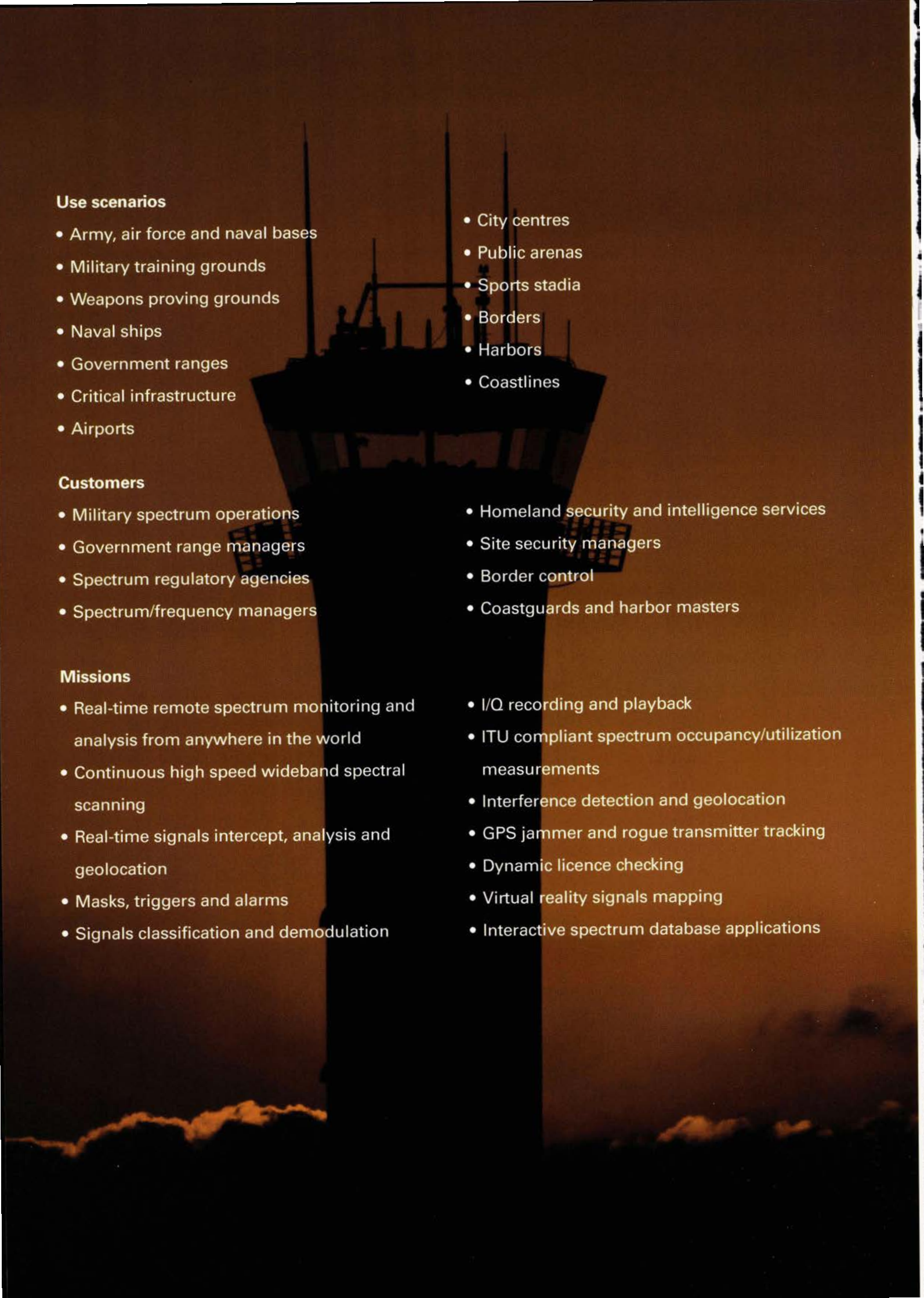
The RFeye Node makes other sensors in its class appear "deaf" by comparison. It has an outstanding noise figure, typically an order of magnitude better than its peers across its frequency range. Similarly, for internal spurious and LO re-radiation, the RFeye is in a class of its own. All this means that it is an extremely sensitive receiver and can reliably detect even very low power signals close to the noise floor.

Multi-user, multi-mission capability

Individual RFeye Nodes or all Nodes in the network can be assigned tasks from a large configurable menu, ranging from requests for basic spectrum sweeps and occupancy measurements, to the detection and alerting of spectrum events, to advanced signal classification and real-time geolocation of sources of interest. RFeye Site software allows authorized users anywhere in the world to access the network of Nodes directly over TCP/IP (via wired or wireless connections to the Nodes). Multiple users can simultaneously interact with any or all of the Nodes. In addition, the on-board logger on each Node continuously captures and logs data of interest to local memory with efficient offload of data to a central database as required.

Geolocation of unauthorized transmitters

When a suspicious signal is detected, the nearest group of 3 or more Nodes to the signal seeks to radiolocate the source using Time Difference of Arrival (TDOA) and also Power on Arrival (POA). These probabilities are plotted on a map of the area and can be shown as 2D heat maps or even in 3D spatial resolution. This mapping makes it easy to physically investigate the source of the transmission, especially when RFeye Array systems are additionally deployed in the RFeye Detect network to combine a line of bearing with the geolocation.



Use scenarios

- Army, air force and naval bases
- Military training grounds
- Weapons proving grounds
- Naval ships
- Government ranges
- Critical infrastructure
- Airports
- City centres
- Public arenas
- Sports stadia
- Borders
- Harbors
- Coastlines

Customers

- Military spectrum operations
- Government range managers
- Spectrum regulatory agencies
- Spectrum/frequency managers
- Homeland security and intelligence services
- Site security managers
- Border control
- Coastguards and harbor masters

Missions

- Real-time remote spectrum monitoring and analysis from anywhere in the world
- Continuous high speed wideband spectral scanning
- Real-time signals intercept, analysis and geolocation
- Masks, triggers and alarms
- Signals classification and demodulation
- I/Q recording and playback
- ITU compliant spectrum occupancy/utilization measurements
- Interference detection and geolocation
- GPS jammer and rogue transmitter tracking
- Dynamic licence checking
- Virtual reality signals mapping
- Interactive spectrum database applications

Deployments

RFeye Detect is modular and scalable and can be deployed in networks ranging from a handful of Nodes for a single site to very large regional or national networks.

RFeye Node

The RFeye Node has been designed for quick and easy deployment and maintenance-free use. The IP67-rated casing provides outstanding environmental protection even under harsh conditions. The operating temperature range of the unit is from -30°C to +55°C (-22°F to +131°F), making it suitable for most environments. The Node can be supplied with a complete pre-assembled mounting kit for easy attachment to wall, pole or mast.

Block Down Converter

The BDC seamlessly extends the upper frequency range of the RFeye Node from 6GHz to 18GHz. The BDC is co-located with the Node using an extended mounting kit.

Antennas

The Node and BDC can be used with any passive or active antenna. CRFS provides a range of lightweight passive omnidirectional antennas that cover frequencies from 25MHz to 18GHz. Mount options for these integrate with the Node mounting kit for ease of deployment. The Node can support up to 4 antenna inputs as required.

RFeye Arrays

For some critical large sites such as ranges and proving grounds, the network of Nodes can be usefully enhanced with the addition of RFeye Arrays at key fixed locations and/or on vehicles for geolocation of interfering or suspicious emitters. The Arrays contain advanced sinuous directional antenna modules and augment the geolocation capabilities of the Node network, providing a unique multi-layer approach including AOA, TDOA and POA, which is more sophisticated and versatile than traditional Direction Finding. Measurements can be overlaid onto a wide variety of 2D and 3D maps to give a unique positional display showing source geolocation probabilities, irrespective of signal power, bandwidth or frequency. Arrays are available for a wide range of frequencies from 100MHz to 18GHz with a further Watson Watt module down to 20MHz.

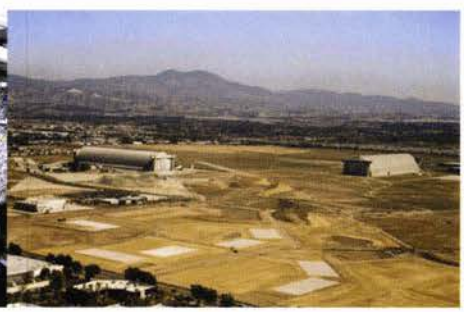
Power and Network Connections

All RFeye systems are designed for low power consumption and to accept flexible power inputs. The RFeye Node takes DC power from 10 to 48 V and typically uses only 6 – 18 W. Systems can be powered direct from mains power, via Power on Ethernet or even from local sources such as solar cells. Network connections can be wired (Ethernet or optical fibre) or wireless (3G or 4G modem or Wi-Fi). The cellular modem allows units to be deployed over very large distances anywhere where there is cellular coverage. The RFeye is truly "plug and play" – simply mount, connect power and network and start monitoring.

Onboard diagnostics

The RFeye Node is designed to operate fully autonomously once it is deployed in the field. It has advanced BIST features including its own built-in calibration oscillators to test and manage the RF performance over time and temperature changes. The on-board Watchdog checks for any core processes that are not running and can either soft restart the system or, if required, sequence the power supplies to hard reset the internal systems. The built-in modem allows for interaction with the Node via SMS or IP connection in the event that the main network is unavailable.





Software

RFeye Site is the latest state-of-the-art software package for managing complex spectrum operations.

It allows networks of RFeye Nodes to be managed and controlled and multiple different tasks and missions to be performed with simple button and mouse control. It has latest .Net tools to provide a uniquely configurable and powerful visual interface with full object-orientated command and control, real-time spectral displays in multiple formats and advanced mapping capabilities, including 3D displays.

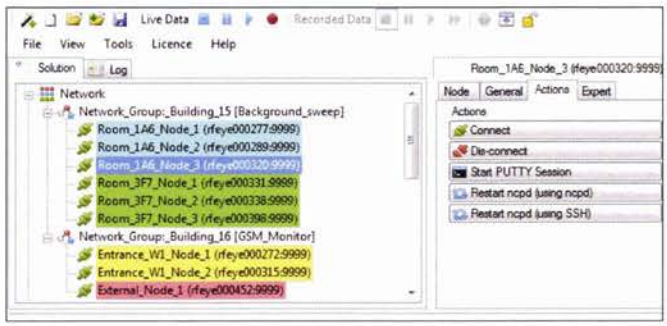
Each individual RFeye Node or all Nodes in the network can be assigned tasks from a large configurable menu, ranging from requests for basic spectrum sweeps and occupancy measurements, to the detection and alerting of spectrum events, to advanced signal classification and real-time geolocation of sources of interest. Multiple users can simultaneously make multiple requests of all or any of the Nodes over wired or cellular networks.

Optional plug-in modules are available for TDOA, AOA and POA geolocation. These support multiple simultaneous geolocations on multiple target frequencies. Results are overlaid on 2D or 3D site maps and are displayed as heat map probabilities. Multiple results can be overlaid onto the map for ease of visualization and analysis. The mapping tools include full zoom facility and ability to display many simultaneous maps, with SRTM data overlay available to aid geolocation analysis.

Depending on the level of expertise of the user, the GUI can be provided as fully configurable by the user or pre-configured with simple controls. RFeye Site also comes with a user friendly configuration tool to allow users to create their own custom configurations.

Key capabilities

Network status monitoring



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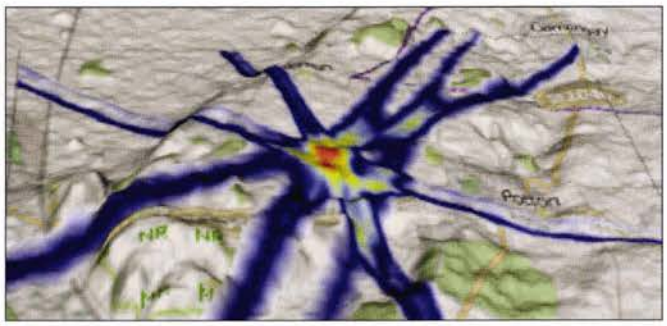
Advanced mapping

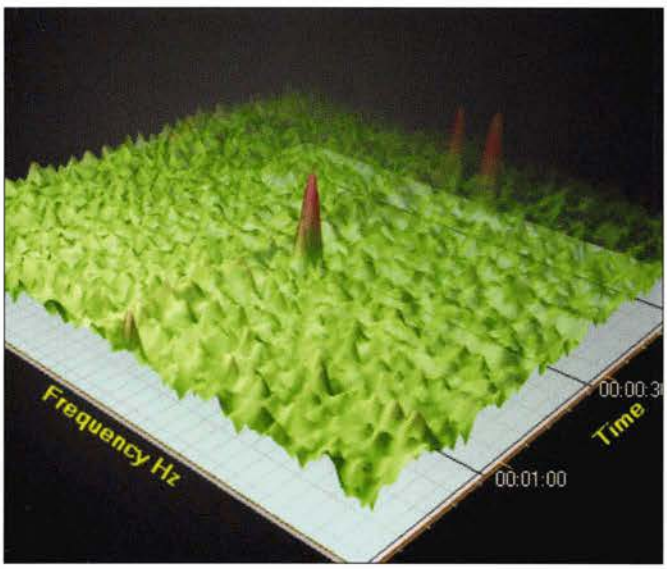


The location of all RFeye Nodes in the network together with their unit information is displayed in RFeye Site via a range of mapping interfaces from 2D maps and topographical data including SRTM, to 3D rendered building models for in-building RFeye Secure networks. The geolocation results including POA and TDOA probability heat maps and real time AOA vectors can be overlaid on the map interface to enable target localization. When combined with the 3D building model display for RFeye Secure, this visualization of the geolocation results provides an unrivalled means of tracking signal location in real-time.

Geolocation of transmitters

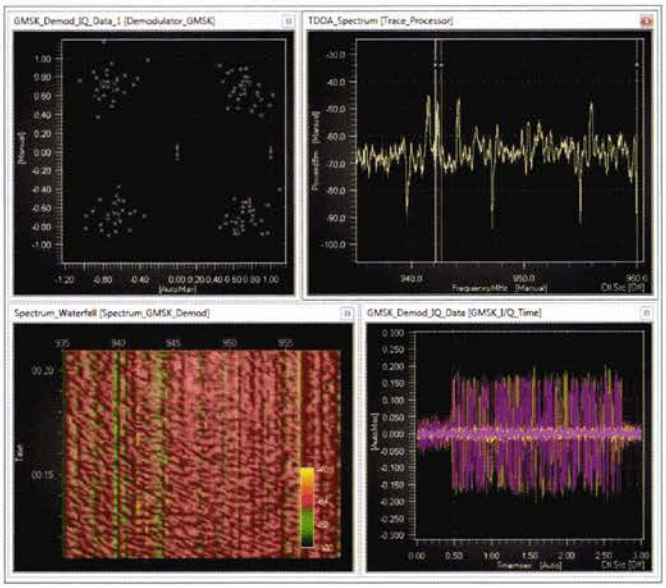
There is a multitude of potential signal types that are the sources of interference, indicators of illegal activity or unauthorised spectrum use. Direction Finding and geolocation techniques are each effective only for a limited range of target signal types, which varies according to many factors including signal bandwidth, modulation, power, background noise, pulse duration and receiver speed. The most reliable and cost effective method to ensure detection and successful localization of the maximum range of target signal types is to combine and augment each technique in a single real-time overlay. This is the powerful and unique approach of RFeye Detect for transmitter detection and geolocation.

Sweeps and time captures



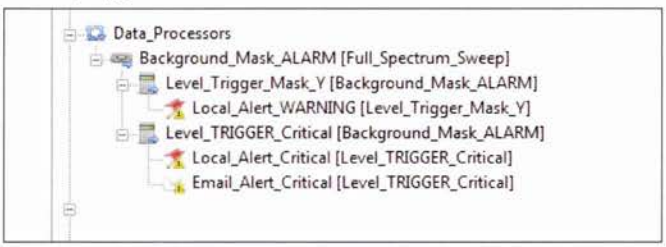
The software can provide a familiar and simple spectrum analyser interface for each connected RFeye Node, with real-time frequency and time domain spectra with constellation diagrams and 2D or 3D waterfall displays. Each Node in the RFeye Detect network can be output to individual displays, or displays can be combined and overlaid for more powerful analysis options with selectable data processing modules. Individual elements of a more complex mission can be controlled and configured per-Node, for example after obtaining a TDOA geolocation result using a GPS synchronised RFeye network, an individual Node can be selected based on proximity to the signal for targeted time captures and further detailed analysis.

Signals analysis and recognition



Extensive and powerful data processor modules and process chains in RFeye Site can be combined and customized to provide in-depth signals analysis data that can in turn be fed into notifications, alarms and reports. Modules can filter and recognise signals including modulation type and channelized data, which is valuable for decision-making on spectrum events and policy in security critical or congested spectrum environments.

Masks, triggers and alarms



RFeye Site can be configured to issue alarms via the local system, to log files, SMS and email from user defined triggers and spectrum masks. Simple mask break scenarios can be useful for triggering alarms when any signal exceeds an expected background spectrum of known signals, or more advanced modules allow notifications on events such as detection of certain modulation types and channel identification.

RFeye Node technical specifications

Receiver Performance	
Frequency range	10 MHz to 6 GHz (18 GHz with Block Down Converter)
Receiver noise figure	8 dB typical (10 MHz – 4 GHz) 11 dB typical (4 GHz – 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz oset -110 dBc/Hz at 200 kHz oset typical, at 2 GHz* (*low noise synthesiser)
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

Sweep and triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: userdefinable masks, user-definable action when mask exceeded

Signal analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Operating system and software development options	
Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Frequency reference	
Selection	Internal, GPS or External
External ref. input	Via expansion port, 10 MHz ± 1 kHz
Reference output	Via expansion port, 10 MHz

Internal frequency reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Timing reference	
GPS	35 ns RMS accuracy typical
RFeye SyncLinc	< 10 ns RMS accuracy typical

Mechanical	
Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]

Environmental	
Operating temp.	-30 to +55°C (-22 to 131°F)
Storage temp.	-40 to +70°C (-40 to 158°F)
Envrn. protection	IP67 (with environmental cover fitted)

Interfaces	
RF input	SMA (X 4)
DC power	10 - 48 VDC
DC power input	Direct to node or via Ethernet
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
Expansion ports	2, congurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

For more information

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CRFS

RFeye®

Node

Distributed spectrum monitoring and surveillance for indoor/outdoor use

Product code: NOD-EYE0001

Key features

- 10 MHz to 6 GHz, optionally to 18GHz
- Fully scalable for small to very large networks
- Fast, sensitive, excellent noise figure
- TDOA, POA and AOA capable
- Built-in Linux processor and local bulk data storage
- Rugged and compact, IP67 with optional environmental cover
- On-board GPS for accurate positional and time stamping
- Multiple RF ports for multi-antenna operation
- Range of powerful RFeye software available
- Open API, fully programmable with supplied SDK

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CRFS

Intelligent networkable node for spectrum monitoring of sensitive buildings, critical sites, borders, or any area of interest

The RFeye Node sets the new standard for high performance, cost-effective, real time 24/7 monitoring of the radio spectrum. It has been designed and packaged to enable flexible and scalable deployments in remote distributed networks. With built-in intelligence, the Node can operate both autonomously and in cooperation with other Nodes in the network.

Very high probability of signal intercept

Capable of sweeping from 10 MHz to 6 GHz (or optionally to 18 GHz) at 40 GHz/s, the RFeye Node captures signals of all types, including transient transmission such as pulsing or short-burst. High sensitivity and exceptionally low spurious components mean that it is able reliably to distinguish even very low power signals from the noise floor.

Flexible multi-user multi-mission capability

The RFeye's unique architecture is capable of supporting multiple concurrent tasks and missions, as well as multiple queries from simultaneous users. Remote programming allows tasks to be assigned relative priorities and the Node is able seamlessly to execute the required tasks in the most efficient manner. In this way, the Node is able concurrently to perform time and IQ captures, make spectrum occupancy measurements, monitor mask breakages and trigger alarms, log data to memory, record sequences for playback, measure an AOA bearing or coordinate with nearby Nodes to carry out geo-location measurements using TDOA or POA techniques. In addition, there is no limit to the number of users who can simultaneously query the Node via IP and make varying requests to display information of interest.

Easy to deploy as fixed or portable/mobile units

The Node is housed in a rugged, compact lightweight enclosure and has an environmental cover that provides IP67 protection for hostile environments. It is low power and can be powered from multiple sources. It can be discreetly deployed in-building, easily mast mounted outdoors or deployed in various man-portable or mobile configurations. Data can accessed in real time via IP, stored locally, transmitted via the built-in modem or downloaded via Ethernet to a centralized database.

Technical specifications

Receiver performance	
Frequency range	10 MHz to 6 GHz
Receiver noise figure	8 dB typical (10 MHz – 4 GHz) 11 dB typical (4 GHz – 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz oset -110 dBc/Hz at 200 kHz oset typical, at 2 GHz* (*low noise synthesiser)
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

Sweep and triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: userdefinable masks, user-definable action when mask exceeded

Signal analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Operating system and software development options	
Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Interfaces	
RF input	SMA (X 4)
DC power	10 - 48 VDC
DC power input	Direct to node or via Ethernet
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
Expansion ports	2, congurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

Frequency reference	
Selection	Internal, GPS or External
External ref. input	Via expansion port, 10 MHz ± 1 kHz
Reference output	Via expansion port, 10 MHz

Internal frequency reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Timing reference	
GPS	35 ns RMS accuracy typical
RFeye SyncLinc	< 10 ns RMS accuracy typical

Mechanical	
Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]

Environmental	
Operating temp.	-30 to +55°C (-22 to 131 °F)
Storage temp.	-40 to +70°C (-40 to 158 °F)
Envrn. protection	IP67 (with environmental cover fitted)

For more information

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CRFS

RFeye®

Block Down Converter

Seamless 6 GHz to 18 GHz frequency extender for the RFeye Node

Product code: NOD-BDC0001

Key features

- Seamless extension of the RFeye Node to 18GHz
- Plug and play installation and operation
- Multi-user, multi-mission compatible
- Rugged and compact
- IP67 rated with optional environmental cover
- Fast synthesiser tuning and preselection filtering
- Multiple RF ports for multi-antenna operation
- Mounting kits available for easy deployment

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CRFS

High performance RFeye monitoring of microwave transmissions up to 18GHz

The Block Down Converter (BDC) seamlessly extends the frequency range of the RFeye Node from 6 GHz up to 18 GHz. Frequencies above 6 GHz are down-converted to allow analysis using the Node. It enables all of the extensive real-time analysis capability of the RFeye Node to be accessed at these higher frequencies with minimal impact on overall system speed and RF performance.

Plug and play operation

The BDC is connected to the RFeye Node via a calibrated IF link and is fully controlled by the RFeye Node allowing for simple plug and play operation. It can be run from the same power supply, simplifying installation and reducing additional cable run requirements. The BDC accepts RF inputs for the full extended RFeye frequency range from 10 MHz to 18 GHz.

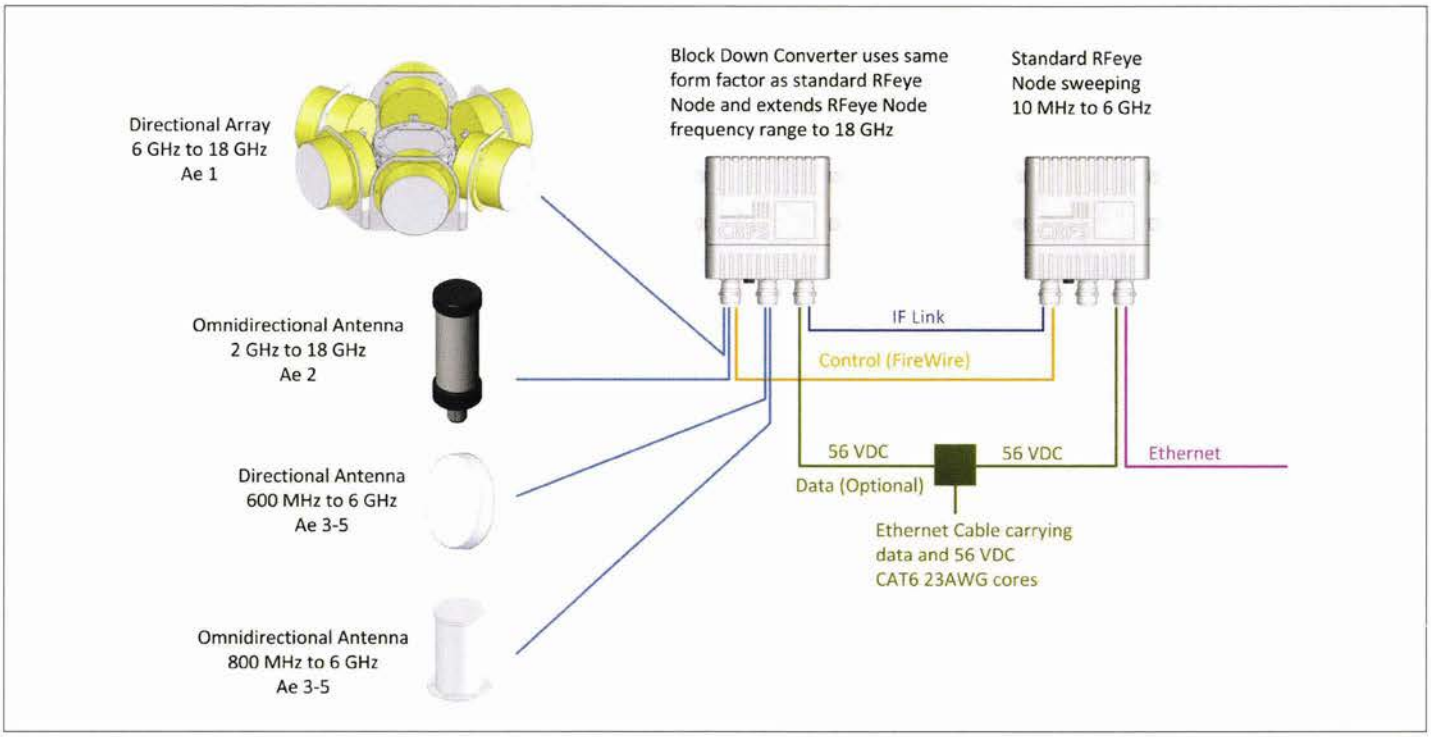
All the power of the RFeye up to 18 GHz

The BDC extends all of the multi-user, multi-mission functionality of the RFeye Node to microwave frequencies allowing monitoring of bands such as radar transmitters, satellite communications, radio relay links, short range terrestrial data links and high frequency bugging devices.

Designed for hostile environments

The BDC uses the same form factor and mounting options as the RFeye Node, permitting standardization of mounting options. It is also built to the same strict environmental specifications and is designed for use in outdoor or indoor, fixed or mobile operation, including in hostile environments.

Architecture



Technical specifications

Frequency	
Range	6 GHz to 18 GHz
IF Bandwidth	3 GHz
IF Centre Frequency	2.5 GHz and 3.5 GHz band dependent
Gain	15 dB
Phase Noise	-110 dBc/Hz @100kHz typical
Preselection bands (standard)	6 - 9 GHz 9 - 12 GHz 12 - 15 GHz 15 - 18 GHz

Interfaces	
RF input	5 switchable inputs (SMA)
DC power from external source	10 - 48 VDC
Power consumption	10 W typical
Reference clock input	10 MHz from RFeye Node

Sensitivity (equivalent noise figures at maximum sensitivity)	
6 GHz - 15 GHz	9 dB typical
15 GHz - 18 GHz	10 dB typical

Signal input	
Input connector	Five switchable SMA inputs 1 x 6 GHz - 18 GHz 1 x 10 MHz - 18 GHz 3 x 10 MHz - 6 GHz
Maximum input level	+15 dBm; 15 VDC

Signal output	
Output connector	Single SMA output, IF to node
Maximum output level	-20 dBm

Mechanical	
Dimensions (w h d)	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight	2.0 kg (4.4 lb) with environmental protection cover

Environmental	
Operating temperature	30 to +55°C (-22 to 131°F)
Storage temperature	-40 to +70°C (-40 to 158°F)
Environmental protection	IP67 with optional environmental cover

For more information

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CRFS

RFeye®

PCIe Module 2000

Spectrum and signal analyzer Vita module with flexible PCIe interface

Product code: NOD-PCI0001

Key features

- 100 kHz to 6 GHz frequency range
- 20 MHz real-time band width
- Fast, sensitive, excellent noise figure
- TDOA, POA and AOA capable
- Lightweight, compact, low power
- 3U rack-mountable
- On–board Linux processor for autonomous operation
- Multiple RF ports for multi-antenna operation
- Flexible real-time signal acquisition and data processing
- Open API, fully programmable with supplied SDK

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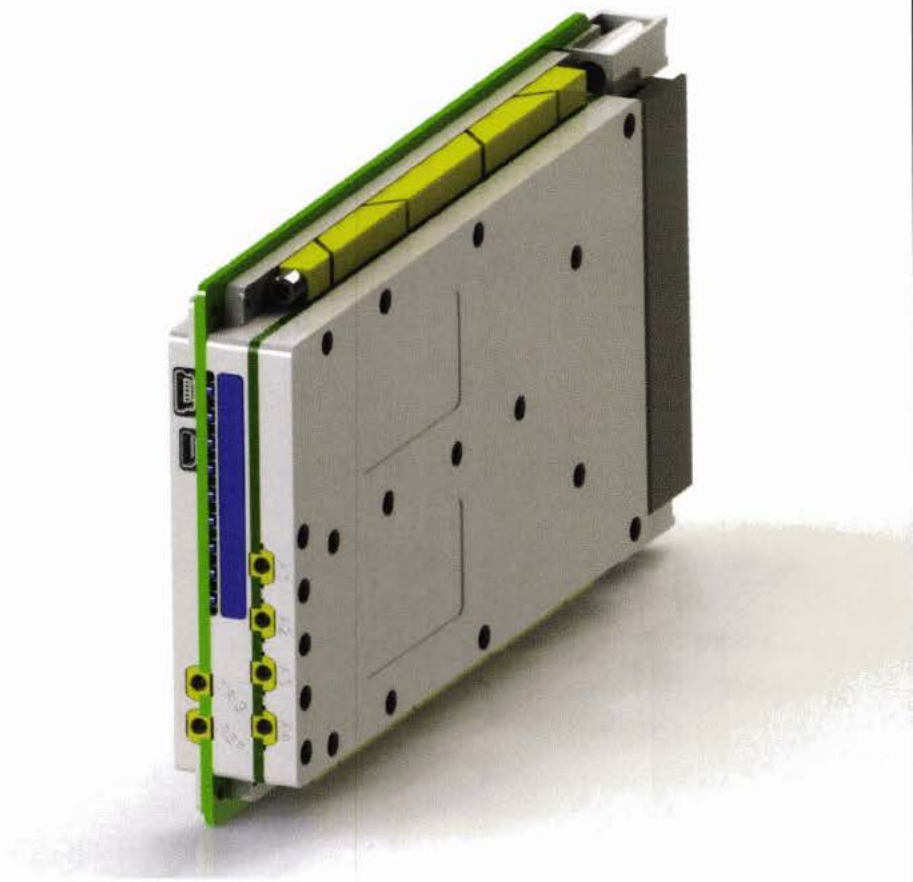


High performance wideband receiver Vita module for integration with rapid data-rate SIGINT and EW systems

The RFeye PCIe Module 2000 is a flexible Vita format unit designed for easy integration with other 3U rack-mounted elements or for use as a stand-alone, intelligent spectrum/signal acquisition system. The PCIe protocol provides data streaming at 160 MBytes/s enabling continuous real-time recording of I/Q data.

Class leading signal interception

Capable of sweeping from 100 kHz to 6 GHz at 40 GHz/s, the PCIe Module 2000 captures signals of all types, including transient transmissions such as pulsing or short-burst. High sensitivity and exceptionally low spurious components mean that it is able reliably to distinguish even very low power signals from the noise floor.

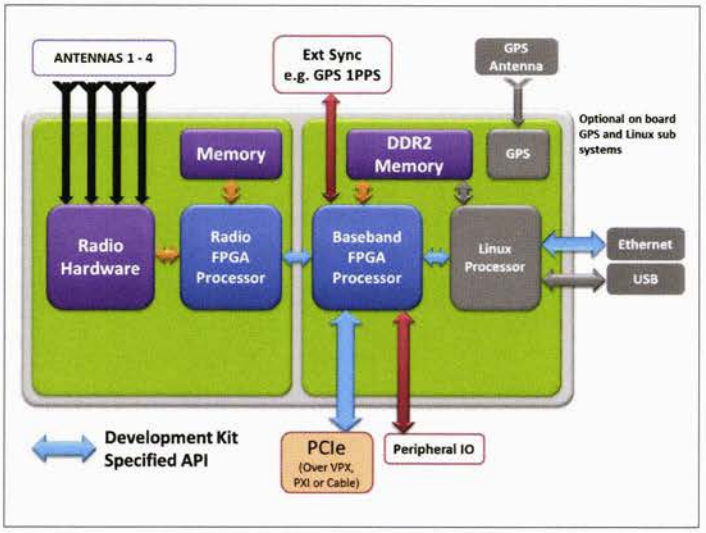
Highly flexible for ease of integration or standalone deployment

The PCIe Module 2000 can be supplied with VPX or PXI backplanes, and can be configured to emulate legacy equipment where required. The on-board Linux processor also allows for fully programmable autonomous operation.

Advanced geo-location capability

Multiple RF inputs allow comparison of signals from different antennas for SIGINT applications and also support direction finding using AOA techniques. In addition, timing and synchronisation features allow correlation of data between multiple PCIe Modules for accurate TDOA or POA geo-location of target signals.

Architecture



Rack mountable modules

Technical specifications

Frequency	
Range	100kHz to 6 GHz

Internal Frequency Reference	
Initial accuracy	better than ±2.5 ppm at 20°C
Stability	better than ±1 ppm at 20°C
Ageing	better than ±2 ppm per year

Sweep and Triggering	
Sweep speed	100 KHz to 6 GHz: 40 GHz/s fast sweep mode 400 GHz/s hyper sweep mode
Sweep mode	Fully programmable: free run, continuous, single, timed
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18Hz min. (reduced analysis b/w)

Software Development Options	
Linux OS version (with Opt 01)	2.6
Development environments	Full SDK in C, C++ and C# .NET development environment available

Sensitivity (equivalent noise figures at maximum sensitivity)	
100kHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Signal Input	
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC

Interfaces	
RF input	4 switchable inputs
DC power	10 - 24 VDC
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
Trigger input	1 pps
Reference clock input	10 MHz, 0.5 V rms
Ethernet	1 x 100 BaseT via optional breakout connector box
USB	1 x USB mini (1.1) via optional breakout connector box
Backplane options	VPX blade connector or PXI multi-way connector
PCIe	Primary direct to FPGA, secondary connected to Linux processor

Mechanical	
Dimensions (w h d)	160 mm x 100 mm x 24.5 mm (6.7 in x 3.9 in x 0.96 in)
Weight	500 g (1.1 lb)

Environmental	
Operating temperature	-30 to +55°C (-22 to 131 °F)
Storage temperature	-40 to +70°C (-40 to 158 °F)

For more information

To find out more or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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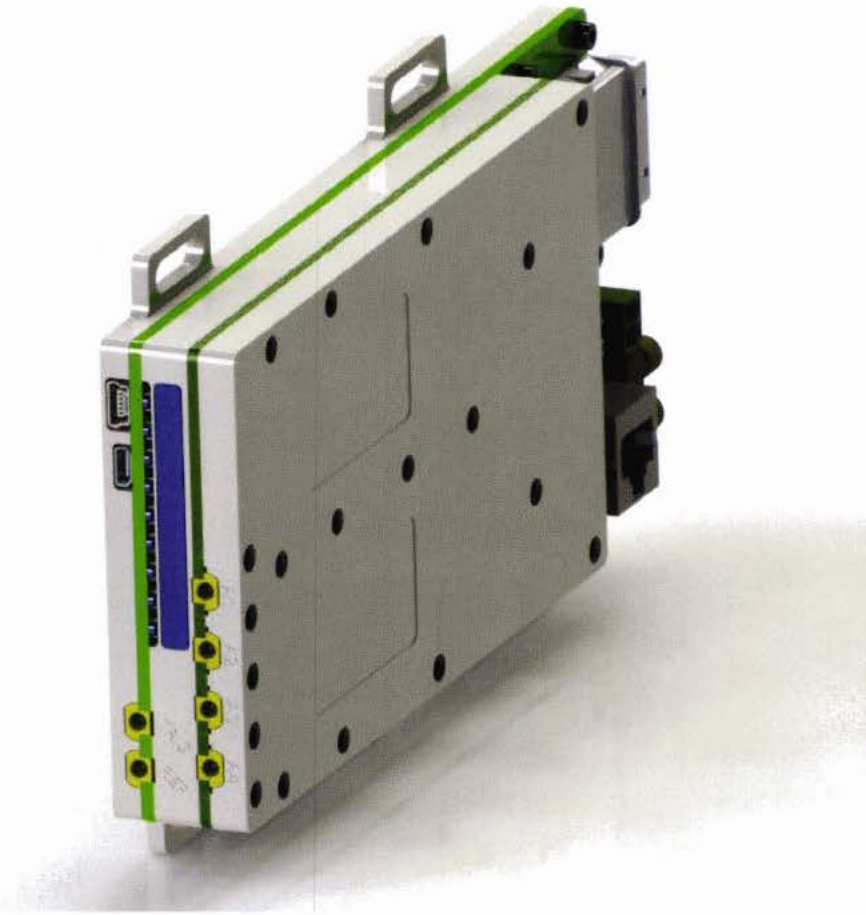
RFeye®

PCIe Module 2100

Spectrum and signal analyzer tab-mounted module with PCIe interface

Product code: NOD-PCI0002



Key features

- 100 kHz to 6 GHz frequency range
- 20 MHz real-time band width
- Break-out connectors for PCIe, power, Ethernet and reference
- On-board Linux process for autonomous operation
- Fast, sensitive, excellent noise figure
- TDOA, POA and AOA capable
- Lightweight, compact, low power
- Multiple RF ports for multi-antenna operation
- Flexible real-time signal acquisition and data processing
- Open API, fully programmable with supplied SDK

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High performance wideband receiver module with tab mounts and break-out connectors for easy integration with high speed PCIe systems

The PCIe Module 2100 is designed for easy integration with other PCIe systems with convenient tab mounting system and exposed connectors. This Module can also be operated as a stand-alone, intelligent spectrum/signal acquisition system using the on-board Linux processor. The PCIe protocol provides data streaming at 160 MBytes/s enabling continuous real-time recording of I/Q data.

Class leading signal interception

Capable of sweeping from 100 kHz to 6 GHz at 40 GHz/s, the PCIe Module 2100 captures signals of all types, including transient transmissions such as pulsing or short-burst. High sensitivity and exceptionally low spurious components mean that it is able reliably to distinguish even very low power signals from the noise floor.

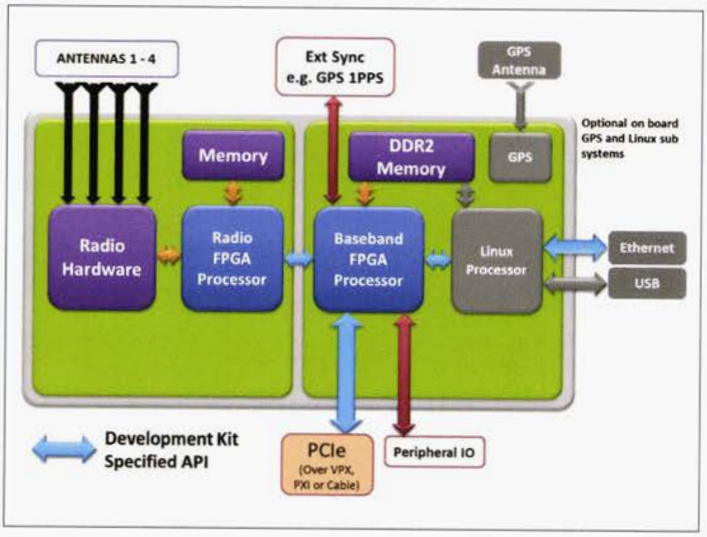
Highly flexible for ease of integration or standalone deployment

The PCIe Module 2100 is designed to be bolted down inside any suitable enclosure and easily connected to power, PCIe, Ethernet and reference input for true "plug and play" installation. The on-board Linux processor allows fully programmable autonomous operation and control of other wider system elements.

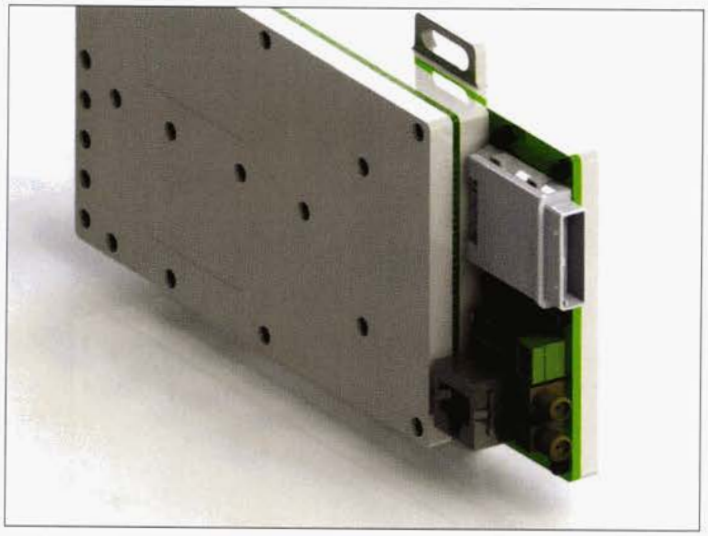
Advanced geo-location capability

Multiple RF inputs allow comparison of signals from different antennas for SIGINT applications and also support direction finding using AOA techniques. In addition, timing and synchronisation features allow correlation of data between multiple PCIe Modules for accurate TDOA or POA geo-location of target signals.

Architecture



Extended interface



Technical specifications

Frequency	
Range	100 kHz to 6 GHz

Internal Frequency Reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±2.5 ppm at 20°C
Ageing	better than ±1 ppm per year

Sweep and Triggering	
Sweep speed	100 kHz to 6 GHz: 40 GHz/s fast sweep mode 400 GHz/s hyper sweep mode
Sweep mode	Fully programmable: free run, continuous, single, timed
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Software Development Options	
Linux OS version (with Opt 01)	2.6
Development environments	Full SDK in C, C++ and C# .NET development environment available

Sensitivity (equivalent noise figures at maximum sensitivity)	
100kHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Signal Input	
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC

Interfaces	
RF input	4 switchable inputs
DC power	10 - 24 VDC
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle
Trigger input	1 pps
Reference clock input	10 MHz, 0.5 V rms
Ethernet	1 x 100 BaseT
USB	USB Mini AB (1.1)
PCIe	Standard PCIe connector Primary PCIe direct to FPGA, secondary PCIe connected to Linux processor

Mechanical	
Dimensions (w h d)	160 mm x 100 mm x 24.5 mm (6.7 in x 3.9 in x 0.96 in)
Weight	500 g (1.1 lb)

Environmental	
Operating temperature	-30 to +55°C (-22 to 131°F)
Storage temperature	-40 to +70°C (-40 to 158°F)

For more information

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CRFS

RFeye®

Array 300

Multi-mission monitoring and geo-location for spectrum-critical sites

Product code: SYS-DFA0001

Key features

- AOA, augmented TDOA and POA
- Fast, sensitive, very high POI of all signal types
- Capture independent of signal polarization
- Antenna modules from 500MHz (optional 300MHz) to 6GHz (optional 18GHz)
- Watson-Watt VHF option down to 20MHz
- Easy integration with legacy and third party systems
- Rugged, IP65 rated, multiple power options
- Standalone or as part of a real-time network
- Ethernet and cellular connectivity
- Optical fibre interface option

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CRFS

Beyond direction finding – detecting and locating unauthorized, suspicious or interfering transmitters

The RFeye Array 300 is a fully integrated multi-mission system for continuous 24/7 spectrum monitoring and surveillance. It is designed to intercept signals, however transient, perform signals analysis and classification and quickly and reliably geo-locate target transmitters, all in real time. It is the smaller of the family of RFeye Arrays and is ideal for most critical site and border monitoring applications.

Class leading signal interception

RFeye Arrays use a unique multi-layer approach that is more sophisticated and versatile than traditional Direction Finding. High performance sinuous directional antenna modules are optimized for different frequency bands and arranged in multiple orientations. The array is sensitive to the majority of incoming signal polarizations including all linear polarizations, allowing it to reliably detect signals including those invisible to most DF systems that use linear polarized antennas. They reliably detect all types of signals from UHF up to SHF.

Augmented geo-location techniques

The RFeye commutates at very high speed around the antennas to make near-simultaneous measurements in multiple directions. It measures correlations and calculates actual positional probabilities using "augmented" Time Difference of Arrival and/or Power on Arrival techniques. In addition, it gives a bearing (Angle of Arrival) based on received power at each antenna. Measurements can be overlaid onto a wide variety of 2D and 3D maps to give a unique positional display showing source geolocation probabilities, irrespective of signal power, bandwidth or frequency.

Modular and flexible deployments

The RFeye Array 300 is fully self-contained within a robust IP65 rated radome designed for hostile conditions. Close coupling of the RFeye node and antenna modules reduces cable runs and cable losses and significantly improves RF performance. Various directional antenna options are available from 300MHz to 18GHz and an RFeye Watson-Watt module is available for VHF transmissions down to 20MHz. The system is modular and further channels can be added to improve probability of intercept.

Powerful software

Advanced GUI provides easy multi-mission control including 24/7 continuous spectrum monitoring, programmable masks and alarms, signal analysis and optional signal classification capability.

Technical specifications

Receiver performance	
Frequency range	10 MHz to 6 GHz, optionally to 18 GHz
Scan speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Noise figure	8 db typical (10 MHz – 4 GHz) 11 db typical (4 GHz – 6 GHz)
Real-time analysis bandwidth	20 MHz
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)
Nominal input impedance	50 Ω
Demodulation	On board demodulation of AM & FM Optional modulation ID software for identificantion and clasification of comprehensive range of analogue and digital modulation types

Direction finding / geolocation performance	
Direction finding method	6-way switched directional array (AOA)
DF frequency range	500 MHz to 6 GHz, optionally 300 MHz to 18 GHz, depending on antennas Watson Watt option down to 20 MHz
Coverage of azimuth	360°
DF accuracy	5° RMS typical (in reflection-free environment)
Polarization	Circular
Time difference of Arrival (TDOA)	100 MHz to 6 GHz, optionally 10 MHz to 18GHz
Power on Arrival (POA)	100 MHz to 6 GHz, optionally 10 MHz to 18GHz
GPS reference	On-board 12-channel receiver, 35ns RMS timing reference accuracy

Radome interface panel	
Auxiliary RF inputs	2 x N-type (0.01 - 6GHz)
LAN	1 x 100 Base T Ethernet, RJ45
USB	1
External battery	1 x 12-24VDC
External solar	1 x 5-32VDC
Additional glands	2 x 4-way

Mechanical & environmental	
Power	10-48 VDC
Operating temperature	-28 to +50°C (-18 to 122°F)
Storage temperature	-40 to +70°C (-40 to 158°F)
Environmental protection	RFeye Node & electronics: IP67 System: IP65
Dimensions	Overall 1.1m/43" Ø, 1.2m/47" height
Weight	80 kg / 176 lbs

Radome	
External Diameter	1.1m / 43"
Construction	Molded 1 layer CSM and 1 layer woven fiberglass
Finish	UV stable gel system in white (Scott Bader 65 PA White)
Attenuation	0.3dB max. at C-Band, 0.8 dB max. at Ku-Band.
Wind Load	Operational 100 Knots Wind / Survival 130 Knots Wind
Ice Load	22 kg/m² / 4.5 lb/ft²

Ordering information

Description	Product	Order code
Base system: Monitoring and geolocation capability from 100 MHz to 6 GHz, DF from 500 MHz to 6 GHz	RFeye Array 300	SYS-DFA0001
Microwave frequency extender to 18 GHz for monitoring and geolocation	RFeye Array 300 - SHF extender	SYS-DFA0001S
DF extender down to 300 MHz	RFeye Array 300 - UHF extender	SYS-DFA0001U
VHF extender down to 20 MHz	RFeye Array 300 - VHF extender	SYS-DFA0001V

For more information

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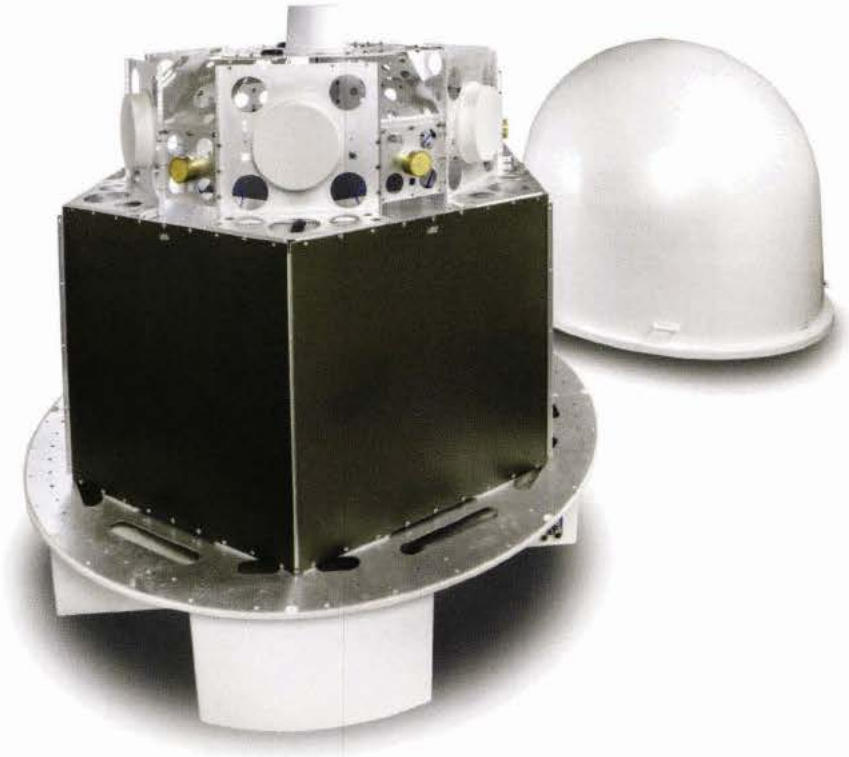
RFeye®

Array 500

Multi-mission monitoring and geo-location for spectrum-critical sites

Product code: SYS-DFA0002



Key features

- AOA, augmented TDOA and POA
- Fast, sensitive, very high POI of all signal types
- Capture independent of signal polarization
- Antenna modules from 100MHz to 18GHz
- Watson-Watt VHF option down to 20MHz
- Easy integration with legacy and third party systems
- Rugged, IP65 rated, multiple power options
- Standalone or as part of a real-time network
- Ethernet and cellular connectivity
- Optical fibre interface option

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Beyond direction finding – detecting and locating unauthorized, suspicious or interfering transmitters

The RFeye Array 500 is a fully integrated multi-mission system for continuous 24/7 spectrum monitoring and surveillance. It is designed to intercept signals, however transient, perform signals analysis and classification and quickly and reliably geo-locate target transmitters, all in real time. It is the larger of the family of RFeye Arrays and is designed for managing spectrum and for monitoring and surveillance on the most critical or sensitive sites and borders.

Class leading signal interception

RFeye Arrays use a unique multi-layer approach that is more sophisticated and versatile than traditional Direction Finding. High performance sinuous directional antenna modules are optimized for different frequency bands and arranged in multiple orientations. The array is sensitive to the majority of incoming signal polarizations including all linear polarizations, allowing it to reliably detect signals including those invisible to most DF systems that use linear polarized antennas.

Augmented geo-location techniques

The RFeye commutates at very high speed around the antennas to make near-simultaneous measurements in multiple directions. It measures correlations and calculates actual positional probabilities using "augmented" Time Difference of Arrival and/or Power on Arrival techniques. In addition, it gives a bearing (Angle of Arrival) based on received power at each antenna. Measurements can be overlaid onto a wide variety of 2D and 3D maps to give a unique positional display showing source geolocation probabilities, irrespective of signal power, bandwidth or frequency.

Modular and flexible deployments

The RFeye Array 500 is fully self-contained within a robust IP65 rated radome designed for hostile conditions. Close coupling of the RFeye node and antenna modules reduces cable runs and cable losses and significantly improves RF performance. Various directional antenna options are available from 100MHz to 18GHz and an RFeye Watson-Watt module is available for VHF transmissions down to 20MHz. The system is modular and further channels can be added to improve probability of intercept.

Powerful software

Advanced GUI provides easy multi-mission control including 24/7 continuous spectrum monitoring, programmable masks and alarms, signal analysis and optional signal classification capability.

Technical specifications

Receiver performance	
Frequency range	10 MHz to 6 GHz, optionally to 18 GHz
Scan speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Noise figure	8 db typical (10 MHz – 4 GHz) 11 db typical (4 GHz – 6 GHz)
Real-time analysis bandwidth	20 MHz
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)
Nominal input impedance	50 Ω
Demodulation	On board demodulation of AM & FM Optional modulation ID software for identificantion and clasification of comprehensive range of analogue and digital modulation types

Direction finding / geolocation performance	
Direction finding method	6-way switched directional array (AOA)
DF frequency range	100 MHz to 6 GHz, optionally to 18 GHz Watson Watt option down to 20 MHz
Coverage of azimuth	360°
DF accuracy	5° RMS typical (in reflection-free environment)
Polarization	Circular
Time difference of Arrival (TDOA)	100 MHz to 6 GHz, optionally 10 MHz to 18GHz
Power on Arrival (POA)	100 MHz to 6 GHz, optionally 10 MHz to 18GHz
GPS reference	On-board 12-channel receiver, 35ns RMS timing reference accuracy

Radome interface panel	
Auxiliary RF inputs	2 x N-type (0.01 - 6GHz)
LAN	1 x 100 Base T Ethernet, RJ45
USB	1
External battery	1 x 12-24VDC
External solar	1 x 5-32VDC
Additional glands	2 x 4-way

Mechanical & environmental	
Power	10-48 VDC
Operating temperature	-28 to +50°C (-18 to 122°F)
Storage temperature	-40 to +70°C (-40 to 158°F)
Environmental protection	RFeye Node & electronics: IP67 System: IP65
Dimensions	Overall 1.66m / 65.4" Ø, 1.63 m/ 64.2" height
Weight	175kg / 385 lbs

Radome	
External Diameter	1.66m / 65.4"
Construction	Molded 1 layer CSM and 1 layer woven fiberglass
Finish	UV stable gel system in white (Scott Bader 65 PA White)
Attenuation	0.3dB max. at C-Band, 0.8 dB max. at Ku-Band.
Wind Load	Operational 100 Knots Wind / Survival 130 Knots Wind
Ice Load	22 kg/m^2 / 4.5 lb/ft^2

Ordering information

Description	Product	Order code
Base system: Monitoring and DF / geolocation capability from 100 MHz to 6 GHz	RFeye Array 500	SYS-DFA0002
Microwave frequency extender to 18 GHz for monitoring and geolocation	RFeye Array 500 - SHF extender	SYS-DFA0002S
VHF extender down to 20 MHz	RFeye Array 500 - VHF extender	SYS-DFA0002V

For more information

To find out more or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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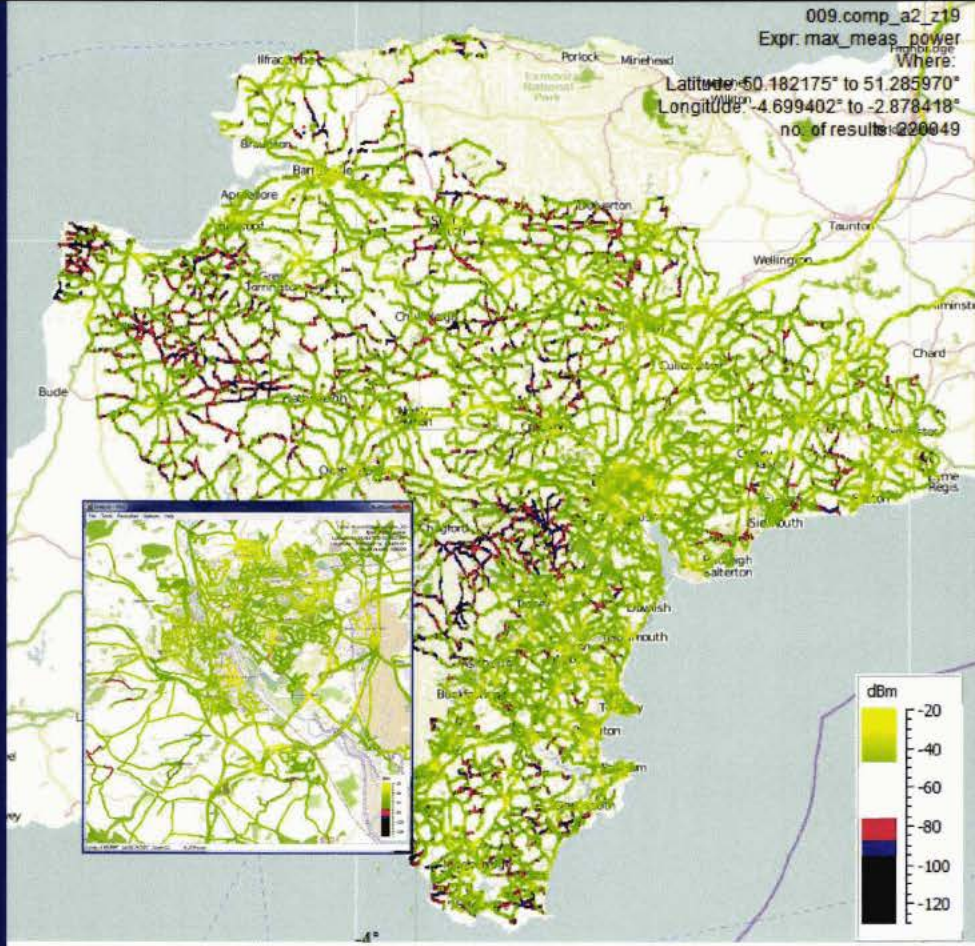
RFeye®

Map

Enterprise-level spectrum mapping and analysis database software for very large data sets

Product code: APP-MAP0001



Key features

- Designed for multi-terabyte data sets
- Fast, interactive data analysis and visualization
- Multiple, synchronized data display windows
- Display of signal levels, peak, mean signal power, band utilization and field strength
- Data selection by frequency, location, time and monitoring node
- Interactive pan and zoom between geographical resolutions
- Geographic points of interest overlays
- Client-server architecture allows local or remote multi-user access
- User-definable reports
- Export of data and results in user-selectable formats

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Powerful database software for managing and analyzing critical site or whole country spectrum data

RFeye Map is an enterprise level database application for the management, analysis and visualization of the very large data sets collected by modern spectrum monitoring organisations. Using a proprietary database architecture and data processing tools designed specifically for this purpose, RFeye Map provides fast, fully interactive analysis and displays of spectrum usage from data collected by networks of monitoring nodes, both fixed and mobile.

Unique interactive functions and synchronized display windows

RFeye Map provides multiple views of spectral data including synchronized map-based displays, spectrum plots and spectrograms, occupancy plots, and time evolutions. Data can be selected by any combination of node/network, location, time window or frequency range, and resolution can be displayed from national level to individual street location.

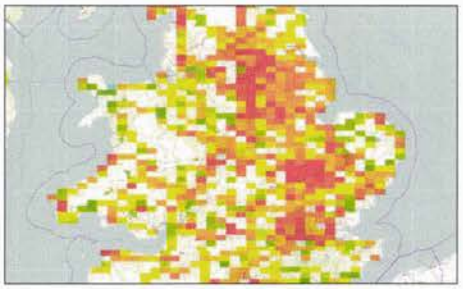
Occupancy profiling, trend analysis, compliance and interference monitoring

RFeye Map has been designed to provide spectrum regulators, planners and managers with real information about spectrum usage to improve planning, operations and decision-making. The detailed maps help identify potential "pinch" points and vulnerabilities, manage compliance and monitor trends over the long term. It is also a valuable tool for license enforcement teams.

Easy database access via internal server or web-interface

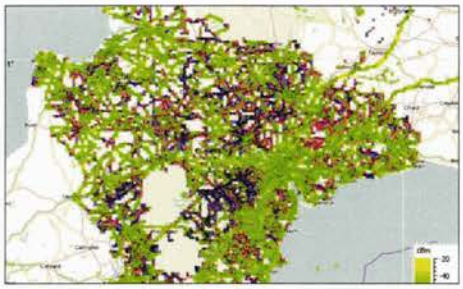
RFeye Map software can be operated from a standalone PC, as a client-server, or via a web-interface to enable remote users to access the data analyzer. Many different reports can be produced and report formats can be tailored to specific requirements.

Screenshots



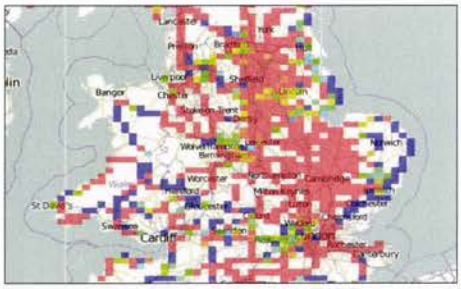
Mean signal

The mean signal screen displays the average signal strength of all measurements taken in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



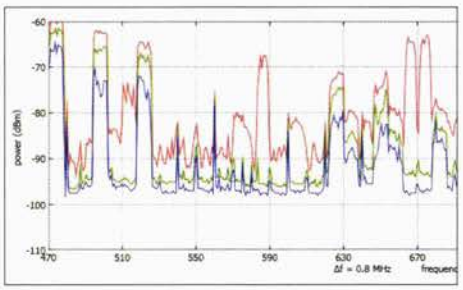
Peak signal

The peak signal screen displays the highest data point measurement of signal strength in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



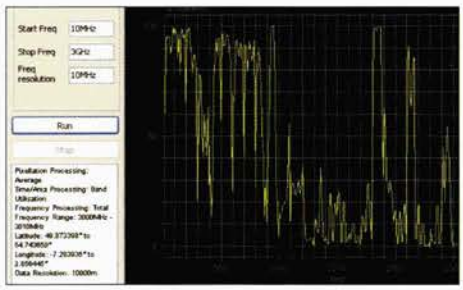
Band utilization

The band utilization screen displays the signal measured in a given geographic area for a given frequency band expressed as a percentage utilization. The parameters of the geographic area and frequency band can be selected.



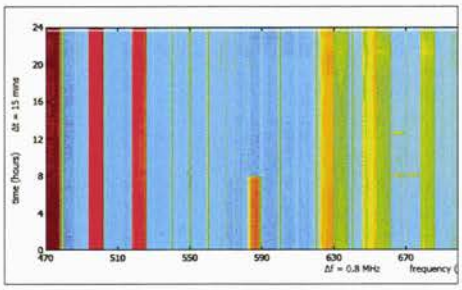
Spectrum

The spectrum screen displays signal strength against frequency for a given geographic area and frequency band. The parameters of the geographic area and frequency band can be selected.



Spectrum use report

The spectrum use report screen displays percentage utilisation of a given frequency band in a given geographic area. The parameters of the geographic area and frequency band can be selected.



Spectrogram

The spectrogram screen displays spectrum usage over time as measured by a mobile RFeye as it travels through an area. The spectrogram shows temporal characteristics of signals and allows the user to map a specific event to a geographic location at a point in time.

Technical specifications

Display Processing Options	
Spatial	Peak, Average, Band Utilization
Frequency	Peak, Average, Total
Pixellation	Peak, Average signal level
Filtering	Frequency, Time and Date, Area, RFeye Node

PC Requirements	
Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	4 GB (Map Cache) + File Storage
Memory	3 GB (recommended)

Databse Platform	
RDBMS	PostgreSQL

Displays	
Map	Whole world to street level
Spectrum and Spectrogram	All frequencies to individual bin
Report	All frequencies to individual bin
Overlay	Any KML Format File

For more information

For more information or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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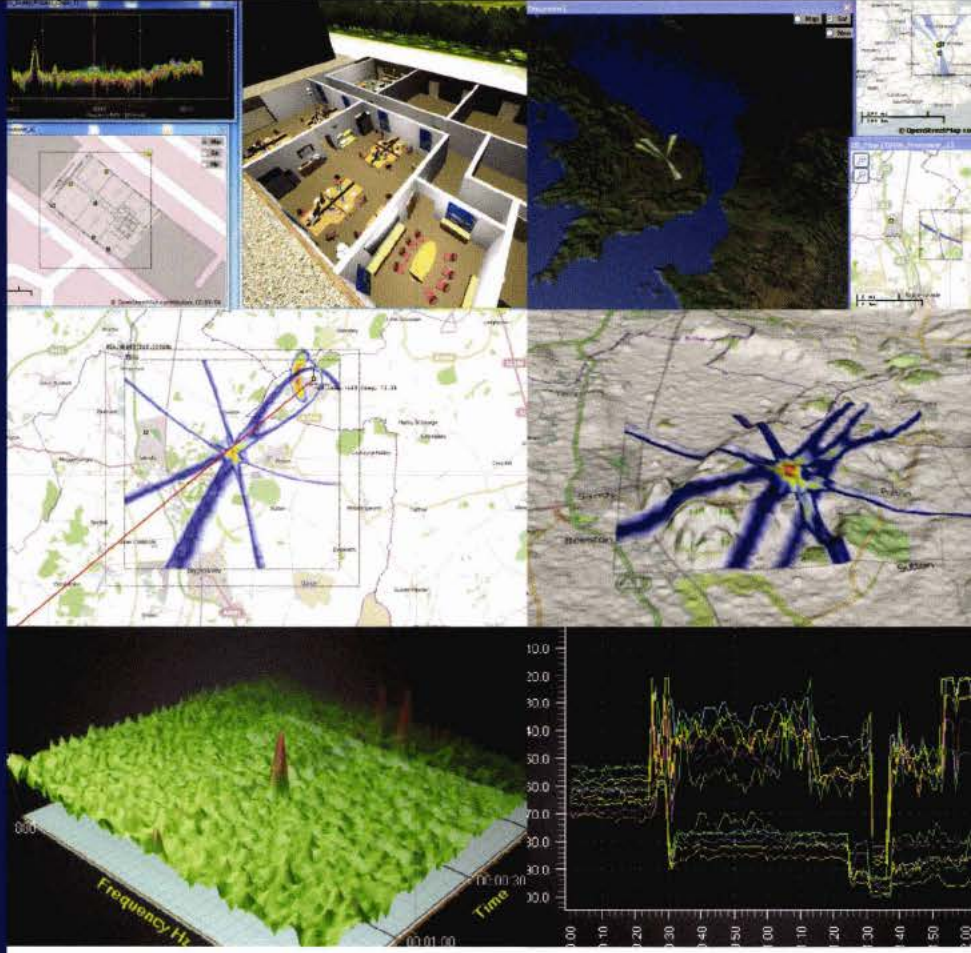
RFeye®

Site

Real-time Windows application software for networks of RFeye nodes

Product code: APP-SIT0001



Key features

- Real-time connection to multiple Nodes and network configurations
- Advanced network status monitoring
- Real-time spectral displays in multiple formats
- Fully programmable time-synchronised sweeps and time captures
- Fully programmable alarms and alerts
- Optional AOA, TDOA and POA modules
- Data recording and playback
- Automatic signal recognition plug-in option
- Support for license data formats including Pub7/8 and SMADEF
- Full MANCAT file format supported for output of sweep data

State-of-the-art desktop application for managing complex spectrum operations in-building or over large sites

RFeye Site allows networks of RFeye Nodes to be managed and controlled and multiple different tasks and missions to be performed with simple button and mouse control. It has latest .Net tools to provide a uniquely configurable and powerful visual interface with full object-orientated command and control, real-time spectral displays in multiple formats and advanced mapping capabilities, including 3D displays.

Unique multi-user, multi-mission capability

Each individual RFeye Node or all Nodes in the network can be assigned tasks from a large configurable menu, ranging from requests for basic spectrum sweeps and occupancy measurements, to the detection and alerting of spectrum events, to advanced signal classification and real-time geolocation of sources of interest. Multiple users can simultaneously make multiple requests of all or any of the Nodes over wired or 3G networks.

Real-time geolocation and direction finding

Optional plug-in modules are available for TDOA, AOA and POA geolocation. These support multiple simultaneous geolocations on multiple frequencies. Results are plotted on 2D or 3D site maps and are displayed as heat map probabilities. Multiple results can be overlaid onto the map for ease of visualization and analysis. The mapping tools include full zoom facility and ability to display many simultaneous maps. SRTM data overlay is available to aid geolocation analysis.

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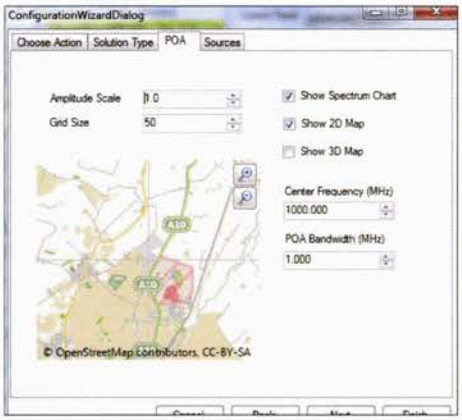
Flexible user-configurable GUI

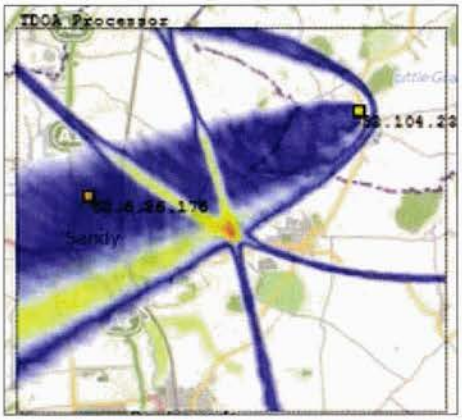
Depending on the level of expertise of the user, the GUI can be provided as fully configurable by the user or pre-configured with simple controls. RFeye Site also comes with a flexible configuration tool to allow users to create their own custom configurations.

Screenshots

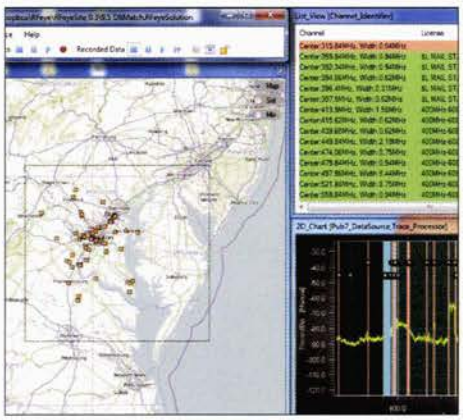
Multi-window display showing AOA, TDOA and POA measurements



Wizard configuration option or full control

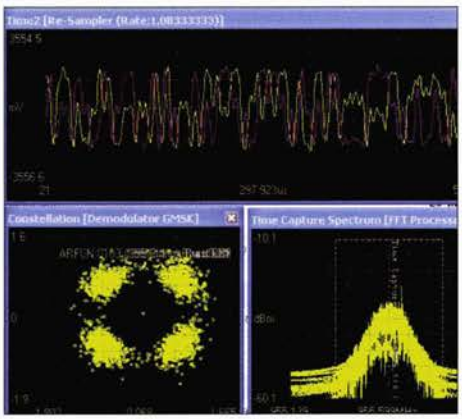


Wide area TDOA zones on full GIS maps



Automatic comparison of spectrum against PUB 7 spectral database

Multiple charting components showing historical spectral data



Custom signals analysis scenarios - here data demod and burst type ID

Technical specifications

PC Requirements	
Processor type	Intel Core 2 (or equivalent) running at 1.4 GHz or greater AMD X2 (or equivalent) running at 1.8 GHz or greater
Operating system	Windows Vista, Windows XP, Windows 7 & 8
Hard disk space	100 MB for the application
RAM	2 GB min recommended
Internet connection	Required

Compatible RFeye Solutions, Systems & Hardware	
Solutions	RFeye Detect (wide area monitoring, including TDOA and AOA geolocation) RFeye Secure (in-building monitoring, including POA geolocation)
Systems & hardware	RFeye Node, RFeye BDC, RFeye Arrays, also mobile & portable systems. Internet connectivity required.

For more information

To find out more or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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RFeye®

Live

Real-time Windows application for dynamic interaction with RFeye Node

Product code: APP-LIV0001

Key features

- Intuitive interface with mouse control
- Interactive local or remote control over IP network
- Fast display update
- Simultaneous multiple RF input display
- Marker and region functions
- Flexible trigger and mask functions
- Signal processing functions including averaging and peak hold
- Data logging functions
- Display of measured power or field strength
- Data map overlay

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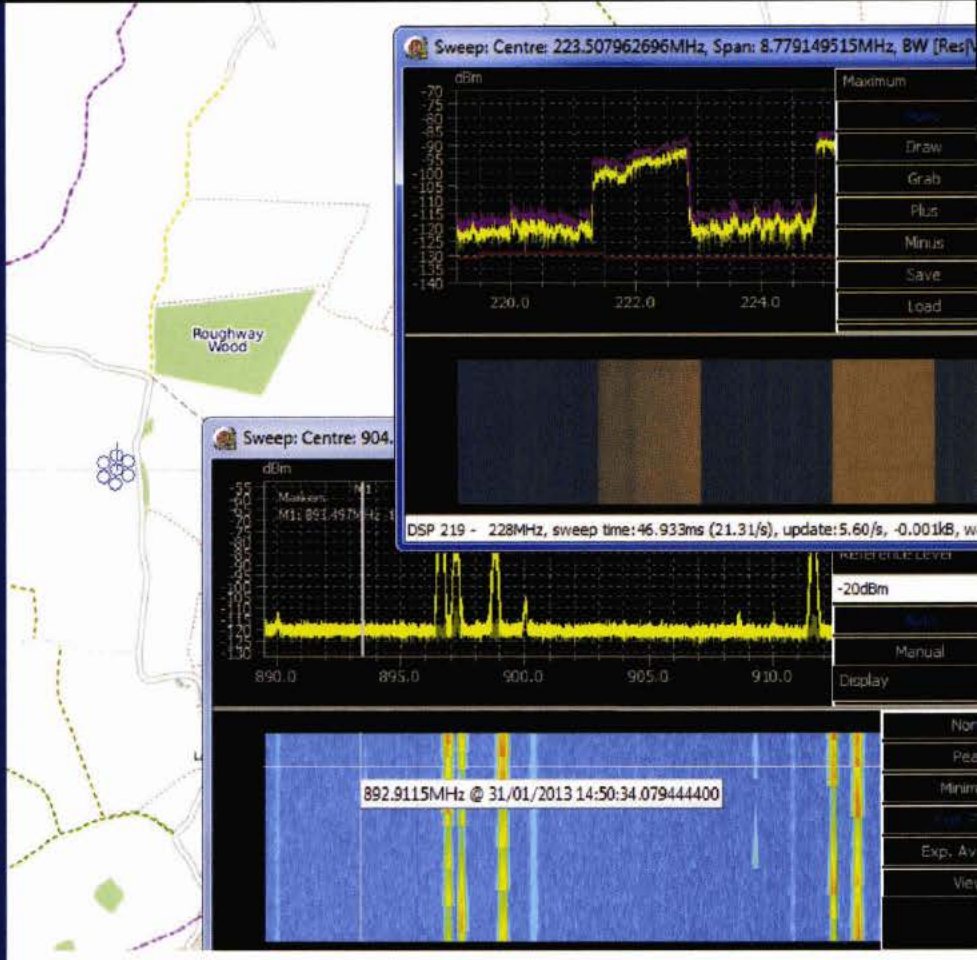


Powerful spectrum analyzer interface for real-time querying and analysis using the RFeye Node

RFeye Live is a standalone PC application that provides a highly flexible and easy-to-use spectrum analyzer interface. It displays live spectral data from the Node either local to the unit or remotely via an IP link and can record data for subsequent playback and analysis. RFeye Live is an invaluable tool for live investigation of the RF environment both in the laboratory and in the field.

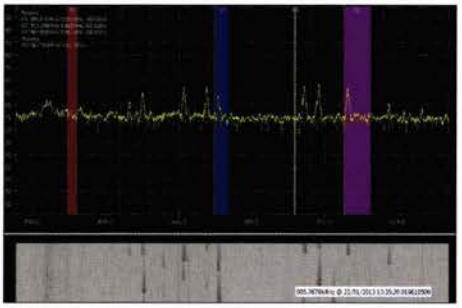
Full suite of functions easily controlled at the click of mouse button

All traditional spectrum monitoring functions are provided plus a number of additional functions specific to the RFeye Node, including simultaneous display of signals from up to 4 RF inputs, dynamic AGC attenuation level and control of signal processing. RFeye Live interacts with the Node to display sweep and time data and perform audio demodulation from 10 MHz to 6 GHz. The dynamic range is extended to 18 GHz when used with the RFeye Block Down Converter. RFeye Live also supports AOA functionality when used in conjunction with a suitable DF antenna array.

Flexible connections to the Nodes

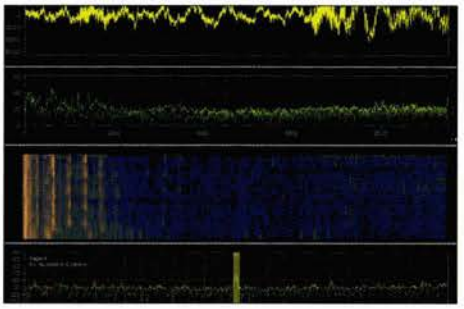
The RFeye Live interface to any single Node in a network can be made from anywhere in the world by simply entering the unique IP address of the Node. Multiple instances of Live can be run on the same computer to allow simultaneous connections to multiple Nodes. Multiple simultaneous connections to any individual Node in the network can also be made by multiple users running Live from different locations.

Screenshots



Sweep

The sweep screen displays a simple sweep with controls to start/stop frequencies and select resolution bandwidth. Multiple analysis options including peak hold, multiple markers, masks, data recording and playback.

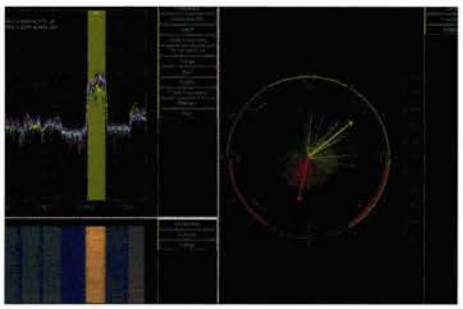


Audio

The audio screen allows the user to tune into a particular frequency and output the decoded FM or AM signal.

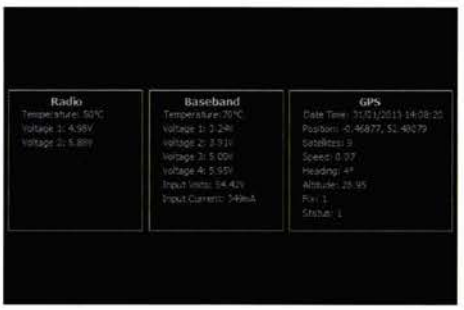
Map

The map screen displays the current location of the RFeye node as determined from the on-board GPS receiver. It also connects with the AOA screen and overlays angle of arrival data.



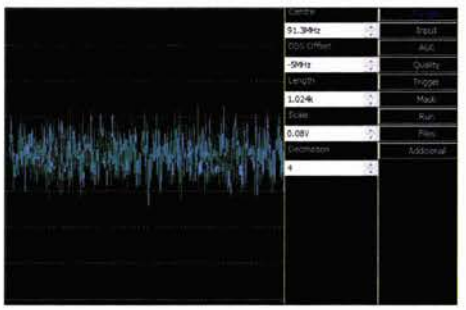
AOA

The angle of arrival screen displays angle of arrival of target signals of interest. Multiple sources can be analysed simultaneously and various functions applied to improve directional display.



Monitor

The monitor screen shows RFeye Node status information such as the Radio and Baseband temperatures and voltages and GPS information.



Time

The time screen displays a simple time capture with controls to set centre frequency, number of samples to capture and trigger mechanisms, plus options to save captured data to file.

Technical specifications

Displays	
Spectrum	Traditional spectrum display with markers and trace functions
Waterfall	Cascading colour coded spectrum display
Status	Network node property tree showing node properties and allowing node conguration

File Export	
Data File	NCP (CRFS format)
Audio	WAV format

PC Requirements	
Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	10 MB
Memory	1 GB recommended

For more information

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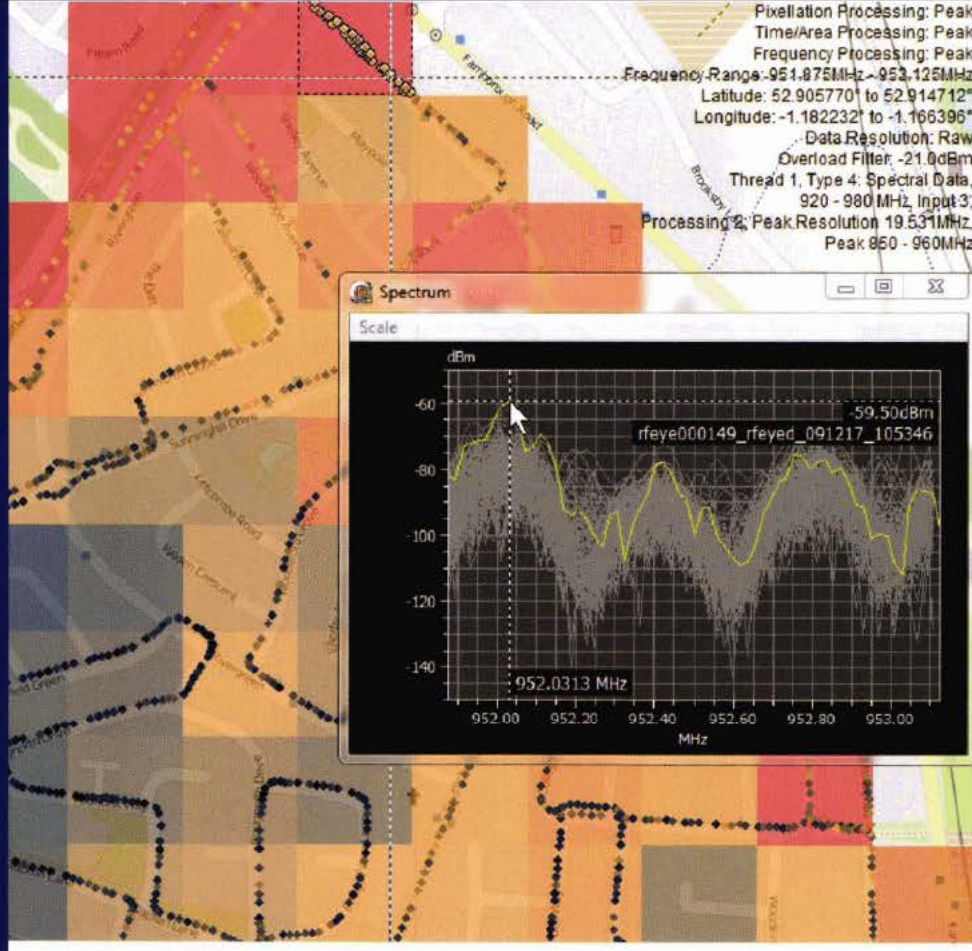
View

Windows application for spectrum mapping, visualization and analysis

Product code: APP-LFV0001



Key features

- Interactive analysis of large data sets up to 2 GB
- Mapping of data from fixed or mobile RFeye Nodes
- Multiple data windows with synchronized display and highlighting
- World-level to street-level display resolution
- Interactive zoom between geographical resolutions
- Geographic points of interest overlays
- Extensive data filtering options
- Signal levels displayed as power or field strength
- Display of peak and mean signal levels and band utilization
- Built-in report generation tool

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Versatile user-friendly software tool for geographic mapping and analysis of spectrum survey data

RFeye View is a standalone PC application that enables powerful visualization and analysis of data captured by RFeye Nodes. Data may be analyzed at any desired geographic resolution, from national level down to individual measurement positions at street level. RFeye View is the ideal tool for quickly visualizing spectral data logged by one or more Nodes during walking or driving-based surveys.

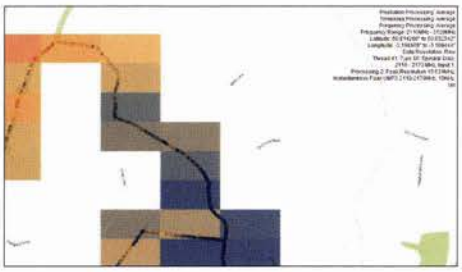
Interactive functions and synchronized display windows

Data captured from either fixed or mobile monitoring networks can be quickly and accurately displayed and analyzed using a variety of tools. For example, the map view provides an overview of the data in a geographic area, whilst the spectrum and spectrogram views give alternative viewpoints of the same data. Selecting data on any one of the display windows automatically highlights the same data in the other windows.

Powerful analysis and mapping functions

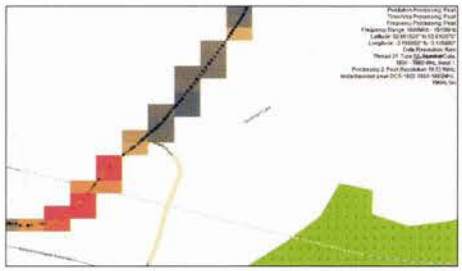
Spectrum usage may be analyzed for specific combinations of monitoring Nodes or networks, for frequency ranges of interest and signal characteristics (e.g. peak or average signal strength, or occupancy). Mapping is provided by OpenStreetMap.org and requires an internet connection.

Screenshots



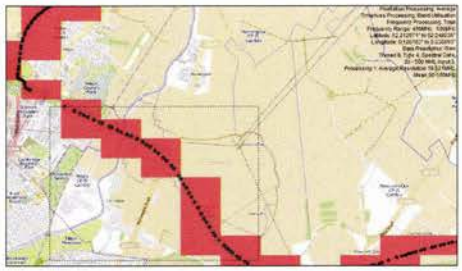
Mean signal

The mean signal screen displays the average signal strength of all measurements taken in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



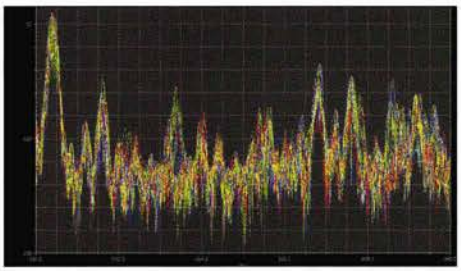
Peak signal

The peak signal screen displays the highest data point measurement of signal strength in a given geographic area for a given frequency band. The parameters of the geographic area and frequency band can be selected.



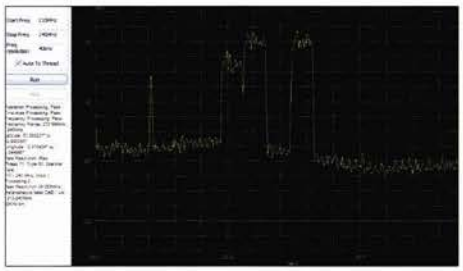
Band utilization

The band utilization screen displays the signal measured in a given geographic area for a given frequency band expressed as a percentage utilization. The parameters of the geographic area and frequency band can be selected.



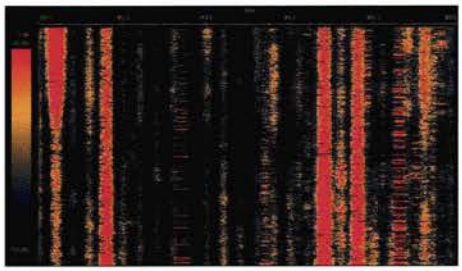
Spectrum

The spectrum screen displays signal strength against frequency for a given geographic area and frequency band. The parameters of the geographic area and frequency band can be selected.



Spectrum use report

The spectrum use report screen displays percentage utilisation of a given frequency band in a given geographic area. The parameters of the geographic area and frequency band can be selected.



Spectrogram

The spectrogram screen displays spectrum usage over time as measured by a mobile RFeye as it travels through an area. It shows temporal characteristics of signals and allows the user to map a specific event to a geographic location at a point in time.

Technical specifications

Display Processing Options	
Spatial	Peak, Average, Band Utilization
Frequency	Peak, Average, Total
Pixellation	Peak, Average signal level
Filtering	Frequency, Time and Date, Area, RFeye Node

Displays	
Map	Whole world to street level
Spectrum and Spectrogram	All frequencies to individual bin
Report	All frequencies to individual bin
Overlay	Any KML Format File

PC Requirements	
Operating System	Windows XP, 2000, Vista, Windows 7
Hard Disk Space	4 GB (Map Cache) + File Storage
Memory	3 GB (recommended)

For more information

For more information or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

CRFS

RFeye®

StormCase

Ruggedized spectrum monitoring system for field deployment

Product code: SYS-CAS0001

Key features

- Fully integrated spectrum monitoring system from 10 MHz to 6 GHz
- Rugged and IP67 rated for hostile conditions
- Connectivity for multiple external power options
- UMTS modem for cellular connectivity
- Built in GPS for high accuracy time stamping of data
- Multiple antenna options via internal and external connections
- Designed for use by skilled or unskilled personnel
- TDOA and POA geolocation capabilities
- Optional connection to local PC for live monitoring with RFeye Live
- Optional post-survey data mapping with RFeye View and RFeye Map

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Rugged integrated RFeye system for spectrum monitoring and intelligence gathering in demanding military, security and civilian environments

The RFeye StormCase is a complete man-portable system containing a ready deployed and ruggedized RFeye Node embedded in a sturdy Peli StormCase. The system is fully configured and ready to go "out of the box". It has been designed for use in hostile environments either in-vehicle or at fixed locations and can operate standalone for data logging or in conjunction with a PC for live spectrum monitoring.

Convenient solution for geolocation of target signal sources

It has inputs for multiple antennas and can be used in-building for security sweeping and geolocating suspicious signal sources by measuring differences in received power at the various antennas. In addition, three or more StormCase units can be networked over 3G to perform real-time geolocation operations or over wide geographic areas.

Multiple power source inputs and rechargeable battery

The RFeye StormCase contains a built-in 12 VDC dry lead-acid battery that is suitable for extreme temperature range operation (and is approved as carry on for commercial flights) giving up to 6 hours continuous battery operation. A versatile power control system allows multiple power source inputs from 10 VDC to 36 VDC as well as mains operation for fast charge and prolonged fixed site operation. 48 VDC POnE connection is also present.

Exposed connectors for easy antenna and comms connections

All ports for antennas, GPS, UMTS modem, Ethernet and USB are exposed to offer maximum flexibility for logging and analyzing spectrum without the need for a laptop. High capacity memory sticks or disk drives can be connected to the USB ports. The RFeye StormCase is supplied with GPS and UMTS antennas, rapid charging system, mains power supply, vehicle power supply connector and spectrum data logger.

Technical specifications

Receiver performance	
Frequency range	10 MHz to 6 GHz
Receiver noise figure	8 dB typical (10 MHz – 4 GHz) 11 dB typical (4 GHz – 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz oset -110 dBc/Hz at 200 kHz oset typical, at 2 GHz* (*low noise synthesiser)
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

Sweep and triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: userdefinable masks, user-definable action when mask exceeded

Signal analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Internal frequency reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Operating system and software development options	
Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Power supplies	
Battery	Dry cell MIL S-901C (non-spillable) 6 hr nominal capacity
Charger	Universal, 100-240 VAC
Charge time	6 hrs typical
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle

Interfaces	
DC power	10 - 48 VDC external DC supply, internal and external connections
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
RF input	3 internal and 1 external, Type N
GPS antenna	Type N, passive and active (3.3 V nominal DC) antennas supported, internal and external connections
UMTS/HSPA modem antenna	Type N, internal connector (antenna supplied)
Expansion ports	1 x internal, configurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output
Logger	Internal control switch with status LEDs

Mechanical	
Dimensions (w h d)	487 mm x 386 mm x 185 mm (19.2 in x 15.2 in x 7.3 in)
Weight	13.7 kg (30 lb)

Environmental	
Operating temp.	-30 to +55°C (-22 to 131°F)
Storage temp.	-40 to +55°C (-40 to 131°F)

For more information

For more information or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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RFeye®

BackPack

Compact lightweight system for discreet spectrum surveys

Product code: SYS-PAC0001

Key features

- Fully integrated spectrum monitoring system from 10 MHz to 6 GHz
- Lightweight portable solution self-contained in rugged backpack
- Rechargeable battery - typically 6 hour life
- Includes power controller/charger and mains/car power adaptors
- Built-in GPS for high accuracy time-stamping of data
- UMTS modem for 2G and 3G cellular connectivity
- GPS and GPRS/HSPA antennas included
- Easy connectivity for other antenna options
- Designed for use by skilled or unskilled personnel
- Optional post-survey data mapping with RFeye View

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Lightweight integrated spectrum data logging system for discreet surveys in urban, security-critical or military environments

The RFeye BackPack is the most man-portable of the RFeye systems and has been designed for easy and discreet spectrum surveying on foot. Built into a standard commercial backpack, the system includes a ruggedized RFeye Node, internally-mounted antennas, rechargeable battery, power controller and charger, and high-capacity USB storage. Overall weight is 6 kg (13.2 lb).

Pre-programmable, flexible and easy to use

The system may be pre-programmed with the required measurement profile - frequency range(s), measurement interval(s), resolution bandwidth(s), statistical processing required, etc. - prior to the start of the survey. This allows deployment by non-technical personnel where required. The built-in high accuracy GPS receiver is used to tag the data received to allow mapping against location. In locations with poor GPS coverage, 'waypoint' based location logging may alternatively be used. Data is logged to a USB memory stick for easy transfer of data after each survey.

Built-in data processing and intelligence

The powerful on-board Linux processor on the RFeye Node allows for conditional data acquisition which means that only data of interest is logged and further scans can be automatically triggered by pre-defined parameters to enrich the data sets. This improves the efficiency of data collection and post-analysis and improves the overall quality of the survey. Collected data can be visualized and analyzed post-survey using RFeye View. In addition, a netbook PC may be connected for real-time monitoring of signals during the survey using RFeye Live.

1. Define acquisition scenario

2. Perform mobile survey

3. Analyze data (RFeye View, Map)

Technical specifications

Receiver performance	
Frequency range	10 MHz to 6 GHz
Receiver noise figure	8 dB typical (10 MHz – 4 GHz) 11 dB typical (4 GHz – 6 GHz)
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC
3rd order intercept point (IP3)	+20 dBm typical (AGC active)
1 dB input compression	+10 dBm typical (AGC active)
Level accuracy	± 2.5 dB typical
Antenna LO re-radiation	-90 dBm typical
Antenna port isolation	30 dB min. at 2 GHz
SSB phase noise	-90 dBc/Hz at 10 kHz oset -110 dBc/Hz at 200 kHz oset typical, at 2 GHz* (*low noise synthesiser)
Synthesiser switching time	50 µs typical (fast sweep mode)
Spurious free dynamic range	60 dB min.
AGC range	60 dB

Sweep and triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: userdefinable masks, user-definable action when mask exceeded

Signal analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18 Hz min. (reduced analysis b/w)

Internal frequency reference	
Initial accuracy	better than ±2 ppm at 20°C
Stability	better than ±1 ppm (10°C to 30°C)
Ageing	better than ±2 ppm per year

Operating system and software development options	
Linux OS version	2.6
Python version	2.6
Development environments	Full SDK C and Python development environment available

Power supplies	
Battery	Dry cell AGM type (non-spillable), 6 hr nominal capacity
Charger	Universal, 100-240 VAC
Charge time	6hrs typical
Power consumption	12 - 18 W, radio operational 6 W typical, radio idle

Antennas	
Measurement	Connection provided for external antenna or internal stub antenna
GPS	Built-in
GPRS/HSPA	Built-in

Interfaces	
DC power	10 - 48 VDC external DC supply
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
Expansion ports	(1) Logger control box (2) congurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

Mechanical	
Dimensions (w h d)	350 mm x 215 mm x 445 mm (13.8 in x 8.5 in x 17.5 in)
Weight	6.0 kg (13.2 lb)

Environmental	
Operating temp.	-30 to +55°C (-22 to 131 °F)
Storage temp.	-40 to +70°C (-40 to 158 °F)

For more information

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CRFS

RFeye®

Evaluation System

Entry level evaluation system for RFeye technology

Product code: SYS-EVA0001

Key features

- RFeye Node (10 MHz - 6 GHz)
- Environmental protection cover
- Broadband omnidirectional antenna and mounting hardware
- GPS and GPRS/UMTS antennas
- Universal mains power supply
- RF and screened Ethernet cables
- Demo software
- Rugged carry case
- Memory sticks

Contains all the hardware and software necessary for broadband evaluation of the RFeye capabilities

The RFeye Evaluation System is the ideal entry-level system for users wanting to trial the extensive capabilities of the RFeye Node. It contains everything required for quick and easy set up ofsw the Node for data logging and/or real-time monitoring. It includes evaluation software that enables powerful mapping and analysis of logged data as well as in live monitoring mode using the real-time spectrum analyzer interface.

Includes software development kit

The RFeye Evaluation System is provided with a full SDK containing tools and libraries to help software engineers develop their own applications to run on the Node's built-in Linux processor. The SDK also gives configuration examples to make it easy for users to control how the Node is set up to collect and process data. This is done with simple scripts making it easy to use and accessible without any programming knowledge.

Designed for end-users and system integrators

We want to make our customers' initial interaction with the RFeye as positive an experience as possible. Our team of specialists is available to support you through the evaluation process and ensure that you get the full benefit of the RFeye's extensive capabilities, whether it for a standlone system, a fully networked deployment, or as part of a broader integrated solution.

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Technical specifications

Frequency	
Range	10 MHz to 6 GHz

Sensitivity (equivalent noise figures at maximum sensitivity)	
10 MHz - 4 GHz	8 dB typical
4 GHz - 6 GHz	11 dB typical

Signal Input	
Input connector	Four switchable signal inputs
Maximum input level	+15 dBm; 15 VDC

Internal Frequency Reference	
Initial accuracy	better than ±2.5 ppm at 20°C
Stability	better than ±1 ppm at 20°C
Ageing	better than ±2 ppm per year

Sweep and Triggering	
Sweep speed	40 GHz/s (fast synthesizer) 10 GHz/s (high quality synthesizer)
Sweep mode	Fully programmable: Free run continuous, single, timed, delay timed user trigger, adaptive (if-then-else)
Trigger on event	Fully programmable: user-definable masks, user-definable action when mask exceeded

Signal Analysis	
Real-time analysis bandwidth	20 MHz maximum
Equivalent resolution bandwidth	20 kHz min. (max. analysis b/w) 18Hz min. (reduced analysis b/w)

Power Supply	
DC power	10 - 48 VDC
Power consumption	12 - 18W, radio operational 6 W typical, radio idle

Interfaces	
RF input	SMA (X 4)
DC power input	Direct to node or via Ethernet
GPS antenna	SMA, passive and active (3.3 V nominal DC) antennas supported
UMTS/HSPA modem antenna	SMA
Ethernet	1 x 100 BaseT
USB	2 x USB A (1.1)
Expansion ports	2, congurable to provide: (a) trigger input (b) frequency reference input (c) external (peripheral) control (d) frequency reference output

Mechanical	
Dimensions (w h d) [RFeye Node]	170 mm x 60 mm x 125 mm (6.7 in x 2.4 in x 4.9 in)
Weight (RFeye Node)	1.4 kg (3.1 lb) [Node only] 2.0 kg (4.4 lb) [with environmental protection cover]
Weight (shipping)	6.7 kg (14.8 lb) [inc. accessories]

Environmental	
Operating temperature	-30 to +55°C (-22 to 131°F)
Storage temperature	-40 to +70°C (-40 to 158°F)

Accessories	
Measurement antenna	800 MHz - 6GHz broadband antenna inc. cable, standard whip antenna
GPS antenna	Active type, panel mount inc. cable
UMTS/HSPA antenna	Panel mount, inc. cable
Environmental protection cover	IP67
Universal power supply	90 - 264 V AC, 57 - 63 Hz
DC power lead	2m (6ft)
Logger Control Box	Inc. 1m (3ft) lead
Ethernet cable	2m (6ft), screened
Carry case	External dimensions: 48.7 cm x 38.6 cm x 18.5 cm (19.2 in x 15.2 in x 7.3 in)
USB memory sticks	4GB (x5), inc. demo application software and supporting documentation

For more information

For more information or discuss your specific application, please e-mail us at enquiries@crfs.com or call +44 (0) 1223 815 615. You can also find useful resources on our website at www.crfs.com.

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