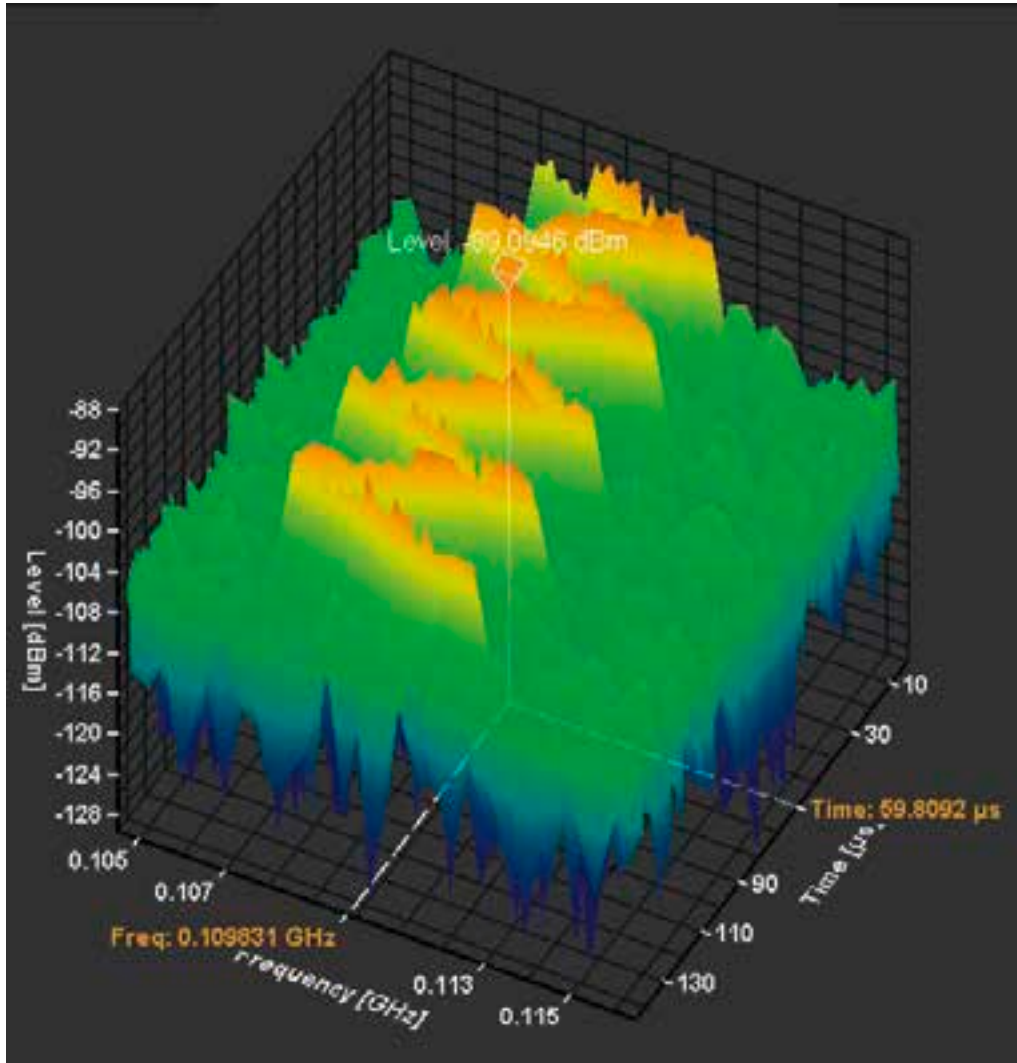


Radar signal interception moves into the digital age

Innovative ELINT solution from Rohde & Schwarz



Rohde & Schwarz ELINT solutions are advanced search, collection, measurement and analysis systems that can be used on almost any platform in any signal environment. The field-proven systems focus on operator usability and functionality and have demonstrated their ability to successfully exploit the modern radar environment.

Radars have become indispensable worldwide. Both military and civilian users employ radar technology for a multitude of different applications. The basic principle of radar is simple, but modern radars have become complex and diverse. Both traditional pulsed radars and continuous wave (CW) radars are becoming more widespread – from relatively simple mechanically scanning navigation radars to complex multifunction electronically scanning radars that offer simultaneous search, acquisition and tracking functions.

It is possible to automatically intercept radar signals and identify the corresponding platform or weapon system. Radar electronic support measures (RESM) provide early warning alerts and contribute to the situational picture and platform protection. RESM systems compare the intercepted signals with an emitter library, which is a product of ELINT.



Relatively low complexity and high power. Still largely analog, but upgrades and digital systems are becoming increasingly common because these radars are able to detect targets that have a low radar cross-section (RCS).

VHF/UHF long-range early warning radars



Around 33 GHz to 36 GHz is the radar designer's K band window for short range target acquisition/tracking radars and missile seekers. Analysis of radar frequencies suggest that the trend for such radars is heading in this direction.

K band radars

The modern radar environment

Multifunction AESA/

Active and passive electronically scanned arrays are a major challenge for both strategic manual analysts and tactical automated systems. They appear in multiple frequency bands and simultaneously perform a multitude of search functions while

The modern radar environment

Radar analysis has never been simple, but modern radar is rarely a single-frequency, single-mode device. Each individual radar has many different forms and profiles. There are multimode, multifunction radars that use complex pulse modulation and frequency agility, all of which is software defined and therefore reprogrammable. Such radars are easy to detect, but incredibly difficult to fully characterize. There are low probability of intercept (LPI) radars that are just plain difficult to even detect, some intentionally, some by the nature of their design. And then there are legacy systems that use decades-old VHF/UHF technology and can detect platforms that use cutting-edge technology, but which cannot be detected by modern systems.

Modern
Environment

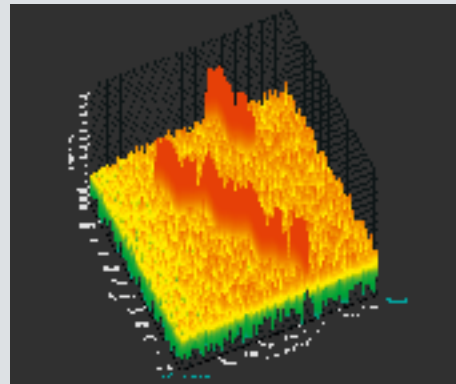
Solid state radars (SSRs)

These radars still use pulsed radar techniques, but have the benefit of a substantial reduction in radiated power. They often operate with adaptive power levels, adjusting the transmitted power according to the range of the target and the applied radar mode. As a result, solid state radars radiate very weak signals, and intercepting them is a question of sensitivity and proximity.



Low probability of intercept (LPI) radars

A commonly used term that includes CW radars such as frequency modulated continuous wave (FMCW) and frequency modulated interrupted continuous wave (FMICW) radars that are pretty much invisible to pulsed radar collection systems.



Function
PESA

potentially carrying out hundreds of tracking functions. Multifunction radars use frequency agility, multiple beams and framed pulses sequences to perform different functions, and represent the greatest challenge to the radar analyst.



Operational challenge

The operational challenge has been to create a system that is able to intercept, collect and analyze all of these modern radars. This system must keep one eye on the future yet still be capable of dealing with legacy systems. It has to have a small form factor in order to be readily deployable on any platform at short notice.

The results of electronic intelligence (ELINT) operations are utilized in fields such as countermeasure and missile system design. But the principal ELINT customer is the ESM and EOB database manager who in turn delivers to the frontline RESM system. Anyone who has experience in this field will attest to the fact that an RESM system is only as good as its database, and the database can only be as good as the ELINT data that was used to create it. Therefore the accuracy and quality of this ELINT data is integral to the protection of frontline assets and personnel.

Today's missions call for intelligent systems that can handle modern radar emissions. These systems must have the highest sensitivity and be able to record and analyze wide bandwidths. They need to be adaptive, multifunctional and operate on any platform in any environment, yet be small, lightweight and consume little power. And they have to support operators throughout the entire process.

Payload concept

ELINT collectors have to be located in the best possible position, a tradeoff between the highest probability of intercepting signals of interest (SOI) and remaining undiscovered. Therefore the collector will have to be deployed in an area where the target can be collected (generally line of sight) without alerting the target of its presence. In order to maintain the greatest range advantage, the system must have the highest sensitivity possible yet still provide a collection bandwidth sufficient to collect SOIs. In light of today's ever-increasing battle for space, the system must have compact dimensions for integration into suitable collection sites/platforms.

Potential ELINT platforms (air/land/sea).



Cutting edge in the field

The Rohde & Schwarz ELINT payload

The system is focused on operator usability and functionality. Devices and system software have been developed in parallel and thus complement each other with many features that support the operator in dense signal environments. This parallel hardware/software development also enables integrated data management and provides a smooth workflow throughout the entire system. The system software controls all devices and contains intuitive operator-friendly GUIs.

The system is designed for efficient operation in complex signal scenarios, facilitating multichannel tasks in dense signal environments.

The collected data in the fully digital collection and analysis system is of the highest quality. Pulse descriptor words (PDW) and continuous I/Q data accurately visualize all radar and pulse parameters.

The system provides the operator with the option to massively reduce the amount of data that needs to be recorded or transferred in the form of I/Q descriptor words (IQDW). IQDWs preserve both phase and frequency information to ensure full intrapulse analysis since the heart of the system is the R&S®WPU500. The R&S®WPU500 wideband processing unit uses the latest state-of-the-art components to be as prepared as possible for the ever advancing developments in radar technology.

Payload example showing two R&S®WPU500 wideband processing units in combination with R&S®GX470 digital wideband storage device.



Digital I/Q recording provides lossless postprocessing and high-quality results.

The Rohde & Schwarz payload is a turnkey solution that is ideal for electronic intelligence (ELINT) and radar electromagnetic spectrum applications, offering integrated workflow and data management for efficient operation.

It is capable of intercepting and analyzing modern, low-power, low probability of intercept (LPI) radar signals and uses high-quality digital signal processing for accurate interpulse and intrapulse analysis

The easy-to-integrate Rohde & Schwarz ELINT solutions are flexible and scalable, from single-operator solutions to nationwide collection systems. They can be controlled via WAN, allowing remote control of unmanned or detached receiver sites. System components have open interfaces to enable integration with existing legacy equipment.

R&S®TPA technical pulse analysis software

The payload includes the powerful R&S®TPA technical pulse analysis software that allows full interpulse and intrapulse characterization of radar emissions at the collection site or at a dedicated analysis center.

Our solution also includes an integrated operator radar database, allowing the ELINT operator to build up a radar database or complement an existing database during their mission.

Rohde & Schwarz offers a tried and tested system from a single supplier. The payload solution has been deployed to mission critical operational areas with exceptional results.

Key features and benefits

▮ **Wide frequency range from 8 kHz to 40 GHz**

- From HF radars to K band missile seekers

▮ **Wide realtime 500 MHz bandwidth that can be adjusted to the signal environment**

- Potential to increase receiver sensitivity for low-power targets and provide maximum range advantage

▮ **Selection of four analysis channels within the selected IF spectrum (up to 500 MHz)**

- Reduction in bandwidth possible in order to target the SOI and prevent pulse on pulse issues
- Absolutely necessary for dense signal environments to isolate SOIs

▮ **Market-leading sensitivity figures (enabling collection of LPI and solid state radars)**

- Modern SSRs with very low ERPs

▮ **Collection of conventional pulsed and continuous wave (including FMCW/FMICW) radars**

- Legacy systems and pulse collection systems are unable to deal with FMCW radars

▮ **Compact solution integrates receiver/digitizer/analyzer into one 4 HU package**

- Significant reduction in SWAP
- No device integration required

▮ **High dynamic range**

- Significant variation of detected power levels in busy radar environments

▮ **Highly intuitive GUIs**

- Intuitive operation for easy and quick ELINT collection

▮ **R&S®TPA technical pulse analysis with a powerful set of analysis tools**

- Ability to fully characterize all radars

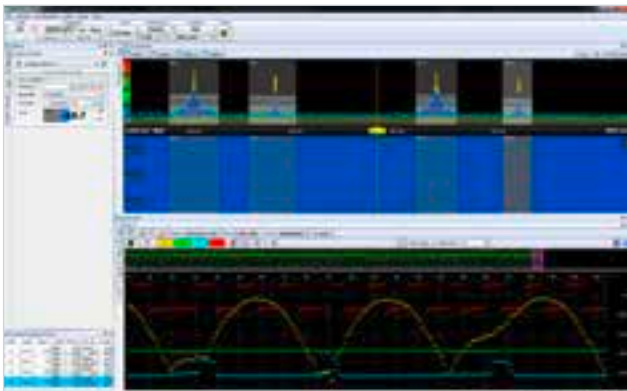
▮ **Fully digital system with lossless data quality throughout the process**

▮ **High-quality, lossless digital signal processing for accurate interpulse and intrapulse analysis**

▮ **Full integration with existing Rohde & Schwarz antennas and existing antenna architecture**

- Flexible antenna architecture to inconspicuously fit the payload to platforms for covert missions

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



Operational training

Rohde&Schwarz offers training and consultancy that keeps up with current operational developments.

Rohde&Schwarz employs dedicated trainers who have years of experience as radar signal collectors and radar signal analysts. They are not only former operators and analysts, they are also qualified trainers with a deep understanding of radar operation and theory. They can handle classes whose participants range from young inexperienced personnel to senior managers and officers. Due to their many years of experience in various environments, they quickly understand the customer's experience and requirements and will tailor the training to suit the level of knowledge within the class.

The courses offered by Rohde&Schwarz are modular. The basic modules are designed to provide students who have no previous experience in the radar world with basic radar theory and an understanding of radar functions. The training develops the skills needed to understand radars, how they operate and why they operate in the modes that they do. The training covers both radar signal collection and analysis. It contains modules on measurable radar parameters and, for military customers, on how the ELINT operator or analyst can interpret the parameters.

Rohde & Schwarz experience

The radar signal collection and analysis system was designed and developed by a team of developers and former operators/analysts. This ideal combination of experience and innovation ensures that the radar signal collection and analysis system provides the best solutions for collecting the pulsed, CW and complex signals found in the modern radar environment.

Radar Signal Analysis Training Courses

Comprehensive instructor-led courses focused on radar signal theory, parameter identification and analysis techniques



ROHDE & SCHWARZ

Radarmonitoring & Radlokation
Product Brochure | 03.00

For more information, see the product brochure: [Radar Signal Analysis Training Courses \(PD 3607.1507.12\)](#).

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, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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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