

# Production testing of radar sensors for automotive applications

Innovative, cost-efficient solution for component and functional test



# Your requirements

A multitude of sensors using many different technologies enable modern automobiles to perceive their surroundings passively or actively. Here, radar is playing an increasingly significant role.

Sensors are being used in ever growing numbers in different driver assistance systems in order to acquire data on the movement and position of objects without making contact with them. In these applications, the sensors are employed in very high frequency ranges, such as the 24 GHz ISM band or even the 77 GHz range.

The parameters (speed, distance) for which data is acquired are used to control convenience-related and safety-critical vehicle capabilities, such as side optical warning (SOW), lane departure warning (LDW) and adaptive cruise control (ACC).

Failsafe requirements are extremely high and must also cover the test requirements throughout the entire production process. The almost exclusive use of these modules in safety-critical systems demands complete testing of all functions.

The radar sensor module in the 6-fold production panel makes contact on both sides via a bed-of-nails fixture. The picture shows the lower (lying horizontally) and upper (standing upright on its side) slide-in contacting units.



# T & M solution

When establishing a testing strategy for modules that, in the most critical usage scenarios, must actively intervene into vehicle kinematics (for example via ESC<sup>1)</sup> systems), the most important criteria are reliability, economy and speed.

The test solution presented here, which can optionally be automated, covers the stages of component testing (for uncovering manufacturing defects) and functional testing. This is accomplished in two stages using a bed-of-nails fixture. This fixture is controlled via CAN<sup>2)</sup> bus – a technology that is used widely in the automotive sector because of the high levels of reliability it achieves.

RF signals and output power can be tested in a third optional stage, which requires additional microwave generators and instruments.

The solution experts from Rohde&Schwarz would be glad to work with you to develop an overall concept for production testing of radar sensor modules, including the testing of all relevant RF parameters.

<sup>1)</sup> ESC = electronic stability control.

<sup>2)</sup> CAN = controller area network.

View into the contacting cell from the front. The picture shows the upper and lower slide-in contacting units as well as the DUT in the middle.



As in all Rohde&Schwarz production test systems, the focus is on simple servicing. The R&S<sup>®</sup>CompactTSVP versatile test platform's LED indicators make it possible to determine the operating modes for all modules at a glance.



# Application

Front view of the contacting cell. The R&S®CompactTSVP test platform is integrated behind the panel in the lower section.



## Universal system core

The core module for this test system is the CompactPCI/PXI-based R&S®CompactTSVP system platform. It is able to perform multiple tasks: It serves as a system platform for measurement, stimulus and switching modules, as a controller for the overall system, and as a power supply for the devices under test (DUTs). Plus, it provides interfaces for connecting to external devices and for the test fixture. The system also contains the modular in-circuit test unit for testing the components for manufacturing defects.

## Efficient combination of test strategies

After using the in-circuit test (ICT) to rule out the possibility of manufacturing and component-level defects, the module is put into operation electrically. In the subsequent functional test, an audio analyzer from the R&S®UPP200/400/800 family is used to examine the sensor module's basic transmission behavior.

The tests are performed with the multitone (MTF) method in the low-frequency range. The intelligent implementation of the FFT method in the test algorithm makes it possible to achieve extremely high test speeds for a higher throughput.

To meet the requirements of the automotive sector, all stimulus and T&M instruments are electrically isolated, which ensures a 1:1 implementation of the automotive suppliers' test requirements. Here or later in the production process, it is optionally possible, for example, to perform a temperature test and an end-of-line test that includes a check of the RF parameters.

The intelligent combination of multiple test strategies optimizes the test depth while taking economic returns into account.

The optimization of the R&S®CompactTSVP system platform for use in production includes the management of all system paths for internal modules and external devices as well as the ability to use industry-standard CompactPCI or PXI-based modules. These modules are integrated seamlessly into the system architecture and can be diagnosed automatically during the self-test should errors arise.





## Modular, flexible system software

A software package allows users to control and operate the system, generate DUT-specific test sequences and ensures communications with the production environment. This package includes the following main components:

### R&S<sup>®</sup>TM-G5 test management software

- For use in production, quality assurance, service and calibration
- Simple, configurable graphical user interface
- Flexible definition of test sequences
- User-programmable interface and menu structures

### Test report management (TRM) software

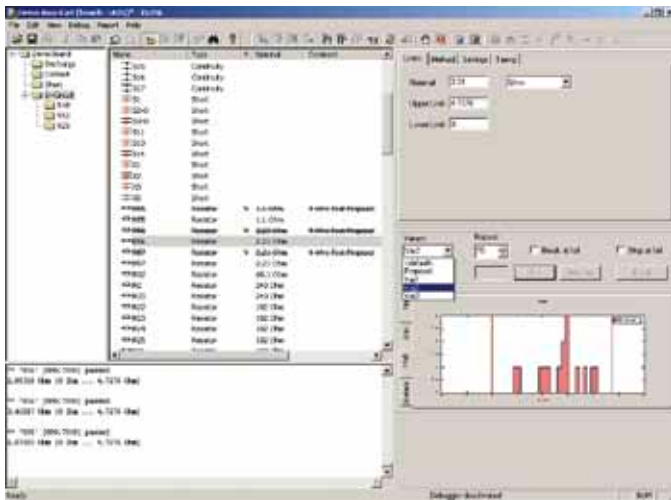
- Automatic test logs as PDF files (programmable scope)
- Measurement data in CSV format with the option of exporting to Excel
- Automatic backup of all data on a server
- Extensive evaluation, analysis and statistic functions (e.g. CpK, 2-Sigma limits)

### In-circuit test (ICT) as well as runtime and development environment (EGTSL)

Realtime application for development and debugging:

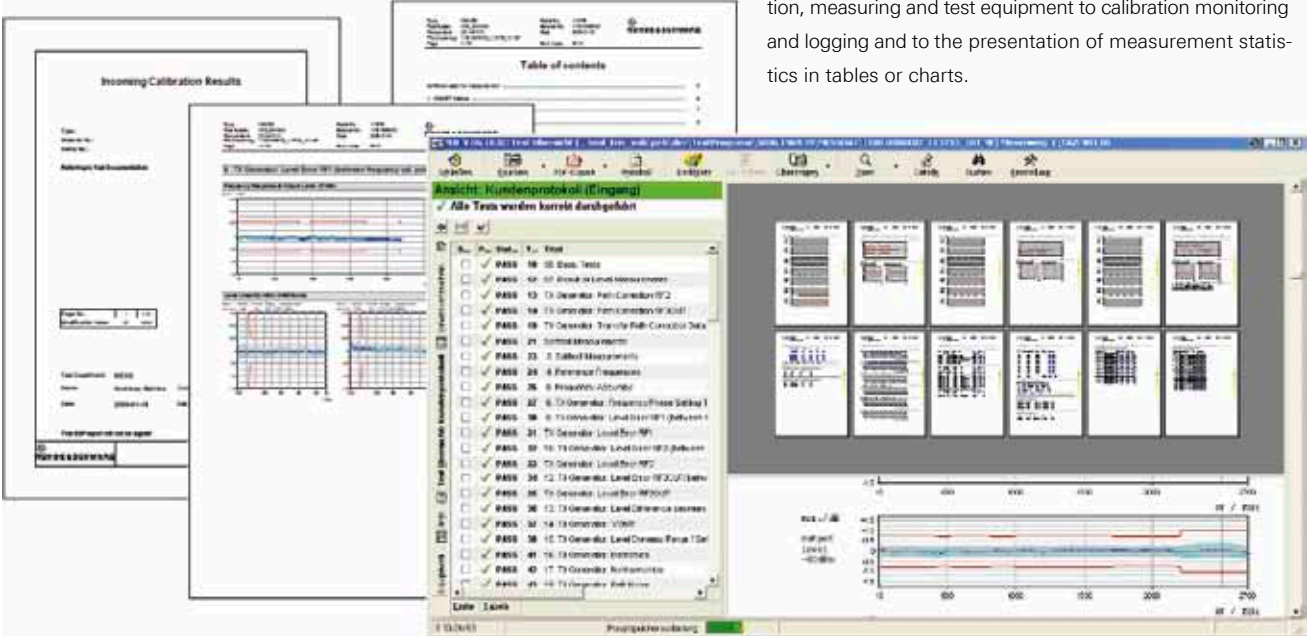
- Intuitive user interface (Windows look and feel), so that learning a programming language is not necessary
- Display of test results as a table, chart or histogram
- Support of version and panel tests

The EGTSL realtime debugging tool's graphical user interface enables users to change and optimize the test program for analyzing manufacturing defects (ICT), without requiring special programming skills. Relevant evaluation functions are available to users at the click of a mouse.



## Example evaluations and test logs produced by the R&S<sup>®</sup>TM-G5 test management software

The extensive analysis, reporting and statistics function cover applications ranging from the management of inspection, measuring and test equipment to calibration monitoring and logging and to the presentation of measurement statistics in tables or charts.



# Test system configuration

## High availability through the use of high-end system components

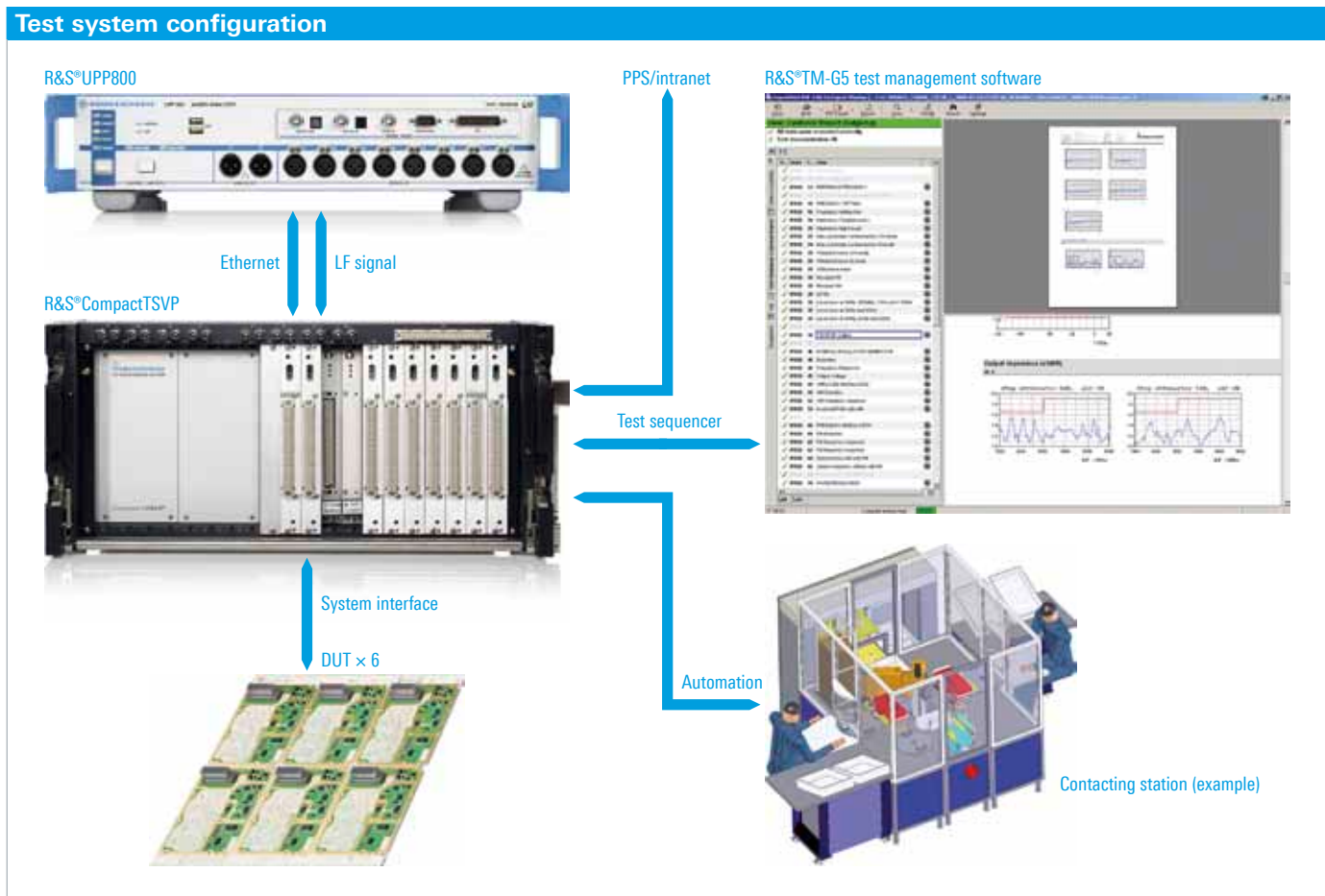
### R&S®UPP200/400/800 audio analyzer family

- ▮ Depending on the model, two, four or eight channels are processed in parallel, which ensures a high throughput
- ▮ High overall system measurement speed
- ▮ Up to 80 kHz bandwidth and 200 kHz sampling rate
- ▮ Compact instrument with integrated PC optimized for use in production
- ▮ Remote control via LAN, USB or IEC/IEEE bus
- ▮ Extensive measurement capabilities on analog and digital interfaces
- ▮ Powerful, multichannel FFT analysis
- ▮ User-programmable filters that can be adapted in seconds to individual measurement tasks
- ▮ Generator and analyzer interfaces can be set independently of one another and used together in any combination

### R&S®CompactTSVP test system versatile platform

Comprehensive, compact system solution with an extensive range of functions to cover all production requirements:

- ▮ Supports Windows XP and Suse Linux 9.0™
- ▮ System-oriented, compact platform suitable for integrating CompactPCI and PXI-based measurement modules (including industry-standard, unmodified models)
- ▮ Implementation of floating stimulus and T&M technology with R&S®CompactTSVP measurement modules
- ▮ Optimized signal concept (analog measurement bus, inputs and outputs on the rear of the instrument), suitable for applications with high voltages and currents
- ▮ Integration of power supply modules and load modules for the DUT
- ▮ Integrated system interface for adapting to the test fixture or production lines (such as Pylon or Virginia Panel)
- ▮ For any combination of functional and in-circuit tests
- ▮ High measurement speed (due to intelligent modules)
- ▮ Standardized, powerful software modules (EGTSL, GTSL) with simulation and error-tracking functionality
- ▮ Ideal for automated production lines
- ▮ Built-in self-test for high system availability and diagnostics at the module level should errors arise
- ▮ On-site calibration possible



# Benefits and key features

## Ideal for use in production

- Long-life components designed for continuous operation keep the failure rate low in everyday production
- Long calibration intervals owing to the large portion of digital T&M engineering also contribute to high instrument availability
- All Rohde & Schwarz instruments have remote control capability that is indispensable in large production facilities; all system components support data traffic via IEC/IEEE bus, USB and LAN
- Simple and economical generation of test programs; the use of an automatic test generator (ATG) for the component test (ICT) and an interactive test generator for the functional test eliminates the need for manuals
- Extensive realtime tools support debugging in test programs and reduce the time required to ready the test program for series production
  - Functional test programs considerably simplify and accelerate error diagnostics by interactively controlling the system components
  - A debugging tool optimized for the component test has been integrated seamlessly into the user interface
- Optimization of the test system for use in production, e.g. by using the R&S®TS-ISC calibration kit (see picture on left), permits long-term investment planning that covers the test system's life cycle
  - The R&S®TS-ISC in-system calibration kit can also be used to calibrate the R&S®CompactTSVP on site, minimizing production downtimes

The in-system R&S®TS-ISC calibration kit



Your local Rohde & Schwarz expert will help you determine the optimum solution for your requirements.

To find your nearest Rohde & Schwarz representative, visit [www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

## See also

[www.rohde-schwarz.com/product/upp](http://www.rohde-schwarz.com/product/upp)

[www.rohde-schwarz.com/product/compacttsvp](http://www.rohde-schwarz.com/product/compacttsvp)

## Service you can rely on

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

## About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

## Environmental commitment

- | Energy-efficient products
- | Continuous improvement in environmental sustainability
- | ISO 14001-certified environmental management system

Certified Quality System  
**ISO 9001**

## Rohde & Schwarz GmbH & Co. KG

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## Regional contact

- | Europe, Africa, Middle East  
+49 89 4129 123 45  
[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)
- | North America  
1 888 TEST RSA (1 888 837 87 72)  
[customer.support@rsa.rohde-schwarz.com](mailto:customer.support@rsa.rohde-schwarz.com)
- | Latin America  
+1 410 910 79 88  
[customersupport.la@rohde-schwarz.com](mailto:customersupport.la@rohde-schwarz.com)
- | Asia/Pacific  
+65 65 13 04 88  
[customersupport.asia@rohde-schwarz.com](mailto:customersupport.asia@rohde-schwarz.com)

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG  
Trade names are trademarks of the owners | Printed in Germany (sv)  
PD 5214.5032.92 | R&S®CompactTSVP/TM-G5/UPP200/400/800 | Version 01.00  
July 2011 | Data without tolerance limits is not binding | Subject to change  
© 2011 Rohde & Schwarz GmbH & Co. KG | 81671 München, Germany



5214503292