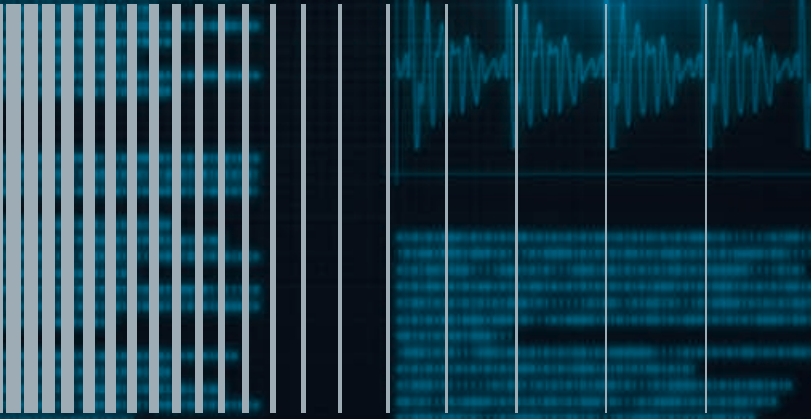


Your partner in testing the Internet of Things



The power of testing in all phases of the product lifecycle

The majority of devices – sensors, actors, gateways – building the Internet of Things (IoT) use wireless machine-to-machine communications technologies to communicate with each other and with IoT applications in the cloud.

The Internet of Things (IoT) and even more the Internet of Everything (IoE) will impact all industries and ultimately everyone's daily life. Already today, things such as containers, street lights, trash cans, trees and cows are connected to the Internet, and who can imagine what will be connected in the near future – the possibilities are infinite. New markets are evolving, such as smart homes, connected cars, smart grids and smart healthcare. Common to all these markets and related applications is the use of realtime data from connected "things" to improve all kinds of processes and ultimately to save money, energy and life.

Therefore, the expectations on reliability, performance, quality of experience and longtime availability are extremely high and connectivity becomes a critical success factor.

Some applications requiring global coverage and mobility will focus on cellular technologies in the future, especially on LTE-M and NB-IoT. But the majority of devices will use non-cellular wireless technologies such as Bluetooth®, Wi-Fi, ZigBee, THREAD, EnOcean, SIGFOX, LoRa™ and others that are operating in unlicensed ISM/SDR bands.

Testing of the overall communications behavior of IoT devices is an important topic in all phases of the product lifecycle in order to ensure proper functionality as well as lifetime quality and performance.

Testing in all phases of the lifecycle of IoT devices and networks

Research and development

- Digital and analog interface debugging
- Clock analysis
- EMI debugging
- Power analysis



Design and validation

- RF parametrics
- Coexistence
- Functionality
- Performance
- Power analysis



Precompliance and compliance

- Standard compliance
- Regulatory compliance
- Carrier acceptance



Manufacturing

- Calibration
- Verification
- Go/NoGo



Deployment and operation

- Installation
- Monitoring
- Optimization



Service and repair

- Fault finding
- Calibration
- Verification



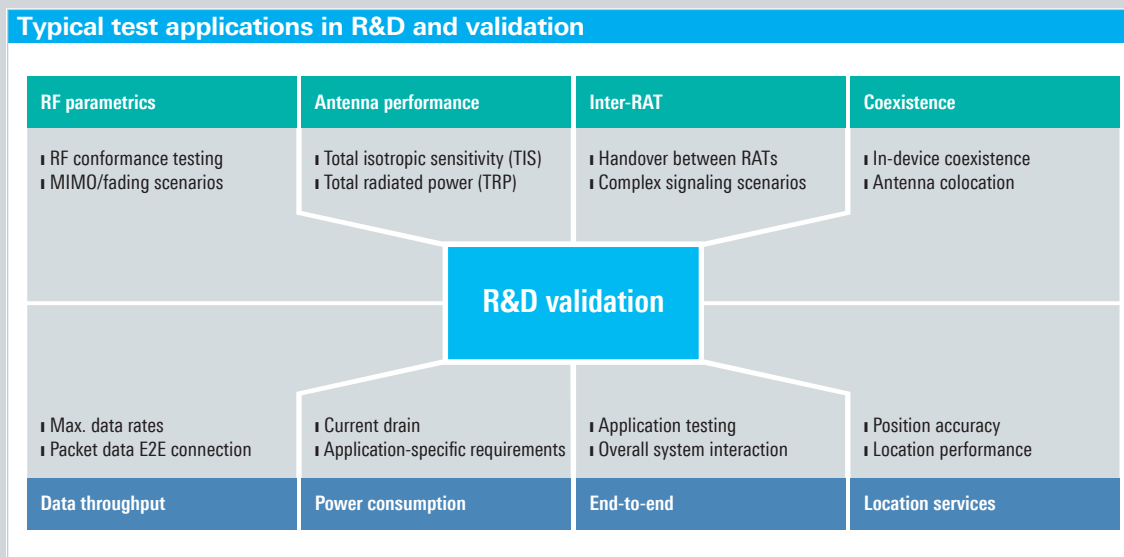
Test and measurement solutions from Rohde & Schwarz cover all major cellular and non-cellular technologies. Our comprehensive product portfolio offers the right T&M solution for your IoT device – from the first product idea through the full device lifecycle.

Summed up as IoT applications, the design challenges may vary. Reliable communications for a smart meter installed in the basement or a modem in a fast moving car must be ensured and battery life requirements of more than 10 years must be fulfilled. To begin with, all such devices require an appropriate hardware and software design. However, it is crucial to verify the design under all relevant test conditions. During development, the RF design needs to be tested under specified RF conditions. In addition, performance measurements, such as power consumption and battery lifetime, are essential. IoT devices also often support more than one wireless technology, including cellular and non-cellular standards. Coexistence tests ensure proper and interference-free operation of each standard implemented in a multistandard IoT device.

Before wireless devices can go on air, they must be tested against the applicable regulatory standards and operator-specific requirements. For cellular IoT devices, the compliance requirements defined by the Global

Certification Forum (GCF) must be met, which include dedicated tests for machine type communications (MTC) features defined by 3GPP. Mobile operators define additional tests which need to be passed for carrier acceptance. Non-cellular devices also have to meet certain regulatory requirements defined by ETSI and FCC or standard requirements defined by Bluetooth® SIG or the LoRa™ Alliance. Finally, for mass production, optimized test setups in the factory detect manufacturing defects within seconds, ensuring the expected quality of a wireless IoT device.

This seems to be very complicated, time-consuming and costly, especially for players entering the wireless communications arena for the first time. As a leader in wireless communications testing, Rohde & Schwarz is your partner, helping you to understand the testing needs and setups and to perform all necessary tests and measurements to bring your IoT application to market as quickly as possible – with the desired quality and performance.



Test and measurement solutions for the Internet of Things (IoT)



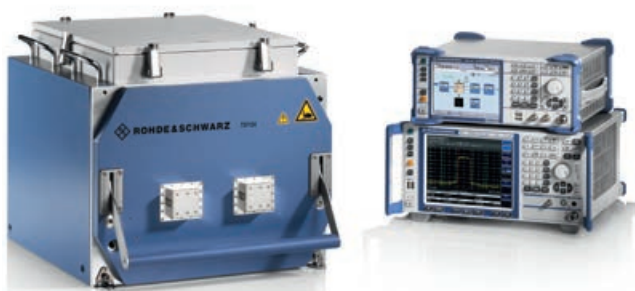
Smart debugging of embedded designs

Troubleshoot your IoT device at the system level through time-correlated analysis of analog components, digital interfaces, protocol-based buses, power supplies and RF signals with a digital oscilloscope.



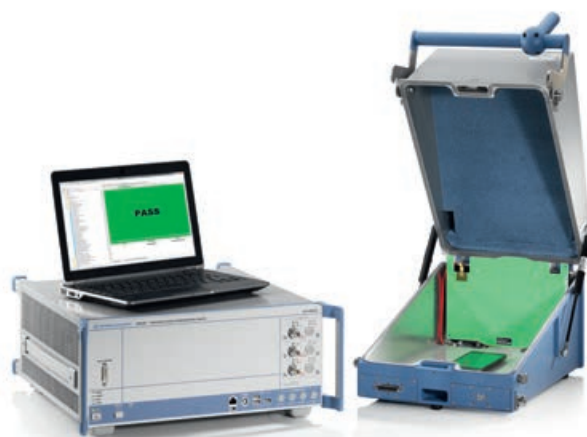
Single-box wireless communications tester

Test RF parametric performance of cellular and non-cellular standards such as LTE, Bluetooth® and Wi-Fi (incl. IEEE 802.11p) as well as cellular protocols, including support of 3GPP MTC features like LTE Cat 0, with one box.



Wireless test setups for R&D and manufacturing

Test the radio interface of various wireless standards over the air with a compact test system consisting of a signal generator, spectrum analyzer and RF shielded box.



Automated functional tests for the essentials

Measure fundamental RF characteristics of cellular and non-cellular standards and perform functional tests under reproducible network conditions especially for integration of RF modules as well as in service and repair.



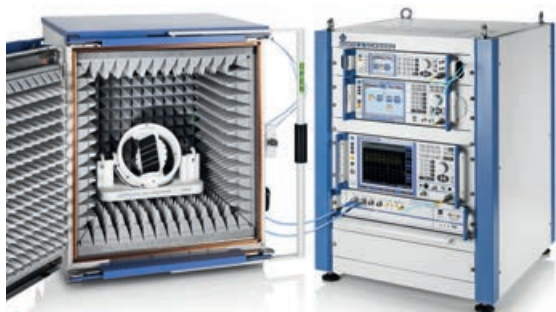
End-to-end application testing

Explore the functionality and performance of your IoT device from the end-to-end perspective by analyzing data and signaling traffic, quality of service and battery consumption under realistic network conditions.



Highly efficient and automated manufacturing tests

Choose a wireless communications tester optimized for high-volume manufacturing to perform non-signaling tests on IoT devices that support cellular and non-cellular standards such as LTE, Wi-Fi, Bluetooth® and ZigBee.



Conformance testing

Test the EMC conformance of your IoT devices operating in the 2.4 GHz and 5 GHz ISM bands such as Bluetooth® and Wi-Fi.



Network installation and maintenance

Use a handheld spectrum analyzer to maintain and install networks, assess signal quality and measure electric field strength to ensure quality of experience (QoE).

Service that adds value

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

About Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries. The electronics group is among the world market leaders in its established business fields. The company is headquartered in Munich, Germany. It also has regional headquarters in Singapore and Columbia, Maryland, USA, to manage its operations in these regions.

Sustainable product design

- | Environmental compatibility and eco-footprint
- | Energy efficiency and low emissions
- | Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

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