E8718A Radar Target Simulator

76 GHz to 81 GHz with Remote Heads

Providing multi-target simulation for automotive radars, the Keysight E8718A with remote heads provides needed flexibility in simulating scenarios, with an added performance boost.

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Introduction

Radar modules are an essential component in today's modern vehicles, and undoubtedly a mandatory sensor for the future of Advance Drive Assistance Systems (ADAS). As demand grows, so do investments into both development and manufacture of the latest radar modules.

The new E8718A Radar Target Simulator (RTS) design reflects how Keysight has extended the base capabilities of the previous generation E8708A and has improved the usability for customers in different stages of the design lifecycle. Given where the test requirements are headed for the future of automotive Radar, this new generation of RTS addresses more challenges, among those, the subject of interference test, and multi-target, multi-angle testing.

Product Description

To add flexibility in physically positioning the radar target simulator, a newly designed remote radio head or remote front end is now available with the E8718A RTS and with it an improved simulated signal performance. The new remote head leads to opportunities in interference testing and allows for simultaneous measurements while simulating targets, removing the need to switch between either in the previous models.

Verification or validation

Both are required, with increasing number of radars installed in vehicles, there is a market need for more testing, and then the question of interference opens new challenges to engineers in both areas to have the right solution to ensure the functionality of their radar units.

Additional IF channels to perform additional measurement

The dual IF in paths from the remote head feeds into the simulator and signal analyzer paths in parallel

Figure 1. E8718A base unit IF connection ports

Alignment laser, available with every head

Antenna available in bi-static or mono-static configuration

Figure 2. Patented Remote Head

As with the previous solutions, the E8718A can be controlled remotely, or just connect it with a keyboard, mouse and monitor to directly access the on-board GUI.
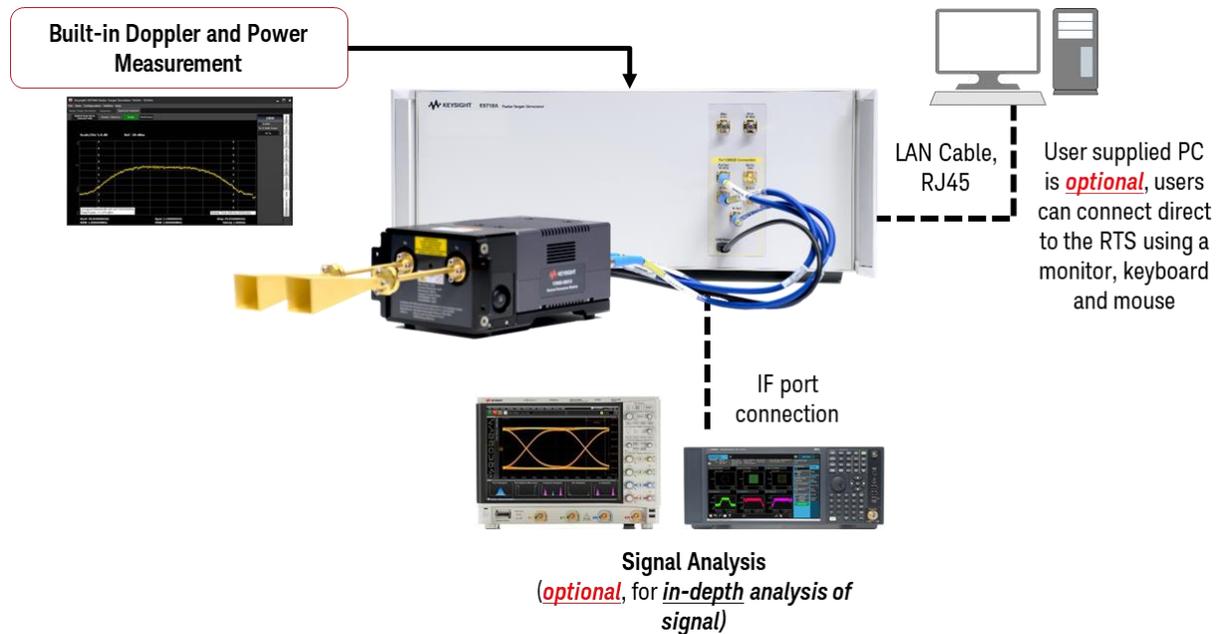

Figure 3. Solution diagram for E8718A

Testing in Manufacturing

In manufacturing, test coverage and test time needs to strike an even balance, and at the correct cost, making part of the overall cost-of-test. Both the single-target and multi-target simulators can be streamlined to meet the required cost-of-test per the coverage required. Instead of a full distance simulator, the E8718A can be configured with fixed distances and should the test require multi targets at an angle, it can be configured to cover 3 targets, with 3 different angles of arrival. Even with a single variable distance module, the time taken to switch between distances is within 100ms, ensuring fast target simulation.

Additionally, the dual IF channels allows measurement of the incoming radar device signal, while simultaneously the RTS continuously projects a target, no need for any switching. The simultaneous feature saves valuable test time, while allowing test coverage to the maintained.

Bringing Testing to The Lab

Our intent is to bring ADAS scenario testing to the lab. Currently, Keysight has the ability to create the Radar signal under test, and with the new E8718A RTS introduces the capability of generating multiple objects at variable distances. Interference signals are created using Keysight's wideband M8195A Arbitrary Waveform Generator. The AWG allows the generation of both predefined and custom interference signals with greater than 5GHz bandwidth from 60GHz to 90GHz. Combining the AWG with the millimeter wave headers, the new solution can be configured to generate up to 16 interference signals at various attack angles. And, the new AutoRad software will fully automate interference Radar test procedures as defined by ETSI.

The new remote head leads to opportunities in interference testing and allows for simultaneous measurements while simulating targets, removing the need to switch between either in the previous models.

Looking into the verification of interference susceptibility, the below diagram provides a quick glimpse of how the E8718A would be used, in combination with the M9185A Arbitrary Waveform Generator, and KS83RX0A software to control the sweeping FMCW and frequency bands as required by ETSI and radar mitigation strategies.

The solution concept in Figure 4, the E8718A continues to provide the target simulation to the Radar unit, at the same time, the AWG provides and interfering signal. For more information please refer to Keysight's Automotive Radar Signal Analysis and Generation Solutions.
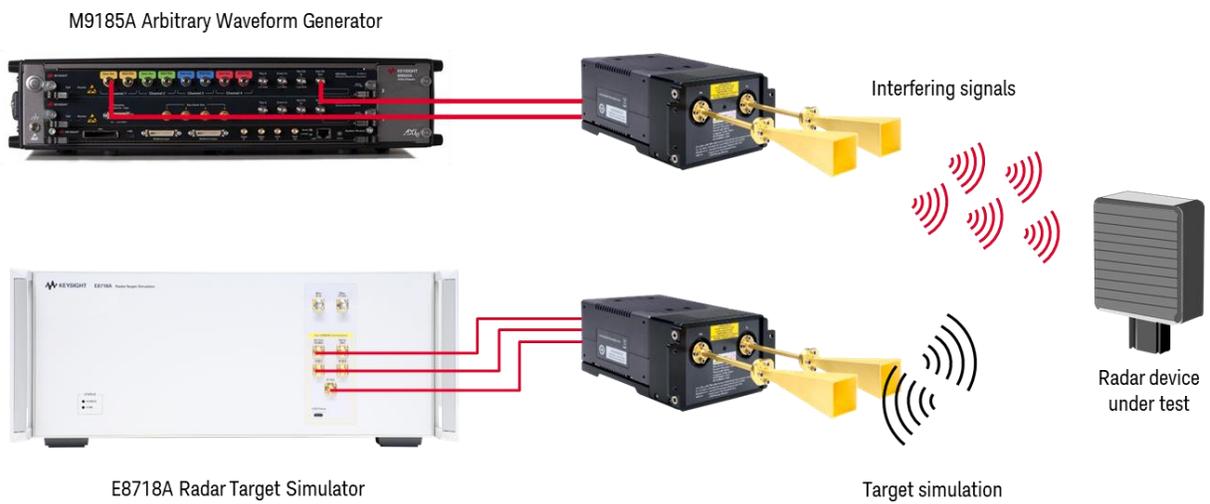

Figure 4. Solution concept, target simulation with interfering signals

Simulate Multi-targets with Confidence

With multi-target simulation, each target needs to be clear and distinct. Any sign of a false target would consume precious time to identify and fix, especially if it is caused by the test setup itself. With the remote heads designed by Keysight, the improved spurious emission is one example of how we can test with confidence. The below in Figure 5, we see a false target being detected by a radar device. Analyzing the unnamed RTS transmit signal, confirms the presence of spurious emissions, in Figure 6.
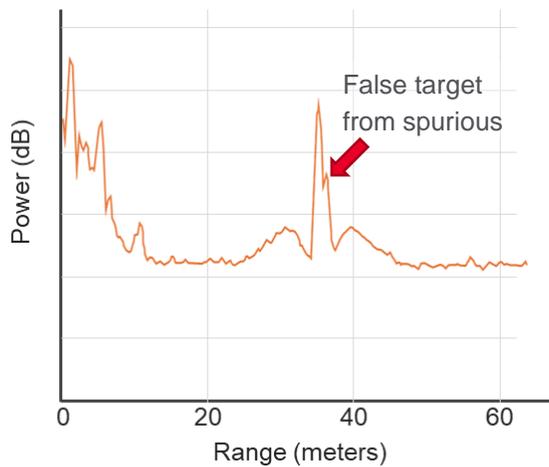

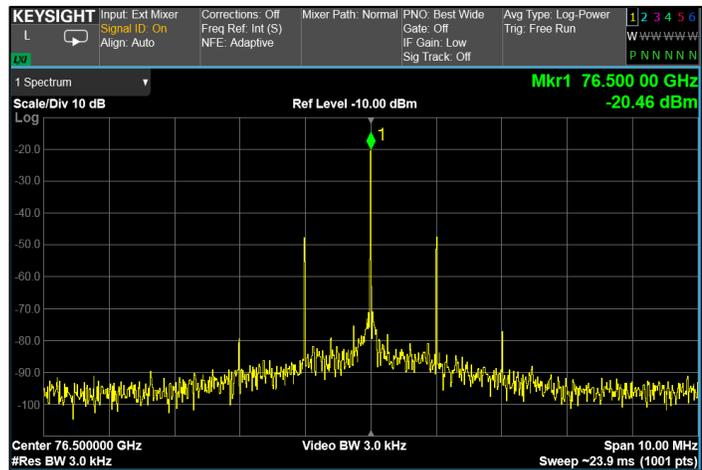Figure 5. False target detected by radar

Figure 6. Unnamed RTS spurious performance

In Figure 7, we see the same analysis result using the E8718A RTS with the new Keysight remote heads, the transmit signal is clear of spurious emissions. To further confirm Keysight multi-target simulator is coherently simulating targets and not causing false targets, a simple test setup was employed. Using the E8718A multi-target simulator, with two targets projecting from two individual heads, with a simulated target distance of 1 meter apart, in Figure 8, you see the result on the radar device, detecting two actual targets.
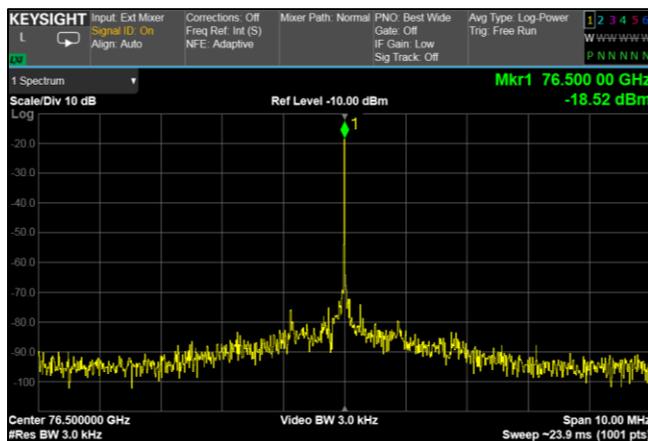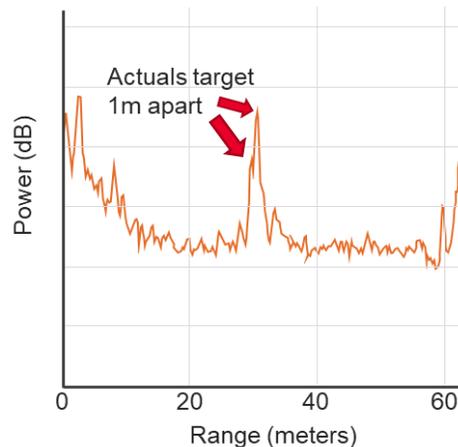

Figure 7. Keysight E8718A RTS spurious performance

Figure 8. 2 targets detected, 1m apart

Specifications

Note
- ***Channel 1*** refers to the variable distance delay channel for both single and multi-target systems
- ***Channel 2 & 3*** is available on the multi-target system, and are fixed distance delays

System Base Configuration	E8718A-C01 (Single Target)	E8718A-C03 (Multi Target)
Frequency Range		
Frequency range (Instantaneous Bandwidth)	77 to 81 GHz (4 GHz)	
	76 to 77 GHz (1 GHz)	
Simulated Targets		
Number of Targets	1	3
Target Distance Type	Variable distance, or; 4 fixed distance values	1 x Variable distance 2 x Fixed distance
Channel 1 Target Distance Simulation		
Min. physical distance, RTS to DUT	1 m	
Min. simulated target distance (0.5m cable)	1 m (physical) + 3 m (simulated)	
Min. simulated target distance (2.0m cable)	1 m (physical) + 5 m (simulated)	
Max. simulated target distance / steps	300 m / 0.1 m	
Distance accuracy	+ / - 0.3 m	
Channel 2 and 3 Target Distance Simulation		
Note: Customer defines the distance required, and the delay/distance will be matched		
Min. physical distance, RTS to DUT	1 m	
Min. simulated target distance (only 2.0m cable)	6 m	
Max. fixed distance	300 m	
Input Power		
Max. input power (at RF flange)	0 dBm	
Min. input power (at RF flange)	- 20 dBm	
Recommended input power (at RF flange)	- 10 dBm	
Radar Cross Section Simulation (RCS) and Other RF Performance Specifications		
Transmit / Receive Gain Control for RCS	60 dB	
RCS resolution	1 dB	
Spurious Emission	-50 dBc (typical)	
Phase Noise	-101 dBc/Hz @ 10 kHz (typical)	
Bandwidth Linearity	6 dB (4 GHz band – typical)	
Internal IF Frequency	1.1 GHz to 5.1 GHz (4 GHz band – typical) 2.6 GHz to 3.6 GHz (1 GHz band – typical)	
(Optional) Target Speed Simulation		
Doppler simulation range / step	+ / - 360 km/h / 0.1 km/h	
Doppler simulation accuracy	+ / - 0.05 km/h	

Physical, environmental, and additional solution specifications

Physical & Environmental		
System base dimension (H x W x D)	422 mm (L) x 177 mm (H) x 426 mm (W)	574 mm (L) x 222 mm (H) x 426 mm (W)
System base chassis	Standard EIA 4RU height	Standard EIA 5RU height
System base weight	15 kg	22.4 kg
Remote head dimension	162.50 mm (L) x 76 mm (H) x 131.50 mm (W)	
Remote head weight	2.05 kg	
Operating temperature range	0 to +55˚C	
Operating humidity range, temperature	Up to 95%, 40°C (Non-Condensing)	
Storage and transportation temperature range	-40 to +70˚C	
Software and Operation		
Embedded operating system	Windows 10 Professional 64-bit, Enterprise LTSB	
Included hardware drivers	No driver is required, GUI is provided	
Programming interface	API (provided)	

Solution Comparison Chart

	E8718A	E8708A	E8707A
76 to 77 GHz @ 1 GHz BW	✓	✓	✓
77 to 81 GHz @ 4 GHz BW	✓	✓	
Multi-target capability	✓		
Internal doppler option	✓	✓	
Internal signal analysis option	✓	✓	
IF port for external analysis	✓	✓	✓
Parallel analyze & simulate	✓		
Front end type	Remote	Fixed	Fixed
Positioning Laser	✓	✓	✓

Ordering Information

A more extensive configuration is available, please refer to E8718A Configuration Guide, or get into contact with your local Keysight representative.

Option	Description
System Base Option	
E8718A-C01	Radar Target Simulator Base for Single Variable Distance
E8718A-C03	Radar Target Simulator Base for Single Variable, and Dual Fixed Distance
Delay Module Options	
E8718A-D01	Single Variable Distance, enable full variable distance, 4m to 300m
E8718A-D11	Single Variable Distance, enable full variable distance, 10m to 300m simulation
Antenna Options	
E8718A-VD1	Vertical front module, dual 20 dBi horn antenna, with in-built laser
E8718A-VS1	Vertical front module, single 20 dBi horn antenna, with in-built laser
E8718A-HD1	Horizontal front module, dual 20 dBi horn antenna, with in-built laser
E8718A-HS1	Horizontal front module, single 20 dBi horn antenna, with in-built laser
Calibration and Report	

- Standard test report data is available with every system via option E8718A-UK6
- For specific test and calibration certification be required, for example ISO/IEC 17025 accredited or non-accredited calibration, please contact Keysight

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