NEXT GENERATION JAMMER TESTING

Ultra-wideband signal analysis and systems performance evaluation.

Test challenges for advanced and integrated jammer designs

The design of advanced jammers plays a central role in providing vital protection for modern military system platforms, as they face a multitude of radar threats spreading over a wide frequency range and are, nowadays, agile in most of their operational parameters. In order to check the correct parameters of the used jamming and deception techniques, interoperability with other subsystems like radar warning receiver systems (RWR) or tactical air navigation systems (TACAN) has to be ensured. In addition, since an imminent threat is often a combination of different emitters (e.g. early warn, target acquisition, target track/illumination and missile guidance radars), different parts of the electromagnetic spectrum have to be tested at the same time.

The art of radar simulation and signal generation

To verify the parameter set of an electronic countermeasure (ECM) technique, multiple-domain analysis is crucial. The threat radar or the full scenario can be simulated with vector signal generators, the R&S®SMW200A. An example for an ECM may be a sophisticated coherent range gate pull-off (RGPO) with range-Doppler matching, which emulates one or more moving false targets and aims at achieving a break lock of the threat radar. The original radar pulse is used as reference for the ECM. To measure the position of the cover pulse, the hook and the dynamic behavior of the RGPO pulse, time domain analysis is necessary. In parallel, in the frequency domain, it needs to be evaluated whether movement of the false target also inherits the corresponding Doppler behavior. Majority of modern radar systems use matched filtering and pulse compression, so the retransmitted false targets have to maintain coherence with the original signal. Otherwise, they will lose in processing gain compared to the original signal and will be ineffective. For frequency agile radars (pulse-to-pulse or burst-to-burst), the DRFM should follow that agility, so an RF hopper analysis over a relatively wide bandwidth may be necessary. It may be noteworthy that lab testing only verifies the correct settings of an ECM technique, not its effect on a radar system. For that, it is necessary to do an evaluation of a live threat system.

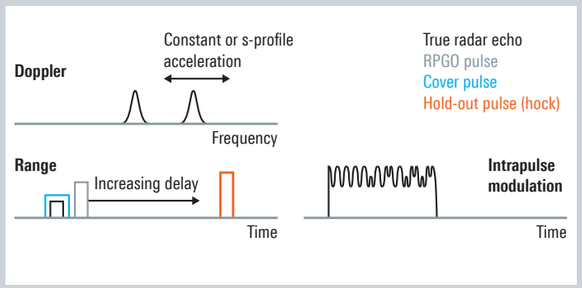

Figure 1 Domains tested for a coherent RGPO deception technique

Webinar: Deceptive jammer/DRFM testing
Rohde&Schwarz offers cutting edge test and measurement solutions for verifying proper operation and timing of the deception techniques on the system level, qualifying individual components, submodules and modules at the RF/IF level, as well as addressing clock jitter and power integrity early, at the design stage.

Watch our webinar at: **www.rohde-schwarz.com/DRFMJammerTesting/webinar**

Ultra-wideband signal analysis. Needed today, more than ever.

In order to analyze these scenarios in the lab, a wide frequency band has to be captured and saved covering different radar emitters at the same time. A multistandard radio analyzer mode enables users to have a detailed look at different frequencies by resampling the whole capture buffer and to analyze how all these systems interfere with each other or what frequencies are covered by frequency agile systems. The R&S®FSW signal and spectrum analyzer is able to capture a wide signal from the RF frequency of 8.3 GHz up to 90 GHz in just one box.

The data can be saved and analyzed by software tools running on an external computer or by internal tools like the multistandard radio analyzer in combination with different application software. The analyzer offers the tools needed to analyze hopping sequences of frequency agile radar systems or to characterize pulses or pulse compression techniques as well as tools for analysis of digitally modulated signals.

All models of the R&S®FSW from 26 GHz and above support up to 2 GHz internal analysis bandwidth, models from 43 GHz and higher frequencies offer the 8.3 GHz internal bandwidth for this application. Internal memory options up to 24 Gsamples/s make a capture time of several seconds possible at a bandwidth of 1 GHz. If longer sequences are needed, signals with bandwidths up to 512 MHz can be streamed over the I/Q interface and sequences up to 40 minutes can be recorded, for example by the R&S®IQW wideband I/Q data recorder. With smaller bandwidths, the sequences can be significantly longer. For example, users can measure real-world scenarios in the field and use a signal generator to feed in a realistic environment in a lab scenario.

Figure 2 The R&S®FSW signal and spectrum analyzer

In addition, for the development and characterization of frequency agile radar systems and communication solutions, it is essential to acquire and process signals seamlessly, detect extremely short signals with a frequency mask trigger without interruptions. This is only possible with a real-time signal analyzer calculating up to 2 million spectra per second. The R&S®FSW signal and spectrum analyzer offers a real-time analysis with a bandwidth 800 MHz. The fast Fourier transform (FFT) length is adjustable between 32 and 16,384 to achieve different resolution bandwidths. Signals as short as 0.46 µs are detected with correct signal level with a probability of intercept (POI) of 100 %, and signals lasting only a few nanoseconds are still reliably detected but not necessarily with correct signal level.

Video Series: The latest radar and jammer test solutions from Rohde&Schwarz
Watch our series of application videos on testing the latest radar and jammer designs. Our experts cover topics such as:
- Radar chirp analysis
- Radar pulse analysis and segmented capture
- Pulse compression radar measurements

Watch our video series at: **www.rohde-schwarz.com/DRFMJammerTesting**

Rohde&Schwarz offers:

- Frequency range from 2 Hz to 90 GHz (up to 500 GHz with external harmonic mixers from Rohde&Schwarz)
- Up to 8.3 GHz internal analysis bandwidth
- 800 MHz real-time analysis bandwidth with 2.4 million FFT/s, 0.46 µs POI for detection of shortest signals
- 500 MHz I/Q data streaming interface to capture real-world scenarios
- Low phase noise of –140 dBc (1 Hz) at 10 kHz offset, –143 dBc at 100 kHz offset (1 GHz carrier)
- SCPI recorder simplifies code generation
- Multiple measurement applications like pulse and hopping analysis can be run and displayed in parallel

Follow our series of articles and webinars on latest test solutions for radar and EW testing. In September, in our next edition, we will be talking about AESA radar frontend testing.

For more information, visit:
www.rohde-schwarz.com/DRFMJammerTesting