# TESTING IOT DESIGNS WITH THE R&S®RTO AND R&S®VSE

FOCUS RF SIGNAL ANALYSIS

The need for internet of things (IoT) solutions can arise fast. In most cases, wireless communications modules are added to an embedded design. When designing and debugging IoT systems, many different measurements need to be performed. Since developers are very familiar with using an oscilloscope for voltage and time measurements, they also want to use it to for all other necessary measurements. And now they can – with the R&S®RTO oscilloscopes.
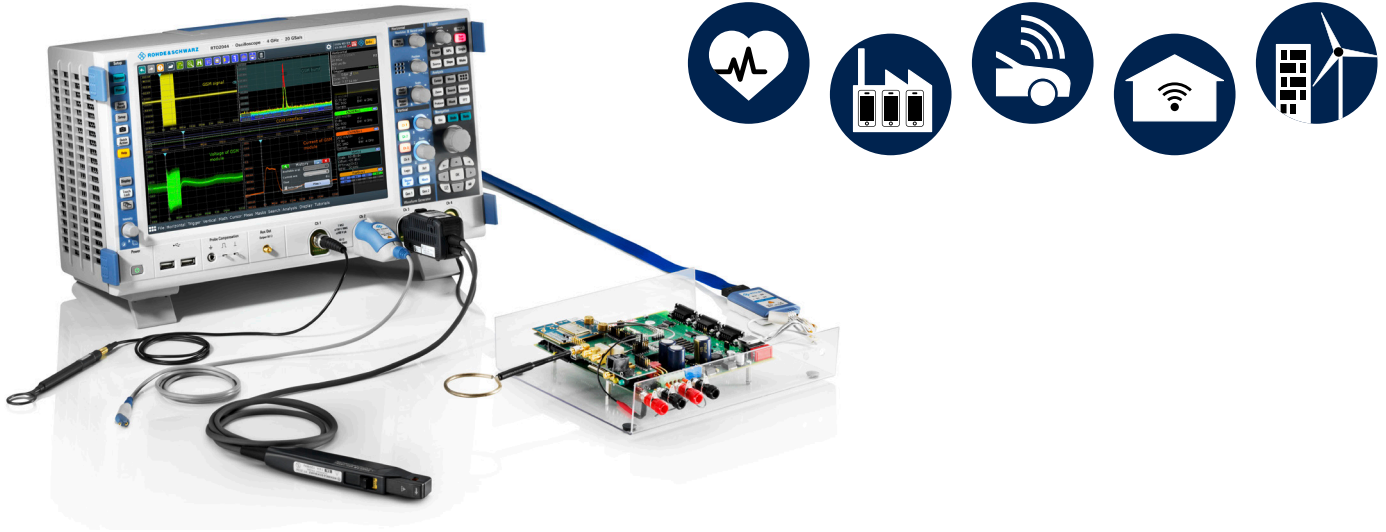
Typical measurement tasks during the development of wireless embedded IoT systems that can be accomplished with Rohde & Schwarz oscilloscope solutions

Task	Need	Product feature
Validation of power management	▶ Measure small currents ▶ Verify power integrity	▶ Up to 16-bit resolution, 500 µV/div vertical scale ▶ High acquisition rate of 1 million waveforms/s ▶ Fast FFT analysis, from DC ▶ High-sensitivity current probe, 1:1 passive probe
Chipset interconnection testing	▶ Trigger and decode serial protocols ▶ Measure bus timing on parallel buses	▶ Serial triggering and decoding options for up to 17 protocols, including custom decoding (NRZ/Manchester protocols) ▶ MSO option with 5 Gsample/s, 16 channels and up to 200000 waveforms/s
Testing of wireless modules	▶ Capture transmission bursts ▶ Check signal quality	▶ Full bandwidth down to 1 mV/div ▶ Fast FFT and mask test in frequency domain ▶ Zone trigger option ▶ Signal analysis with R&S®VSE vector signal explorer software
Validation of overall system	▶ Trigger and decode serial protocols ▶ Correlate device activity at various interfaces and the power supply	▶ Time-correlated view of analog signals, decoded serial and parallel buses, signal spectrum ▶ Segmented memory and history mode
EMI debugging	▶ Identify EMI sources on the PCB ▶ Precompliance testing against EMI standard	▶ Fast FFT with spectrogram option ▶ Log scale and mask for EMI precompliance measurements against EMI standards

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Make ideas real

Measurement examples

Analysis of a wireless module's data capture, processing and communications timing

The screenshot displays an IoT module's GSM connection time-correlated to power consumption and data traffic on the modem interface. The RF and power supply voltage and current are measured on the analog channels. The digital channels acquire the module's modem interface communications via UART and decode the protocol. The spectrum of the GSM bursts is shown on the top right.

Timing analysis of data capture, processing and communication of a wireless module.

Analysis of the wireless signal

The optional R&S®VSE vector signal explorer base software can load I/Q data acquired in real time from the R&S®RTO with the R&S®RTOx-K11 option and provides extensive analysis. The base version of the R&S®VSE software provides magnitude, spectrum, statistics and I/Q vector analysis. This example shows a GSM based magnitude, power versus time (PvT) measurement and the modulation spectrum. In addition there is a table view of the modulation accuracy and the modulation spectrum.

Analysis of a GSM signal with the R&S®VSE vector signal explorer software.

Suggested configuration

The table shows a suggested configuration for IoT measurements. This configuration can be extended depending on your needs, e.g. by adding custom decoding for NRZ/Manchester protocols, I/Q acquisition and vector analysis software, even after the initial purchase. A broad portfolio of active and current probes is also available.

Designation	Type	Order No.
Oscilloscope series, Base unit, 200 Mpoints/800 Mpoints, 4 channels, bandwidth option required	R&S®RTO64	1802.0001.04
I/Q software interface	R&S®RTO6-K11	1801.6812.02
GSM/EDGE/EDGE Evolution and VAMOS signal analysis	R&S®VSE-KT10	1345.1705.02