Flexible target generation for radar receiver testing

The R&S®SMW200A vector signal generator emulates radar targets to test noncoherent L-/S-/X-/Ku-band radars more flexibly than ever before. It emulates radar echo signals up to 20 GHz RF frequency with configurable target range, radial velocity and radar cross section (RCS).

Your task

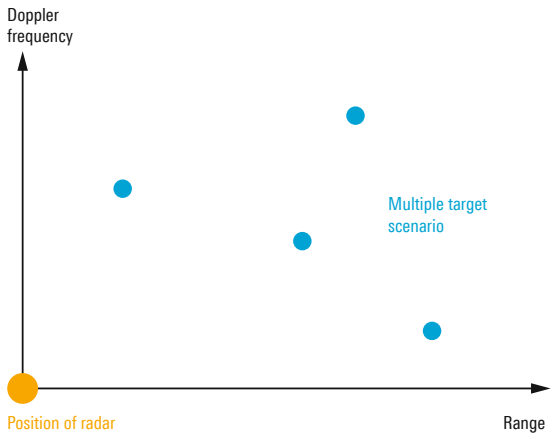
Testing radar systems is mandatory to ensure proper sensor functionality. An essential part of verifying the overall functionality of the radar is target emulation. Traditionally, radar targets are emulated using a fiber-optic line to introduce a time delay which translates into a target range relative to the radar. An additional I/Q modulator inserts a Doppler frequency shift to emulate a radial target velocity. Although this method is common practice, it lacks flexibility. The time delay cannot be changed easily because the fiber-optic line is of fixed length. It is therefore not possible to emulate time-varying ranges such as occur when the target is moving. Additionally, multiple virtual targets require multiple optical fibers of different lengths, leading to a complex test setup.

T&M solution

Rohde&Schwarz offers a novel approach to flexibly and conveniently generate radar echoes. Range and Doppler frequency shift can be controlled and adapted in a straightforward manner to reproduce scenarios with multiple static and moving targets.

The solution consists of two instruments. The R&S®FSW signal and spectrum analyzer receives the radar signal and downconverts the RF signal to in-phase and quadrature data. The resulting digital I/Q signal is transferred to the R&S®SMW200A vector signal generator. The R&S®SMW200A has a built-in digital fading simulator for modifying the incoming radar signal. It generates virtual radar targets by applying time delays, Doppler frequency shifts and attenuations – in realtime and reproducibly.

Typical range-Doppler diagram with multiple radar targets



The resulting radar echo is then upconverted to the specified radar carrier frequency (up to 20 GHz) and transmitted back to the radar under test.

The fading simulator has a bandwidth of 160 MHz and can be easily configured (manually and remotely) with user-defined time delay (range), Doppler frequency shift (radial velocity) and attenuation (RCS). The time delay is adjustable from 10.5 µs to 0.5 s, resulting in an applied range of up to several thousand kilometers. The Doppler frequency shift can be up to ±4 kHz with 0.01 Hz resolution.

Point-shaped targets as well as extended targets in range or Doppler can be set up quickly. The R&S®SMW200A supports up to 40 independently configurable targets. All targets are generated simultaneously and independently of the radar waveform and dwell time.

The target generator solution from Rohde&Schwarz, based on the R&S®SMW200A and R&S®FSW, is capable of emulating radar echo scenarios in a very flexible manner. This novel solution is highly beneficial for testing noncoherent radar systems – from the early development phase all the way to final acceptance tests, and for operational and lifetime tests.

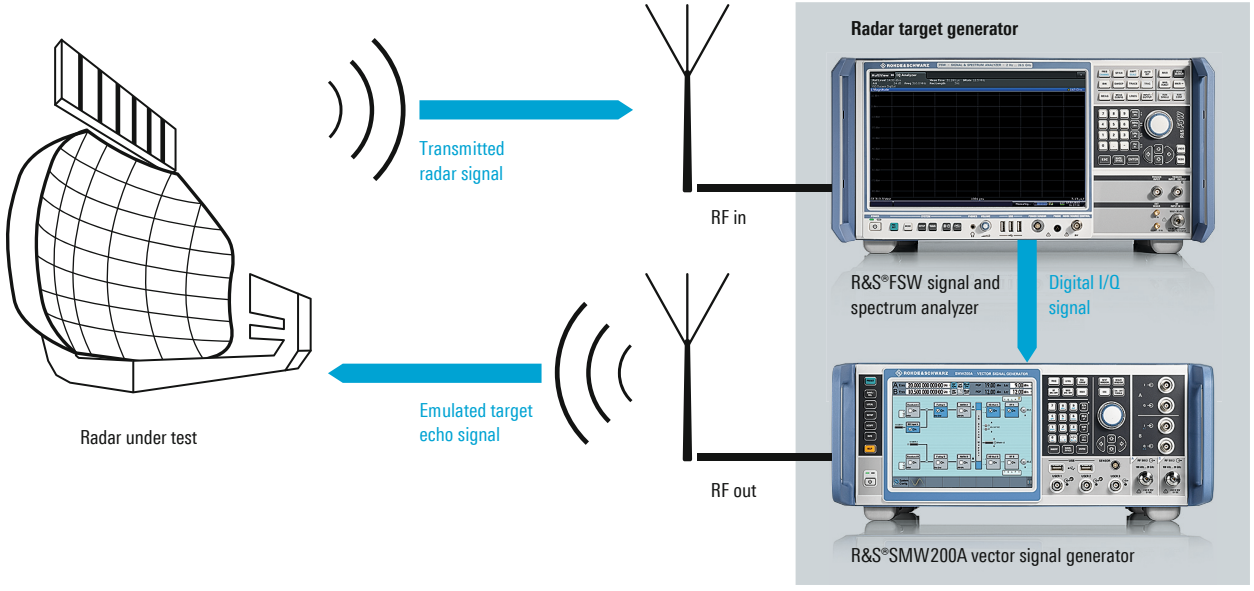
Key benefits

- Easy configuration and fast reconfiguration of target parameters
- No optical delay lines necessary
- Simultaneous generation of multiple targets
- Standalone solution – no synchronization to the radar system required
- Radar waveform independent solution
- Additional RF signals (jamming) possible

See also

www.rohde-schwarz.com/product/SMW200A
www.rohde-schwarz.com/product/FSW

Novel test setup for radar receiver testing using a target generator solution



The flexible target generator solution from Rohde&Schwarz, based on the R&S®SMW200A with its integrated fading simulator and the R&S®FSW, realistically emulates uncorrelated radar echo signals with configurable range, radial velocity and RCS for many kinds of radar waveforms.

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