Flexible and powerful radar echo generator

The R&S®SMW200A vector signal generator with the R&S®SMW-K78 radar echo generation option tests L-/S-/X-/Ku-band radars up to 40 GHz RF frequency more flexibly than ever before. Since it allows the object range, radial velocity and radar cross section (RCS) of radar echo signals to be configured, it is ideal for radar development, maintenance and training.

Your task

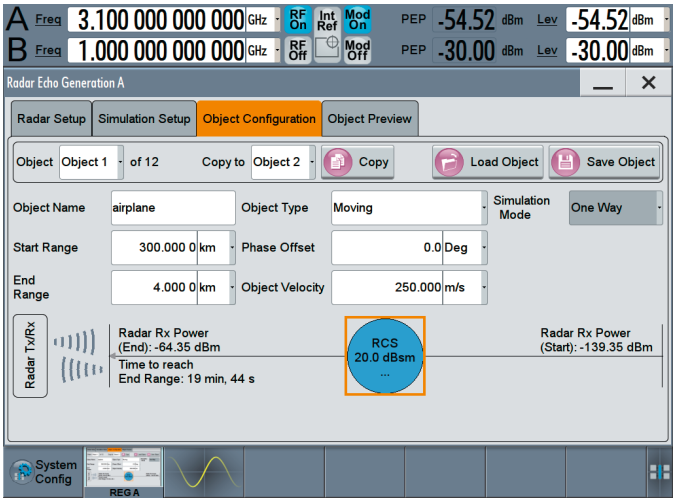
Testing radar systems is mandatory to ensure proper sensor functionality. An essential part of verifying the overall functionality of the radar is target emulation. Traditionally, radar echoes are emulated using a fiber-optic line to introduce a time delay which translates into a target range relative 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 objects.

The solution consists of two commercial off-the-shelf measuring 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 radar echo generator for modifying the incoming radar signal. With the R&S®SMW-K78 option installed, the R&S®SMW200A generates virtual radar echoes from objects by applying time delays, Doppler frequency shifts and attenuations – in realtime and reproducibly.



Echo configuration using R&S®SMW-K78: airplane with 100 m² RCS flying at 250 m/s from 300 km range toward the S-band radar under test.

The resulting radar echo is then upconverted to the specified radar carrier frequency (up to 40 GHz) and transmitted back to the radar under test. This solution supports both conducted tests in lab environments as well as over-the-air testing.

The radar echo generator has a bandwidth of 160 MHz and can be easily configured (manually and remotely) with user-defined range, radial velocity and radar cross section of Swerling 0 targets. The range is adjustable from 2.1 km (about 1.8 km in underrange) to 10 000 km. The Doppler frequency shift can be up to 190 kHz with 0.001 m/s resolution. There are two ways to define the radar echo levels: using the radar scenario and the radar equation or by manual assignment for each echo. A realtime preview visualizes the expected RF power levels of the echoes and the configured radar scenario in the range-Doppler domain.

All objects can be set up quickly. The R&S®SMW200A supports up to 24 independently configurable objects. All echoes from the objects are generated simultaneously and independently of the radar waveform and dwell time.

The radar echo 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 radar systems – from the early development phase all the way to final acceptance tests, and for operational and lifetime tests.

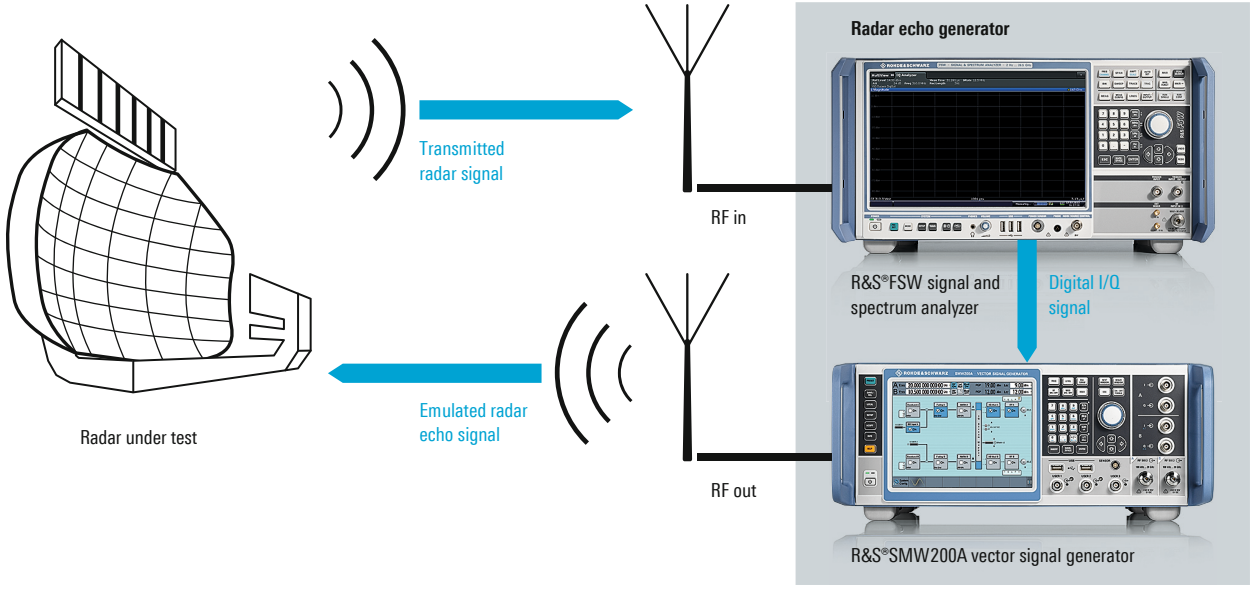
Key benefits

- Realtime capability for echo generation
- Simultaneous generation of multiple echoes
- Standalone solution – no synchronization to the radar system or external PC required
- Full control of echo generation solution via the R&S®SMW200A
- Radar waveform independent solution
- Additional RF signals (e.g. jamming, LTE) possible

See also

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

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



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

Rohde&Schwarz GmbH&Co. KG
Europe, Africa, Middle East | +49 89 4129 12345
North America | 1 888 TEST RSA (1 888 837 87 72)
Latin America | +1 410 910 79 88
Asia Pacific | +65 65 13 04 88
China | +86 800 810 82 28 | +86 400 650 58 96
www.rohde-schwarz.com
customersupport@rohde-schwarz.com

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