R&S®WPU500
Wideband Processing Unit
Optimum performance for interception and collection of radar signals

ROHDE&SCHWARZ

Radiomonitoring & Radiolocation

Product Brochure | 03.00

R&S®WPU500 Wideband Processing Unit

At a glance

The R&S®WPU500 wideband processing unit allows optimum performance for interception, collection and analysis of radar signals. The device is connected directly to an optimum antenna and works with realtime over-the-air emissions. The rich feature set and versatile functionality make the R&S®WPU500 the benchmark for all radar processing units.

The R&S®WPU500 is designed and developed to be the heart of any modern ELINT/RESM system. Using this wideband processing unit, any ELINT system becomes a state of the art sensor for leading edge data collection in any radar signal environment.

The R&S®WPU500 is an ELINT system that consists of:

- VHF/UHF and SHF tuner
- 12-bit high-speed digitizer and 16-bit high-performance digitizer
- 4 pulse analyzer channels in parallel
- FFT-based realtime spectrum display included in the receiver box
- Fast FFT spectral scan (panorama scan) included in the receiver box

The system is accommodated in just one 19" 4 HU box, making the R&S®WPU500 the most comprehensive and rack space saving device available on the market.

Key facts

- Up to 500 MHz realtime bandwidth
- Frequency range from 20 MHz to 18 GHz (optionally from 9 kHz)
- Four parallel pulse analyzer channels within realtime bandwidth
- Channel bandwidths matched to signal bandwidths
- Baseband (I/Q) intrapulse description words (IQDW) via LAN interface
- Pulse description words (PDW) via LAN interface
- Intrapulse data available over 500 MHz bandwidth
- Pulsed and FMCW (FMICW) processing in the same band (signal duration from 50 ns to CW)
- Realtime spectrum (FFT) from 1 MHz to 500 MHz with high frequency resolution
- Fast FFT spectral scan over the full frequency range (PSCAN)
- Online pulse video display during signal collection
- 4 Gbyte memory for internal storage of intrapulse data
- 10 Gbit Ethernet interface for output of wideband data (I/Q, IQDW, PDW)
- Highest sensitivity and dynamic range
- Acquisition ring buffer for continuous collection of the output of up to four receiver channels to avoid missing high priority events or signals of interest during radar mode changes
- Rohde&Schwarz system software available for easy and fast startup
- Third-party systems integration possible (control interface commands based on SCPI standard)

Benefits and key features

Data quality

- I/Q / IQDW preserves signal quality throughout the intercept process, in contrast to envelope processing (LogVideo) only
- Intrapulse modulation recognition (e.g. PMOP, FMOP)
- Fully digital system with all the advantages of modern digital signal processing (e.g. high speed, best S/N, versatile data storage and evaluation)

Future-ready

- Innovative technology utilizing Rohde&Schwarz I/Q data processing expertise
- Compatible with analysis software packages such as R&S®TPA

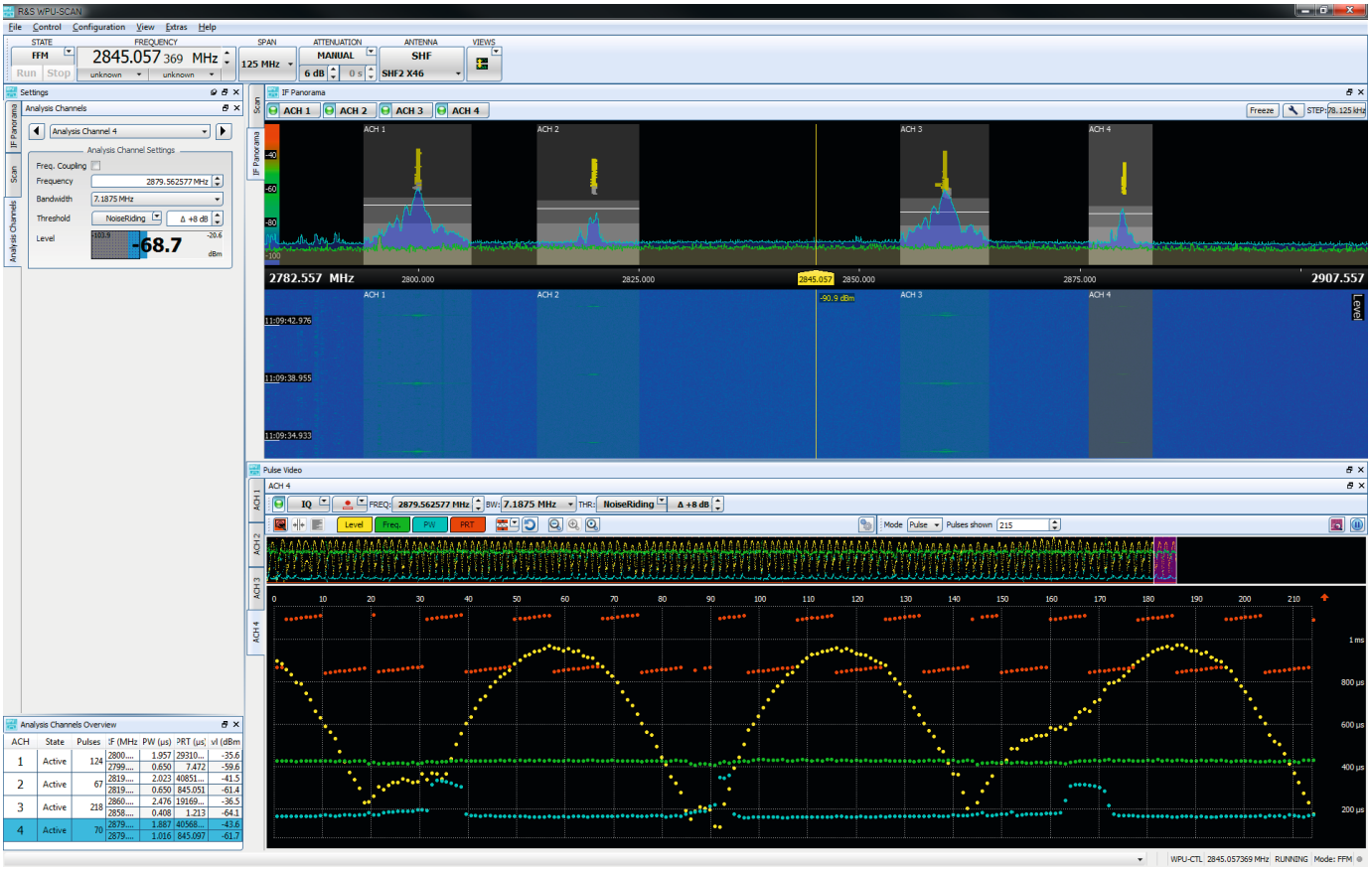
State-of-the-art scanner/receiver/pulse analyzer

- Compact solution integrates scanner/receiver/digitizer/analyzer
- Simple data transfer to pulse analysis suite
- Highest sensitivity and dynamic range

Convenient user interface

- User-specific arrangement of result windows (e.g. spectrum and waterfall, pulse video and receiver settings in one view)

Graphical user interface of the R&S®WPU500 wideband processing unit.



Applications

Detection collection and online analysis of radars

Four analysis channels in parallel

Each of the four channels can be parametrized independently. Signal parameters measured by each channel include:

- Center frequency
- Signal bandwidth
- Channel power
- Pulse duration
- Pulse repetition time
- Rise/fall time of pulse edge
- Pulse description word
- Intrapulse description word

Processing of radars (pulsed and CW) ranging from legacy long-range early warning radars to complex multifunction electronically scanning arrays

The R&S®WPU500 is designed to overcome the challenges of LPI emissions such as FMCW and low-power solid-state radars.

The R&S®WPU500 offers a wide frequency range from 20 MHz (9 kHz optional) to 18 GHz. The low receiving frequency of 20 MHz makes it possible to easily detect VHF radars with just one box. Processing radar signals in this frequency range is especially challenging due to the many coexisting communications signals.

The R&S®WPU500 can conveniently extract radars in the presence of other communications signals due to detecting in the time and frequency domain.

"Pulse on pulse" issues that have always been a problem for traditional "log video detectors" used for radar signal reception can now be overcome.

Detection and analysis of wideband radars such as synthetic aperture radars and airborne surface search radars

Radars can use a variety of operating modes to detect a target. Synthetic aperture radars (SAR) and airborne surface search radars typically use a bandwidth of up to 500 MHz during their operation. The R&S®WPU500 includes a realtime bandwidth of up to 500 MHz. This wide "stare bandwidth" enables the user to work on SAR and airborne surface search radars.

Strong and weak radar signal power levels need to be processed simultaneously

When observing the live radar environment, it may be required to simultaneously intercept radar signals that have similar frequencies but differing power levels.

The R&S®WPU500 features up to four independently processed channels to analyze radar signals based on pulse description words (PDWs), which has significant advantages especially when processing signals with varying power levels that are adjacent in frequency.

SAR and RF agile radars using intrapulse modulation over a wide bandwidth

In many cases radars use intrapulse modulation to improve the range resolution (pulse compression). To analyze these kind of radars, the intrapulse data needs to be preserved over the entire bandwidth used by the radar systems.

In order to reduce the amount of data that needs to be collected and analyzed, the R&S®WPU500 is able to produce I/Q descriptor words (IQDW). In this case, the I/Q stream is only transmitted when the signal level is above the set squelch threshold. This concept drastically reduces the I/Q data volume.

The IQDW preserves the I/Q within the pulse and discards the noise between the pulses while drastically reducing the data rate that needs to be processed. This allows the operator to collect and analyze intrapulse data from radars that have bandwidth up to 500 MHz.

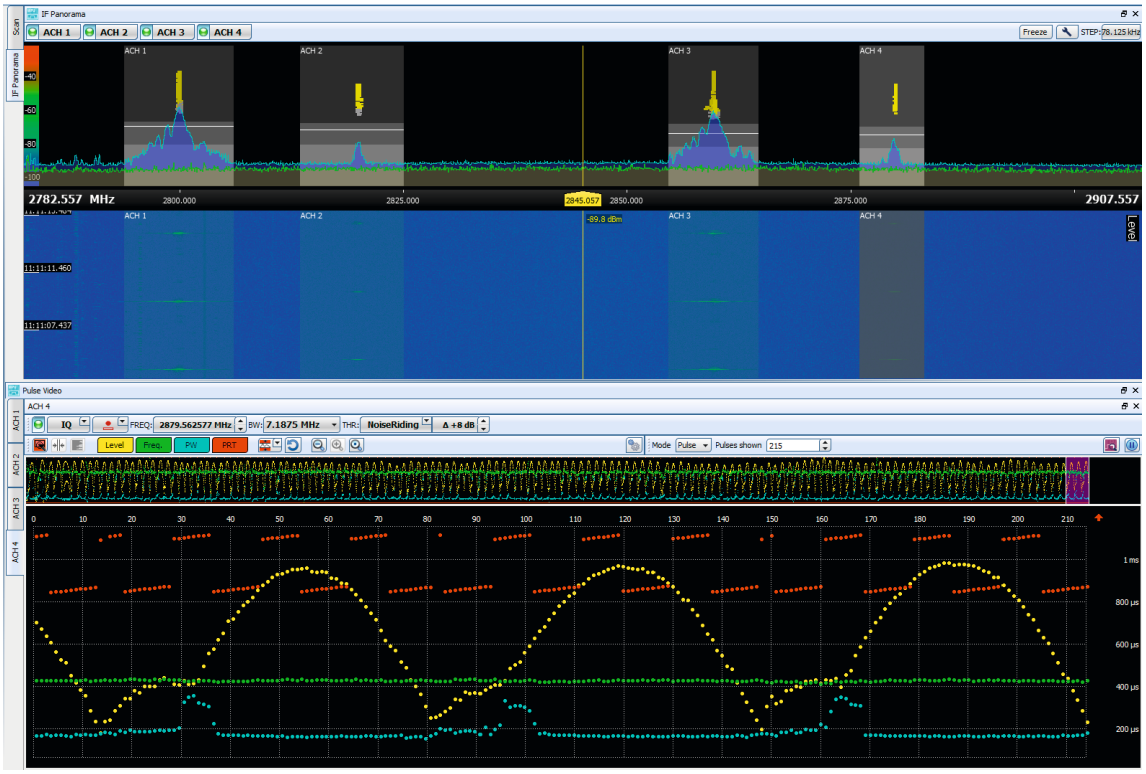
The realtime video display can be paused for instant initial observation while background collection continues.

The collection GUI displays the full predetection IF spectrum and the post detection PDW spectrum. A benefit here is that the operator is provided with an instantaneous indication if a signal does not have a sufficient signal-to-noise ratio to produce PDWs. In some situations the operator is also able to identify the intrapulse modulation type of a signal based on the spectral shape of the radar. This is available at any time, independent of the squelch level settings and thresholds.

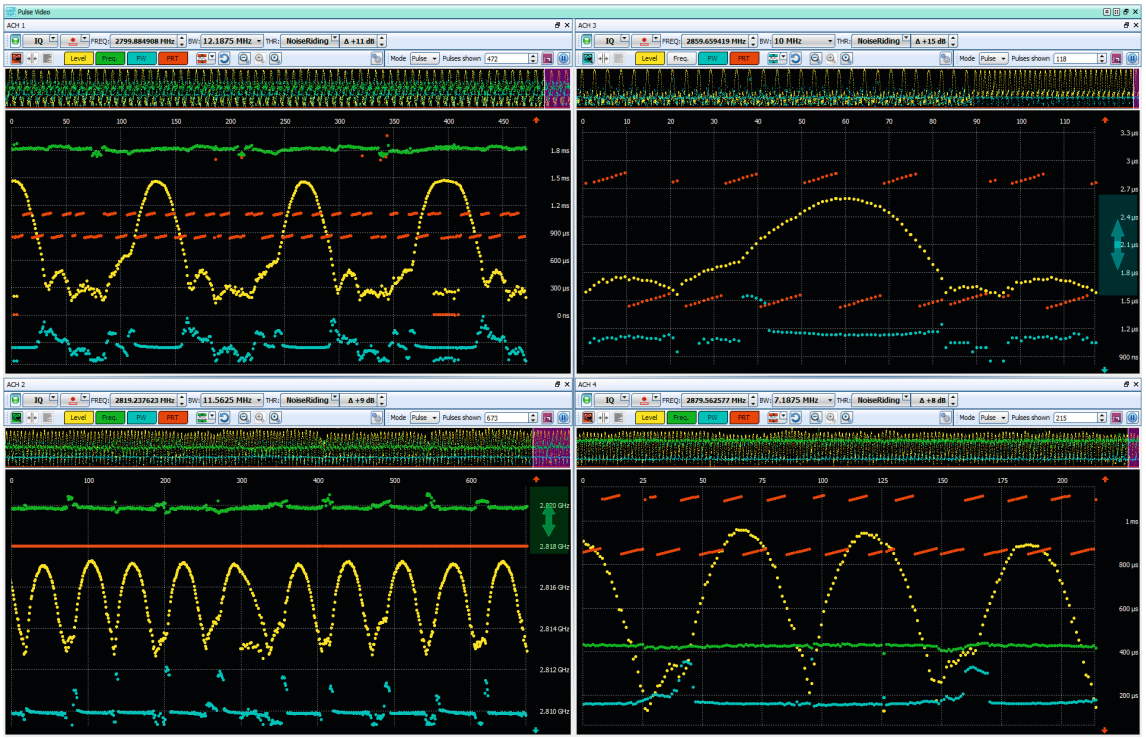
Real IF spectrum inside (not only a PDW spectrum)
Full predetection data, and not just post detection where missing detections would not show the signal at all. The waterfall diagram shows a quick overview of the timing behavior and signal duration.

The wideband processing unit offers different operating modes. The user selects the operating mode needed to ensure optimum signal reception and analysis for the current task.

Individual pulses can be seen realtime in the pulse video display while signal collection carries on in the background.

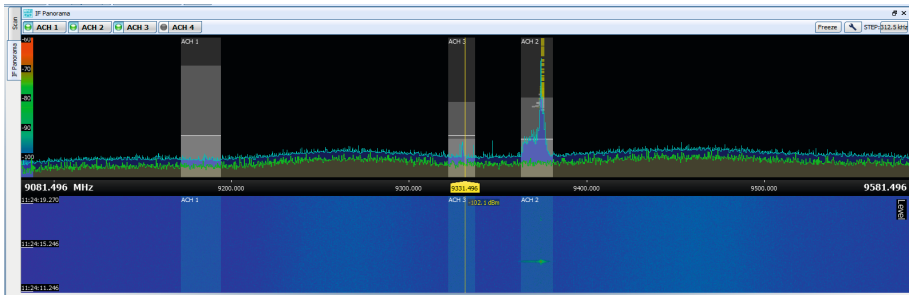


The user can view up to four independent channels, with individually optimized settings for each pulse video display.

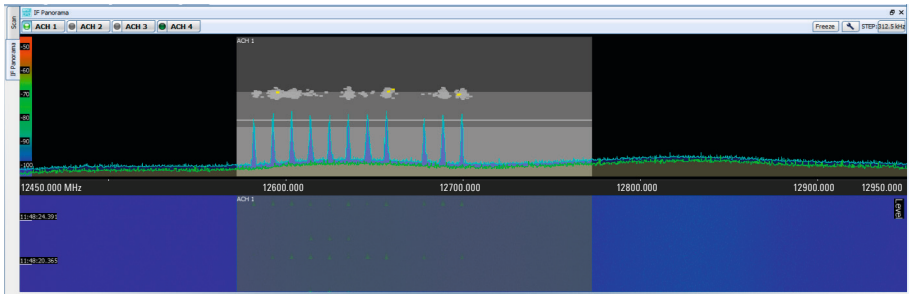


Operating modes

Fixed frequency mode (FFM)



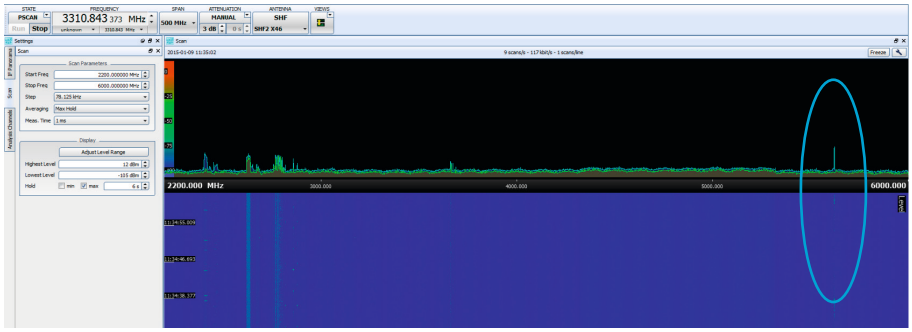
In this screenshot, the ground surveillance radar of the Munich airport is captured in FFM. Here you see the excellent displayed average noise level (DANL) of –100 dBm at 312.5 kHz resolution in the 9 GHz frequency range.



In this screenshot, a live aircraft's frequency agile, multifunction radar is captured in FFM.

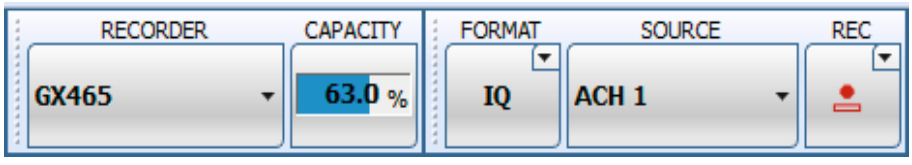
Fast FFT scan mode (panorama scan, pscan)

By selecting the start and stop frequency and scan resolution parameters, the user can quickly set up a wideband scan, e.g. over several GHz of frequency range, as needed for a certain operating scenario.



In this screenshot, a helical scanning weather radar with a center frequency of approximately 5.8 GHz is captured in panorama scan mode. Here you see the extremely fine scan resolution of 78.125 kHz over the entire scan bandwidth of 3.8 GHz.

Using the R&S®WPU-Control software, the user can hand collected signals over [1] to other parts of the networked system, e.g. to the R&S®TPA technical pulse analysis software or the R&S®GX465 digital wideband storage device.



The R&S®WPU-Control user interface where you can select the wideband recorder and start the recording.

[1] Handover functionality requires additional system software.

Specifications in brief

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Frequency range	base unit	20 MHz to 18 GHz
	with R&S®WPU500-HF option	9 kHz to 18 GHz
Multichannel reception	channel 1	up to 500 MHz
	channel 2	up to 250 MHz
	channels 3 and 4	up to 125 MHz
FFT realtime spectrum		up to 500 MHz [1] steps: 1/2/5/10/20/40/80/125/250/500 MHz
Spectral display		clear/write, average, max. hold, min. hold, histogram
Fast FFT scan (pscan)		RF spectrum with user-selectable start/stop frequency and step width: 0.625/1.25/3.125/6.25/12.5/25/50/78.125/156.25/312.5 kHz
	speed	up to 200 GHz/s (step width = 312.5 kHz)
LAN	for data transmission and remote control	2 × 1 Gbit LAN interfaces (Ethernet 1000BASE-T)
10 Gbit Ethernet	10 Gbit Ethernet for I/Q data	optical/copper interface in line with SFP+, up to 125 MHz I/Q bandwidth
External reference input	10 MHz	input level = 0 dBm to 10 dBm
Control signals, inputs		GPS, GPS trigger, compass, serial, trigger, blank
Environmental conditions		
Temperature	operating temperature range	0 °C to +50 °C
	permissible temperature range	–10 °C to +55 °C
Damp heat		+25 °C/+55 °C, 95 % rel. humidity, cyclic, in line with EN 60068-2-30, without condensation
Altitude	operating	5000 m
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 150 Hz, in line with EN 60068-2-6
	random	10 Hz to 500 Hz, in line with EN 60068-2-64
Shock		in line with EN 60068-2-27, MIL-STD-810E, method 516.4, procedure I
Dimensions	W × H × D, without feet and handles	426 mm × 176 mm × 450 mm (16.8 in × 6.9 in × 17.7 in) 19", 4 HU
Weight		approx. 20 kg (44 lb) (depending on optional equipment installed)

[1] 500 MHz realtime bandwidth are available starting at 2150 MHz center frequency. Below the maximum bandwidth is 80 MHz.

For data sheet, see PD 3606.9827.22 and www.rohde-schwarz.com

Ordering information

Designation	Type	Order No.
Wideband Processing Unit Package, consisting of R&S®WPU500 (hardware) and R&S®WPU-CTL (software)	R&S®WPU500P	3052.0530.00
Options		
HF Module, 9 kHz to 32 MHz	R&S®WPU500-HF	4093.2227.02
Accessories		
19" Rack Adapter	R&S®ZZA411	1096.3283.00
19" Rack Mounting Kit, mobile	R&S®RMK411	4074.7504.02

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

About Rohde&Schwarz

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries. The electronics group is among the world market leaders in its established business fields. The company is headquartered in Munich, Germany. It also has regional headquarters in Singapore and Columbia, Maryland, USA, to manage its operations in these regions.

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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