



From the last mile to the last inch

Test & measurement solutions for wireless wide area, local area and personal area networks

- ◆ WiMAX
- ◆ RFID
- ◆ WLAN
- ◆ Bluetooth
- ◆ DVB-H
- ◆ GPS
- ◆ ZigBee



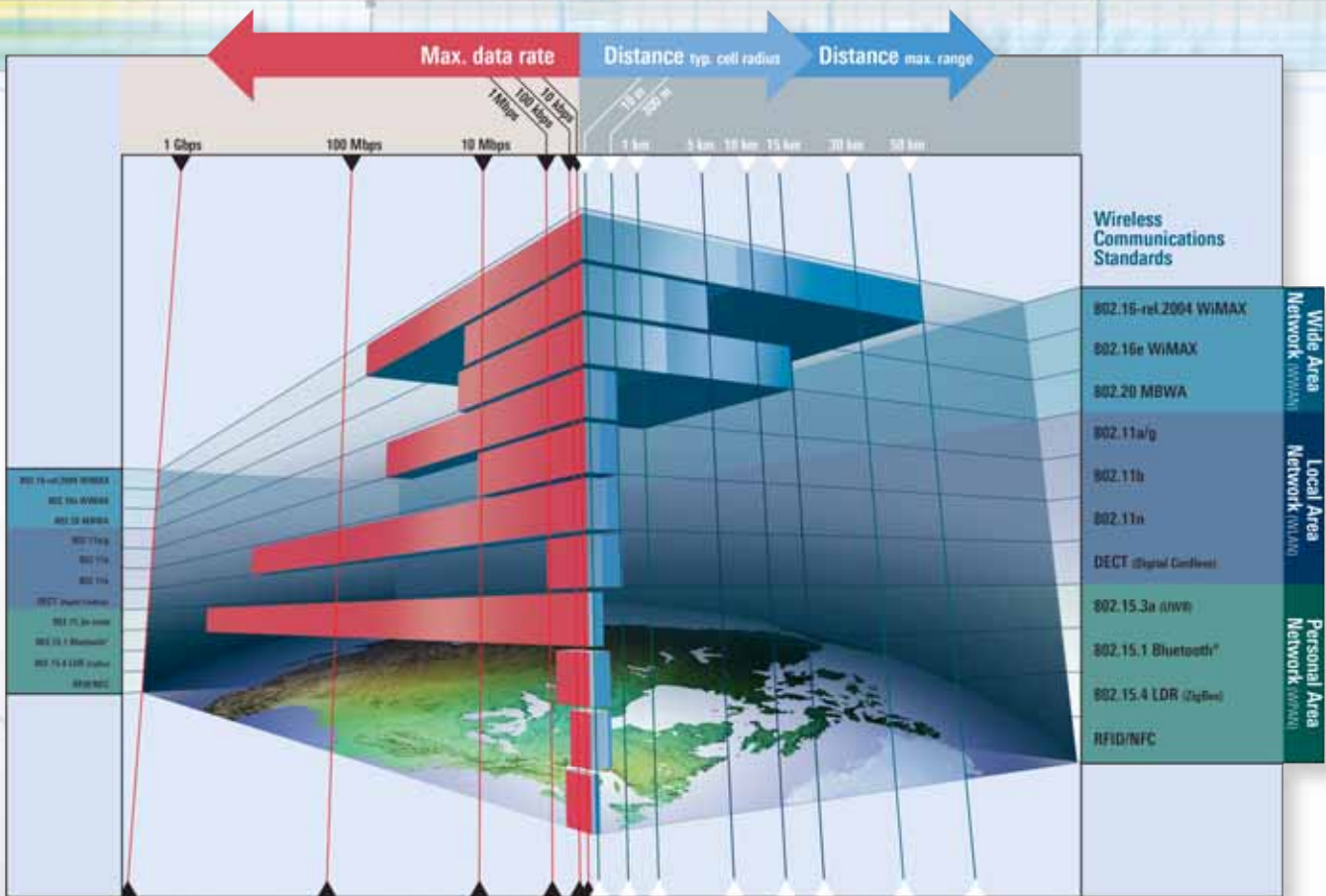
ROHDE & SCHWARZ

On the cusp of total communication

Not long ago, wireless communication meant conversation on a mobile phone. How times have changed! The mobile wireless device in your pocket now has a dozen possible names and a multitude of possible functions: personal digital assistant, navigation system, video player and music machine, camera, database, TV. It can also function as a hub for connecting other digital personal devices such as microphones, loudspeakers, and laptop computers. None of these functions mean much without data. Alongside the mobile phone networks where it all started, dozens of wireless local area network technologies are evolving at a pace almost too fast to follow. The number of technologies is outstripping any attempt by standards bodies to keep up. Some technologies will make the breakthrough to mass use; others will become obsolete overnight.

However, in order for the networked world to function, many customized radio standards must work hand in hand, interference-free, maintenance-free and reliably. Precision T&M equipment from Rohde & Schwarz paves the way for this. From research and development to production and quality assurance, we supply all the T&M instruments to quickly and efficiently make your new wireless products ready for market. The following pages provide an overview of the most important instruments and systems from our current range of products. For details, consult our website or ask our sales engineers.





Comparison of the range and data rate of the current standards for wide, local and personal area networks.

WiMAX

Stands for "worldwide interoperability for microwave access"; standard (IEEE 802.16 Release 2004) for local radio networks, theoretically enables up to 50 km range and data transfer rates of up to 70 Mbit/s. Due to this performance, WiMAX technology is also being discussed as an alternative to wired DSL connections. Owing to its higher mobility, the currently edited standard 802.16e can offer an alternative to cellular mobile radio systems.

RFID

Stands for "radio frequency identification", a generic term denoting technologies used for noncontact identification of objects, merchandise, persons, animals, etc. An RFID system usually includes a transponder, a reader and system integration components for connection to a merchandise information system, for example. RFID is used in process control, for tracking merchandise or goods, for access checks, in tire pressure monitoring systems and for many other purposes.

WLAN

Standard for wireless network communications. The Institute of Electrical and Electronics Engineers (IEEE)

has defined the most important characteristics of wireless LAN in the 802.11 (a, b, d, e, f, g, h, i) group of standards. Data is transmitted predominantly in the microwave range (2.4 GHz or 5 GHz). 802.11g allows transmission rates up to 54 Mbit/s; 802.11n will permit up to 500 Mbit/s.

Bluetooth®

Standard defined in IEEE 802.15.1 for wireless ad hoc connections of infotainment products (such as mobile phones, cameras, headsets) over distances of up to 100 m in the 2.4 GHz band. Version 2.0 EDR (enhanced data rate) of the standard, which was adopted at the end of 2004, implements data rates of up to 2.178 Mbit/s.

DVB-H

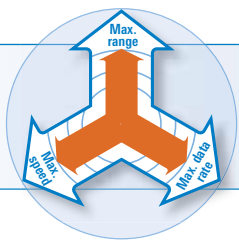
Digital Video Broadcasting Handheld is an adaptation of the digital terrestrial TV standard DVB-T to the requirements of mobile applications, particularly with battery-powered handheld equipment. The addition of time slicing, forward error correction and a further modulation mode to DVB-T produces a transmission system that is just as good at meeting the requirements of battery-powered devices as it is at handling the reception conditions at high speed.

GPS

GPS is a satellite-based positioning system that is operated by the United States Department of Defense and was officially put into operation in 1995. Using the difference in the radio signal propagation times of at least three of the 24 GPS satellites, a GPS receiver can accurately determine its position worldwide to within a few meters. Signals for civil use are transmitted at a frequency of 1575.42 MHz. The European Galileo system will be largely compatible with GPS.

ZigBee

The aim of ZigBee (based on IEEE 802.15.4) is to establish a standard for particularly cost-efficient and power-saving wireless local area networking at a relatively low data rate. ZigBee technology is versatile; it can be used for facility management, sensor and machine networking as well as computer keyboards, interactive games and toys and many other applications. Especially attractive is its low power consumption, which allows battery cycles of several years or permanent operation with supply via small solar cells, induction coils and the like.



WiMAX (IEEE 802.16)

Frequency range	Modulation	Multiple access	Duplex	Channel bandwidth	Number of channels	Peak data rate
2 GHz to 66 GHz in various bands	BPSK, QPSK, 16QAM, 64QAM, OFDM, SC	TDMA/OFDMA	TDD/FDD	In accordance with local radio regulations	In accordance with local radio regulations	15 Mbit/s (5 MHz channel) to 134 Mbit/s (28 MHz channel)

Selected products



R&S®SMU 200A

The R&S®SMU 200A, with its outstanding signal quality and versatility, offers the ideal basis for generating modern communications signals such as WiMAX (R&S®SMU-K49 software option).

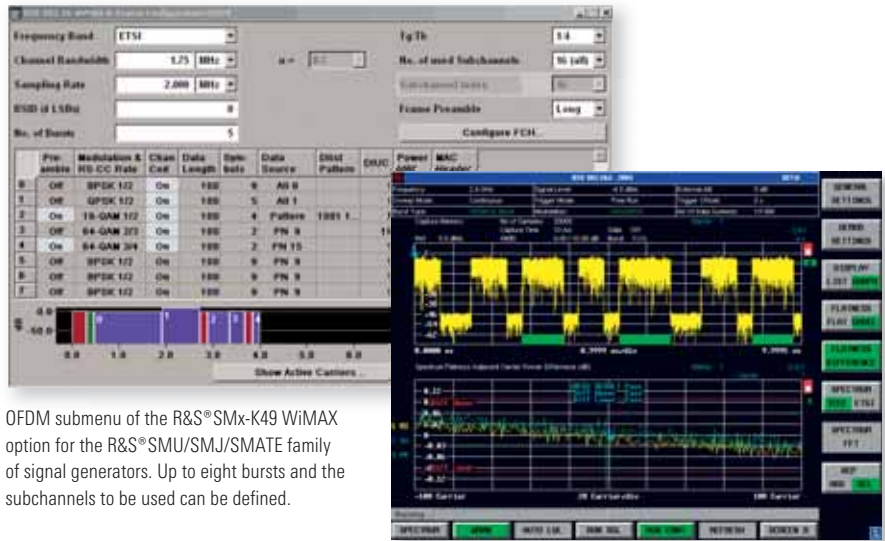


R&S®FSQ

A one-box solution for transmitter measurements on WiMAX signals: Signal Analyzer R&S®FSQ

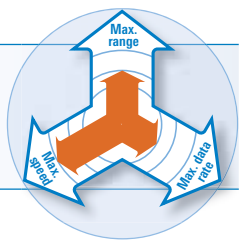
WiMAX measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A <p>+ R&S®SMx-K49 software option</p>	<ul style="list-style-type: none"> • Signal generation to IEEE 802.16 Rel. 2004 Rev. D • Physical layer (OFDM mode), MAC • Signals for packet error ratio (PER) measurements • Frequency range 100 kHz to 6 GHz • Internal I/Q modulation bandwidth 80 MHz (in FR) • Up to two signal generators in one box (e.g. useful signal + interferer, R&S®SMU 200A and R&S®SMATE 200A), both up to 6 GHz in the R&S®SMATE 200A • Fading simulator (option) with up to 40 fading paths (R&S®SMU 200A) • Extremely fast setting times and addressable list mode for production (R&S®SMATE 200A)
Signal analysis	<ul style="list-style-type: none"> • Signal Analyzer R&S®FSQ <p>+ R&S®FSQ-K92 software option</p>	<ul style="list-style-type: none"> • Graphical results of EVM measurement, frequency error vs. preamble, phase error vs. preamble • Display of spectrum flatness, group delay, constellation diagram, bit stream, spectrum emission mask • Adjacent channel power and CCDF measurements • I/Q constellation • Symbol clock error



OFDM submenu of the R&S®SMx-K49 WiMAX option for the R&S®SMU/SMJ/SMATE family of signal generators. Up to eight bursts and the subchannels to be used can be defined.

Group delay measurement of a WiMAX signal with the R&S®FSQ-K92 software option for the R&S®FSQ/FSU/FSP family of signal and spectrum analyzers.



RFID

Selected products



R&S®SMJ 100A

The R&S®SMJ 100A is the universal generator solution for the development of wireless mobile equipment of any given standard and the associated components.



R&S®FSL

The Spectrum Analyzer R&S®FSL with the option R&S®FSL-K7 (AM, FM, PM measurement demodulator) ideally supports the RFID signal including ASK and FSK modulation. The built-in tracking generator allows response and Q factor measurements.

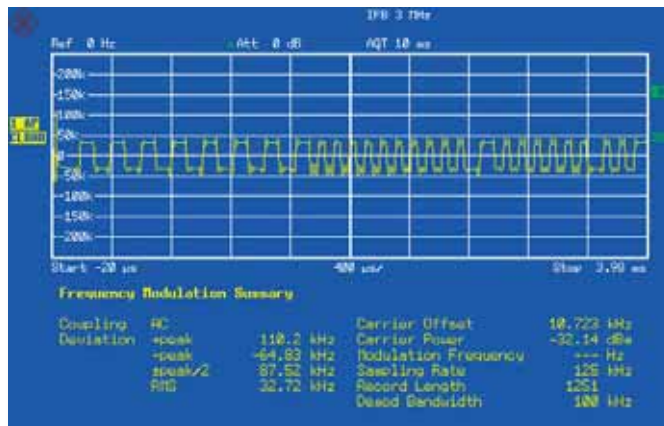


R&S®TS 7810

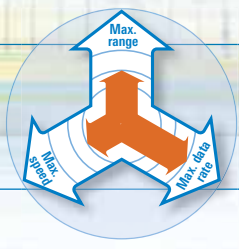
RFID technology has versatile applications, for instance in the automobile industry. The RF Test System R&S®TS 7810 performs production tests on wireless tire pressure sensors connected with onboard electronics.

RFID measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A 	<ul style="list-style-type: none"> • Frequency range 100 kHz to 6 GHz • Internal I/Q modulation bandwidth 80 MHz (at RF) • Arbitrary waveform generator with 64 Msamples • Up to two signal generators in one box (e.g. useful signal + interferer, R&S®SMU 200A and R&S®SMATE 200A), both up to 6 GHz in the R&S®SMATE 200A • Fading simulator (option) with up to 40 fading paths (R&S®SMU 200A) • Extremely fast setting times and addressable list mode for production (R&S®SMATE 200A)
Signal analysis	<ul style="list-style-type: none"> • Spectrum Analyzer R&S®FSL or • Spectrum Analyzer R&S®FSP or • Signal Analyzer R&S®FSQ or • Spectrum Analyzer R&S®FSU + R&S®FS-K7 software option + R&S®FSL-K7 software option • Handheld Spectrum Analyzer R&S®FSH 3/6 	<ul style="list-style-type: none"> • FM, AM, PM demodulation • Power measurements • Frequency range 100 kHz to 3 GHz / 6 GHz • Internal preamplifier • Displayed average noise level typ. -135 dBm (RBW 100 Hz) • Level accuracy typ. 0.5 dB • Resolution bandwidths 100 Hz to 1 MHz, one and three steps • Wide range of detectors: sample, max/min peak, auto peak, RMS
Probes	<ul style="list-style-type: none"> • Probe Set R&S®HZ-11 • Probe Set R&S®HZ-14 	<ul style="list-style-type: none"> • Frequency range 100 kHz to 2 GHz, nearfield probes for E and H field • Frequency range 9 kHz to 1 GHz, nearfield probes for E and H field



Demodulated data packet of a tire pressure sensor, measured by means of the R&S®TS 7810 system



WLAN (IEEE 802.11)

WLAN measurement solutions

	Recommended products	Standards covered	Features/measurements						
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®SMx-K48 software option 	802.11 a/b/g	<ul style="list-style-type: none"> • Physical layer (OFDM, CCK, PBCC modes), MAC, FCS • Signals for packet error ratio (PER) measurements • Frequency range 100 kHz to 6 GHz • Internal I/Q modulation bandwidth 80 MHz (in RF) • EVM typically 0.6% for 802.11a • Up to two signal generators in one box (e.g. useful signal + interferer, R&S®SMU 200A and R&S®SMATE 200A), both up to 6 GHz in the R&S®SMATE 200A • Fading simulator (option) with up to 40 fading paths (R&S®SMU 200A) including WLAN Hyperlan/2 fading models • Extremely fast setting times and addressable list mode for production (R&S®SMATE 200A) 						
	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®SMx-K19 software option + R&S®WinIQSIM software 	802.11 a/b/g	<ul style="list-style-type: none"> • WLAN multicarrier signals • Multicarrier mixed signals (e.g. Bluetooth + 802.11b/g in the 2.4 GHz ISM band) 						
	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®SMx-K15 software option + R&S®WinIQSIM software 	802.11 a/g	<ul style="list-style-type: none"> • Custom OFDM signal generation for spectrum measurements 						
Signal analysis	<ul style="list-style-type: none"> • Signal Analyzer R&S®FSQ + R&S®FSQ-K91 software option 	802.11 a/b/g/j	<table border="0"> <tr> <td>Demodulation of</td> <td>Measurement of</td> <td>Plus:</td> </tr> <tr> <td> <ul style="list-style-type: none"> • OFDM (802.11 a/g/j): BPSK, QPSK, 16QAM, 64QAM • Single carrier (802.11 b): BPSK, QPSK, CCK, BPCC </td> <td> <ul style="list-style-type: none"> • EMV • Frequency/symbol clock error • Crest factor • Carrier leakage • I/Q imbalance </td> <td> <ul style="list-style-type: none"> • Spectrum emission mask • FFT • Signal field content </td> </tr> </table>	Demodulation of	Measurement of	Plus:	<ul style="list-style-type: none"> • OFDM (802.11 a/g/j): BPSK, QPSK, 16QAM, 64QAM • Single carrier (802.11 b): BPSK, QPSK, CCK, BPCC 	<ul style="list-style-type: none"> • EMV • Frequency/symbol clock error • Crest factor • Carrier leakage • I/Q imbalance 	<ul style="list-style-type: none"> • Spectrum emission mask • FFT • Signal field content
	Demodulation of	Measurement of	Plus:						
<ul style="list-style-type: none"> • OFDM (802.11 a/g/j): BPSK, QPSK, 16QAM, 64QAM • Single carrier (802.11 b): BPSK, QPSK, CCK, BPCC 	<ul style="list-style-type: none"> • EMV • Frequency/symbol clock error • Crest factor • Carrier leakage • I/Q imbalance 	<ul style="list-style-type: none"> • Spectrum emission mask • FFT • Signal field content 							
<ul style="list-style-type: none"> • Spectrum Analyzer R&S®FSP + R&S®FSP-K90 software option 	802.11 a/g (OFDM only)	Like R&S®FSQ, for carriers -14 to +14							
Protocol test	<ul style="list-style-type: none"> • WLAN Protocol Tester R&S®PTW 70 	802.11 a/b/g (802.11 e/i under development)	<ul style="list-style-type: none"> • Tester mode (adjustable physical/MAC/LLC layer settings for valid and invalid behavior tests) • Reference mode (acting as station or access point or TCP/IP gateway) • Sniffer mode (accurate packet detection with 50 ns time resolution) • External remote control via TCP/IP • Graphical and programmable user interface • Analysis of protocol sequences in detail for all operating modes 						
Coverage measurements	<ul style="list-style-type: none"> • Coverage Measurement Software R&S®ROMES + WLAN option 	802.11 b/g	<ul style="list-style-type: none"> • Measurement parameters: <ul style="list-style-type: none"> - Received signal strength (dBm) - RX/TX throughput (bytes/s) - Connection state - Statistics of received / sent frames (good, corrupted) • WLAN scan measurement parameters such as MAC address, SSID or frequency • WLAN scan view 						
Measurements via air interface	<ul style="list-style-type: none"> • Shielded RF Test Fixture R&S®TS 7110 	Depending on the measuring instrument connected to the fixture	<ul style="list-style-type: none"> • Can be connected to any RF measuring instrument • Combination of RF and audio testing • Low reflection inside fixture • Suppression of external sources of interference • Testing of mobile phones, WLAN and Bluetooth devices 						
Power measurements	<ul style="list-style-type: none"> • Digital Radio Communication Tester R&S®CMU 200 + R&S®CMUGo software 	802.11 b/g	<ul style="list-style-type: none"> • Power measurements in 2.4 GHz band 						

	Frequency range	Modulation	Multiple access	Duplex	Channel bandwidth	Number of channels	Peak data rate
IEEE 802.11.a	5.15 GHz to 5.35 GHz (USA), 5.470 GHz to 5.725 GHz (Europe), 5.725 GHz to 5.825 GHz (USA/China)	BPSK, QPSK, 16QAM, 64QAM, OFDM	CSMA/CA	TDD	20 MHz	12	54 Mbit/s
IEEE 802.11.b	2.4 GHz to 2.4835 GHz (North America, Europe), 2.471 GHz to 2.497 GHz (Japan), 2.4465 GHz to 2.4835 GHz (France), 2.445 GHz to 2.475 GHz (Spain)	BPSK, DQPSK in header; BPSK, QPSK in payload (CCK, PBCC)	CSMA/CA	TDD	20 MHz	14 (overlapping) 3 (nonoverlapping)	11 Mbit/s
IEEE 802.11.g		BPSK, DQPSK, QPSK, 16QAM, 64QAM, OFDM, CCK, PBCC	CSMA/CA	TDD	20 MHz	14 (overlapping) 3 (nonoverlapping)	54 Mbit/s

Selected products



R&S® SMATE 200A

Ensures maximum test performance in the production of wireless components: Signal Generator R&S® SMATE 200A.



R&S® FSQ

Conveniently analyzes any WLAN signal: Signal Analyzer R&S® FSQ.



R&S® PTW 70

Indispensable in the development, component integration and verification of WLAN products: Protocol Tester R&S® PTW 70.

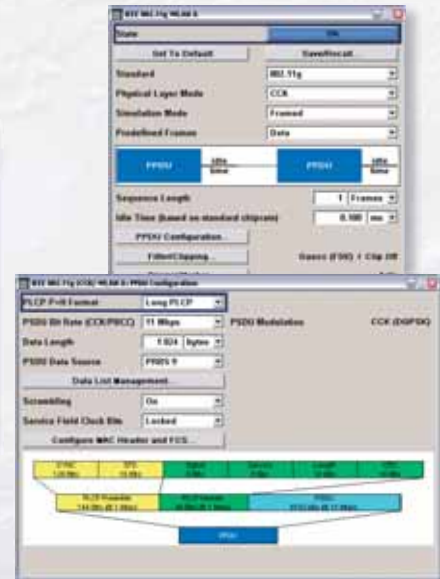


R&S® TS 1110

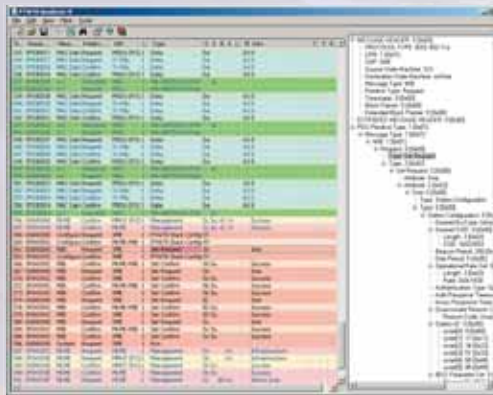
Provides ideal conditions for testing wireless components via the air interface: Shielded RF Test Fixture R&S® TS 1110.



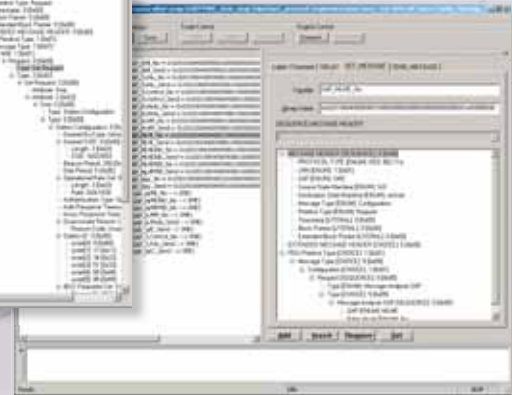
Demodulation of a WLAN(a) signal with the Signal Analyzer R&S® FSQ and option R&S® FS-K91.



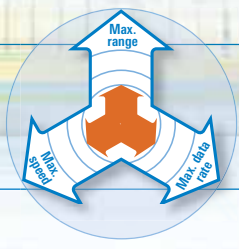
WLAN configuration menus of signal generator option R&S® SMx-K48.



R&S® PTW 70 graphical script editor and analyzer.



Application notes	
Title	Designation
Generating Signals for Wireless LAN, Part I: IEEE 802.11b	1GP49
802.11 Packet Error Ratio Testing to Standard 802.11 a/b/g	1GP56
WLAN Tests to Standard 802.11 a/b/g	1MA69
Power Measurements in the 2.4 GHz Band to Standard 802.11 b/g	1CM55



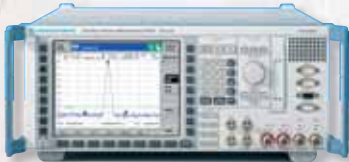
Bluetooth® (IEEE 802.15.1)

Frequency range	Modulation	Multiple access	Duplex	Channel bandwidth	Number of channels	Peak data rate
2402 MHz to 2480 MHz	GFSK	FHSS	TDD	1 MHz	79	723.2 kbit/s

Bluetooth® measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®SMx-K5 software option 	<ul style="list-style-type: none"> • BER tests • Sensitivity tests for Bluetooth receivers • Carrier-to-interference performance tests • Blocking performance tests • Intermodulation performance tests • Maximum input level performance tests
	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®WinIQSIM software 	<ul style="list-style-type: none"> • Bluetooth signals including frequency hopping • Multicarrier mixed signals (e.g. Bluetooth + 802.11b/g in the 2.4 GHz ISM band) • Bluetooth EDR signals
Signal analysis	<ul style="list-style-type: none"> • Signal Analyzer R&S®FSQ or • Spectrum Analyzer R&S®FSU or • Spectrum Analyzer R&S®FSP + R&S®FS-K8 software option 	<ul style="list-style-type: none"> • RF tests to Rev. v0.91 • TX measurements: output power, adjacent channel power, modulation characteristics, initial carrier frequency tolerance, carrier frequency deviation
Signaling measurements	<ul style="list-style-type: none"> • Digital Radio Communication Tester R&S®CMU 200 + R&S®CMU-B53 and R&S®CMU-K53 options + R&S®CMUGo software 	<p>Transmitter measurements:</p> <ul style="list-style-type: none"> • Power measurements: nominal power, peak power, leakage power • Timing measurements: packet timing error • Spectrum measurements: 20 dB bandwidth, adjacent channel power • Modulation measurements: frequency accuracy, frequency drift, maximum drift rate, average, maximum and minimum frequency deviation <p>Receiver measurements:</p> <ul style="list-style-type: none"> • Sensitivity (single-slot/multislot packets) • BER: search function, sensitivity level for a predefined BER level • Packet error ratio (PER, percentage of packet errors that have occurred within the current statistical cycle)
	<ul style="list-style-type: none"> • Bluetooth Tester R&S®CBT or • Bluetooth Tester R&S®CBT 32 + R&S®CBT-B55 and R&S®CBT-K55 EDR options 	<ul style="list-style-type: none"> • Bluetooth characteristics same as the R&S®CMU 200, plus: • Dirty transmitter in line with RF test specification • R&S®CBT 32 optimized for production applications • Very short cycle time for high production throughput • Bluetooth EDR TX and RX testing, loopback test mode
Protocol test	<ul style="list-style-type: none"> • Bluetooth Protocol Tester R&S®PTW 70-BT 	<ul style="list-style-type: none"> • Analyzer mode • Sniffer or monitor mode • Graphical and programmable user interface • Analysis of protocol sequences in detail for all operating modes
Conformance test	<ul style="list-style-type: none"> • Conformance Test System R&S®TS 8960 	<ul style="list-style-type: none"> • Validated conformance test system for Bluetooth RF test cases • All test cases in line with Bluetooth RF test specifications 1.1 and 1.2 as automatic test routines, can also be run with variable parameters • Additional test cases
Measurements via air interface	<ul style="list-style-type: none"> • Shielded RF Test Fixture R&S®TS 7110 	<ul style="list-style-type: none"> • Can be connected to any RF measuring instrument • Combination of RF and audio testing • Low reflection inside fixture • Suppression of external sources of interference • Testing of mobile phones, WLAN and Bluetooth devices

Selected products



R&S® CMU 200

All mobile radio standards and Bluetooth in one box:
Universal Radio Communication Tester R&S® CMU 200.



R&S® CBT

If you're looking for a tester especially for Bluetooth, the R&S® CBT is the one to choose. Also available without display as the R&S® CBT 32 for production. Compatible with the R&S® CMU 200.



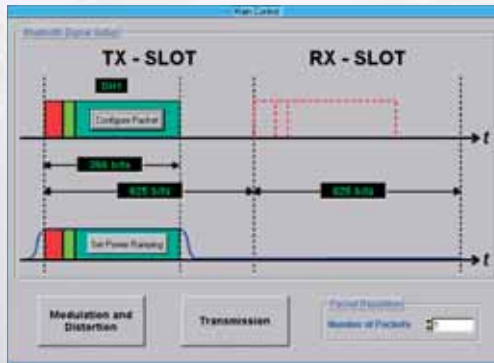
R&S® PTW 70

For conformance testing: Protocol Tester R&S® PTW 70.

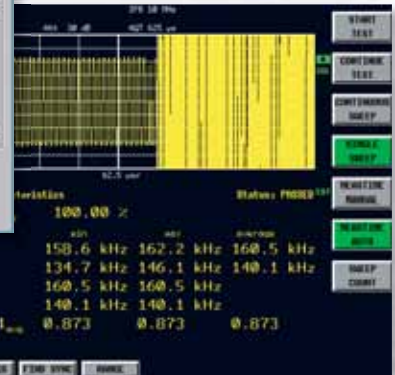


R&S® TS 8960

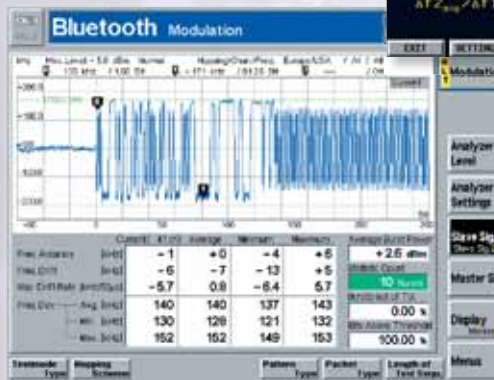
The validated RF Conformance Test System R&S® TS 8960 rounds out the Rohde & Schwarz T&M portfolio for Bluetooth.



The R&S® SMx-K5 option for the Signal Generators R&S® SMU/SMJ/SMATE configures the Bluetooth test signal in no time at all.



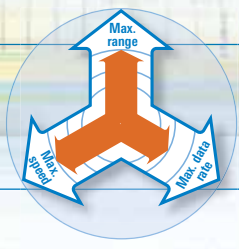
Measurement of the modulation characteristics of a Bluetooth signal using the R&S® FS-K8 software option for the R&S® FSQ/FSU/FSP analyzers.



Modulation measurement with the Bluetooth Tester R&S® CBT.

Application notes

Title	Designation
Measurements on Bluetooth Devices using R&S® CMU 200 and R&S® CMUgo	1CM50
Transmitter Measurements on Bluetooth Modules	1MA26
Generating Bluetooth RF Test Signals with R&S® SMIQ Signal Generator	1MA31
Transmitter Measurements on Bluetooth Modules with R&S® FSP	1MA33
Transmitter and Receiver Measurements on Bluetooth Modules with R&S® CMU 200	1MA46
Bluetooth Transmitter Measurements without Connection Setup	1MA49
Out of Band Spurious Measurements for Bluetooth Modules	1MA53
Generating Bluetooth Signals with R&S® FSQ and Application Software R&S® SMIQ-K5	1GP48



DVB-H

Frequency range	Modulation	Source coding	Channel coding	Channel bandwidth	Number of channels	Mobility
VHF: 174 MHz to 230 MHz UHF: 470 MHz to 862 MHz	QPSK, 16QAM, COFDM	H.264	Convolutional and Reed-Solomon FEC	5/6/7/8 MHz	11 video channels 25 audio channels 3 data channels	Up to 200 km/h

DVB-H measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • DTV IP Inserter and Generator R&S® DIP 010 	<ul style="list-style-type: none"> • Time slicing, FEC and signaling of data services via IP/MAC notification table supported for generation of DVB-H-compliant data streams • Insertion of additional data (IP packets) into an MPEG-2 transport stream • Utilization of dedicated MPEG-2 resources (null packets) • Realtime data insertion with up to 15 Mbit/s • Two operating modes: MPEG-2 inserter and MPEG-2 generator • TS interfaces for input and output: ASI, SPI
	<ul style="list-style-type: none"> • DTV Recorder Generator R&S® DVRG 	<ul style="list-style-type: none"> • Playing and recording of DVB/DVB-H transport streams (TS) • Seamless loop TS generation • Huge TS library including DVB-H streams • Support of DVB-H multiprotocol encapsulation, time slicing and forward error correction • Software multiplexer for application-specific DVB/DVB-H TS creation
	<ul style="list-style-type: none"> • Broadcast Test System R&S® SFU 	<ul style="list-style-type: none"> • Complete DVB-H support: 4k mode, FEC, time slicing, in-depth interleaver, TPS carrier signaling • DTV multistandard test platform (100 kHz to 3 GHz) • Large output level range for transmission and chip applications • Digital noise source (AWGN) for channel simulation • Up to 40 paths channel simulation (fading) • Full digital baseband processing • BER measurement • ASI, SPI, SMPTE 310M inputs and test signals
Signal analysis	<ul style="list-style-type: none"> • TV Test Receiver R&S® EFA 	<ul style="list-style-type: none"> • Display of DVB-H signaling (TPS bits) • Display of interleaver mode • 2k and 8k modes supported • Realtime demodulation, analysis and monitoring • Several analog and digital TV standards available • Wide variety of measurement functions • Alarm messages for measurement functions, internal storage • Transport stream output: ASI and SPI • MPEG-2 decoder option
	<ul style="list-style-type: none"> • Digital Video Measurement System R&S® DVM 400 	<ul style="list-style-type: none"> • Realtime and in-depth analysis of DVB/DVB-H transport streams (TS) • Monitoring of up to 20 streams in parallel with one system and advanced measurement • Playing and recording of DVB/DVB-H TS • DVB/DVB-H data broadcast analysis • DVB-H data de-encapsulation

Selected products



R&S® SFU

The multistandard test platform for digital TV with full DVB-H support: Broadcast Test System R&S® SFU.



R&S® DVRG

The baseband source for digital video streams: DTV Recorder Generator R&S® DVRG.



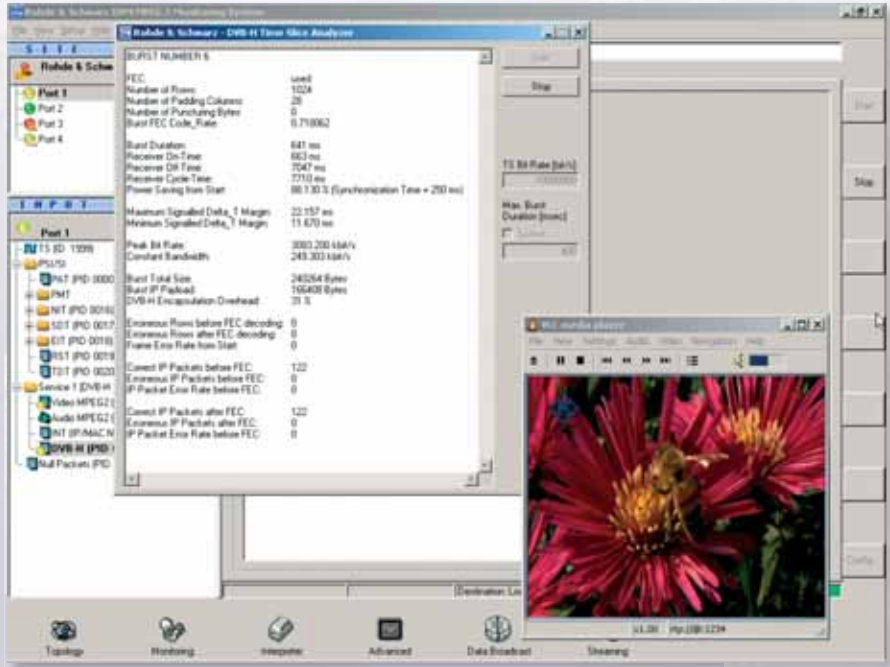
R&S® EFA

First choice for demodulating and analyzing digital video signals: TV Test Receiver R&S® EFA.



R&S® DVM 400

Monitors, analyzes and generates MPEG-2 transport streams: Digital Video Measurement System R&S® DVM 400.



The R&S® DVM 400 provides developers with a wide range of measurement tools for DVB-H, such as the measurement screen for time slice analysis shown here.



All parameters of a DVB-T/H signal can be easily varied with the R&S® SFU.

GPS

Frequency range	Modulation	Multiple access	Duplex	Channel bandwidth	Number of channels	Peak data rate
L1: 1575.42 MHz L2: 1227.6 MHz	BPSK	Not needed	Not needed	20.46 MHz	Up to 32 satellites	50 bit/s

Selected products



R&S®SMU

To be able to determine its position, a GPS receiver must "see" at least four satellites. With the R&S®SMU-K44 option, the R&S®SMU provides up to eight virtual satellites.



R&S®CRTU-G

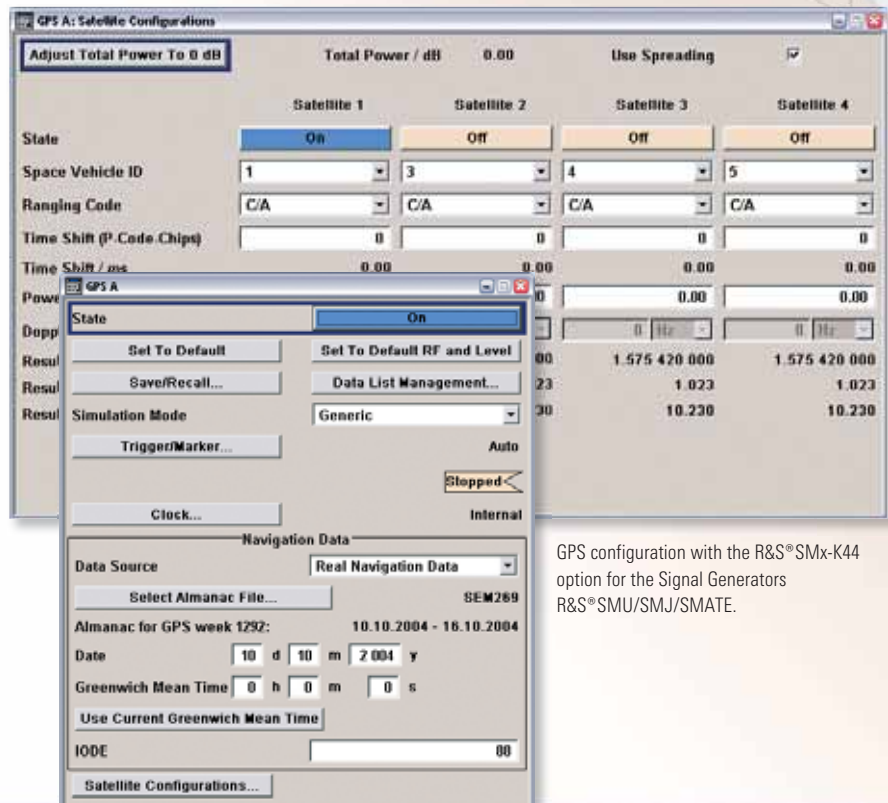
GPS will be an important feature of future mobile phone generations. The R&S®CRTU-G supports this integration with 3GPP-based A-GPS test cases.

Application notes

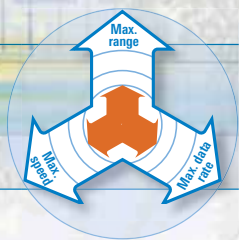
Title	Designation
Synchronization for CDMA Base Stations (GPSOne Measurements)	1CM33

GPS measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A + R&S®SMx-K44 software option 	<ul style="list-style-type: none"> • Ranging codes C/A • Receiver tests • Simulation of up to four GPS satellites per baseband • Fading simulator (option) with up to 40 fading paths (R&S®SMU 200A) • Extremely fast setting times and addressable list mode for production (R&S®SMATE 200A) • Up to two signal generators in one box (e.g. useful signal + interferer, R&S®SMU 200A and R&S®SMATE 200A), both up to 6 GHz in the R&S®SMATE 200A
Signaling measurements	<ul style="list-style-type: none"> • Radio Communication Test Set R&S®CRTU-G 	<ul style="list-style-type: none"> • 3GPP-based A-GPS test cases • Control of GPS simulator from test cases • Support of all signaling messages
	<ul style="list-style-type: none"> • Universal Radio Communication Tester R&S®CMU 200 	<ul style="list-style-type: none"> • Enables gpsOne® tests



GPS configuration with the R&S®SMx-K44 option for the Signal Generators R&S®SMU/SMJ/SMATE.



ZigBee (IEEE 802.15.4)

Frequency range	Modulation	Multiple access	Duplex	Channel bandwidth	Number of channels	Peak data rate
2.4 GHz to 2.4835 GHz (World) 902 MHz to 928 MHz (America) 868.3 MHz (Europe)	BPSK (868/915 MHz), OQPSK (2.4 GHz)	CSMA/CA	TDD	5 MHz	1 (868 MHz) 10 (915 MHz) 16 (2.4 GHz)	20 kbit/s (868 MHz) 40 kbit/s (915 MHz) 250 kbit/s (2.4 GHz)

Selected products



R&S®SMJ 100A

With its ARB generator, the R&S®SMJ 100A can generate any type of waveform including, of course, ZigBee signals.



R&S®FSQ

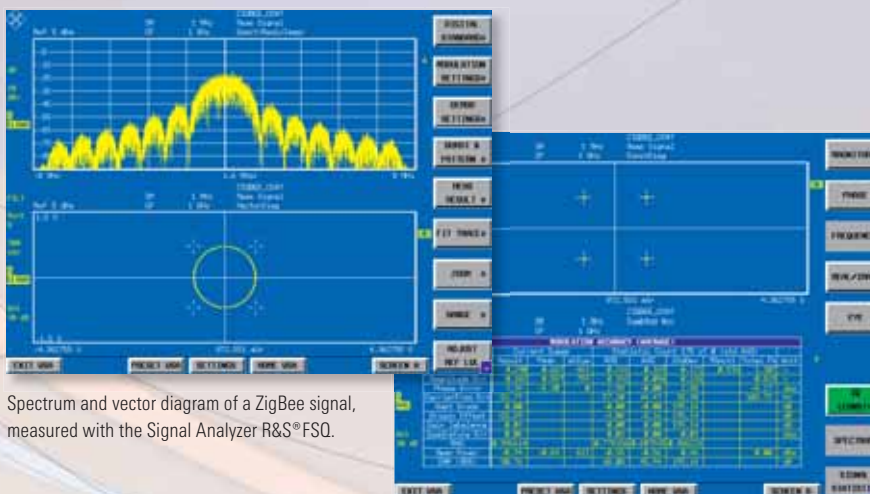
Not all analyzers are able to demodulate ZigBee-specific OQPSK signals, which requires an unusual filter characteristic. With the R&S®FS-K70 option, this is no problem for the R&S®FSQ.

Application notes

Title	Designation
OQPSK Measurements	1EF55

ZigBee measurement solutions

	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S®SMU 200A or • Signal Generator R&S®SMJ 100A or • Signal Generator R&S®SMATE 200A 	<ul style="list-style-type: none"> • Frequency range 100 kHz to 6 GHz • Internal I/Q modulation bandwidth 80 MHz (at RF) • Arbitrary waveform generator with 64 Msamples • Up to two signal generators in one box (e.g. useful signal + interferer, R&S®SMU 200A and R&S®SMATE 200A), both up to 6 GHz in the R&S®SMATE 200A • Fading simulator (option) with up to 40 fading paths (R&S®SMU 200A) • Extremely fast setting times and addressable list mode for production (R&S®SMATE 200A)
Signal analysis	<ul style="list-style-type: none"> • Signal Analyzer R&S®FSQ + R&S®FSQ-K70 software option • Handheld Spectrum Analyzer R&S®FSH 3/6 	<ul style="list-style-type: none"> • EVM • I/Q imbalance • Demodulated bits • Power measurements • Frequency range 100 kHz to 3 GHz / 6 GHz • Internal preamplifier • Displayed average noise level typ. -135 dBm (RBW 100 Hz) • Level accuracy typ. 0.5 dB • Resolution bandwidths 100 Hz to 1 MHz, one and three steps • Wide range of detectors: sample, max/min peak, auto peak, RMS



Spectrum and vector diagram of a ZigBee signal, measured with the Signal Analyzer R&S®FSQ.

EVM measurement on a ZigBee modulation generated with the Signal Generator R&S®SMJ 100A. The very low residual EVM of <0.3 % is a prerequisite for accurate EVM measurements.

General RF

In addition to the measuring equipment that provides standard-specific or standard-compliant functions, a large number of general-purpose measuring instruments is needed – in development labs, in production and in service. A small selection from our wide range of products is presented here. Due to their unique characteristics, each of these instruments soon becomes indispensable for the user.

Selected products



R&S® SML

The Signal Generator R&S® SML is not only a versatile laboratory tool but also a fast and reliable signal source for production purposes.



R&S® FSH3/6

Small and mobile, the R&S® FSH3/6 is a high-quality miniature RF laboratory that combines a variety of functions ranging from spectrum analysis and vector network analysis to power measurement and test receiver mode.



R&S® NRP

When the task at hand is high-precision measurement of RF power, the R&S® NRP and its sensors can't be beat. The sensors feature a USB interface and can thus be operated on any computer.



R&S® ZVB

The R&S® ZVB shows how convenient network analysis can be. Its helpful wizards also enable fast, reliable measurements on multiport and balanced DUTs.

General RF measurements


	Recommended products	Features/measurements
Signal generation	<ul style="list-style-type: none"> • Signal Generator R&S® SML • Vector Signal Generator R&S® SMV 03 	<ul style="list-style-type: none"> • Frequency range 9 kHz to 3.3 GHz • SSB phase noise <-122 dBc (1 Hz, at f = 1 GHz, offset 20 kHz) • High level accuracy (dev. <0.5 dB at levels >-120 dBm, f <2 GHz) • AM/FM/wM • Optional pulse modulator with integrated pulse generator • Optional stereo/RDS coder • External I/Q modulation bandwidth 100 MHz in RF (R&S® SMV 03)
Signal analysis	<ul style="list-style-type: none"> • Handheld Spectrum Analyzer R&S® FSH 3/6 	<ul style="list-style-type: none"> • Frequency range 100 kHz to 3 GHz / 6 GHz • Internal preamplifier • Displayed average noise level typ. -135 dBm (RBW 100 Hz) • Level accuracy typ. 0.5 dB • Resolution bandwidths 100 Hz to 1 MHz, one and three steps • Wide range of detectors: sample, max/min peak, auto peak, RMS
Power measurements	<ul style="list-style-type: none"> • Power Meter R&S® NRP 	<ul style="list-style-type: none"> • Intelligent sensors – simply plug in and measure • High measurement speed • 90 dB dynamic range • Accurate measurement of average power regardless of bandwidth and modulation • Measuring modes: continuous, burst average, timeslot, timegate, scope
Network analysis	<ul style="list-style-type: none"> • Vector Network Analyzer R&S® ZVB • Vector Network Analyzer R&S® ZVM • Vector Network Analyzer R&S® ZVK • Vector Network Analyzer R&S® ZVR/E • Vector Network Analyzer R&S® ZVC/E • Vector Network Analyzer R&S® ZVA • Vector Network Analyzer R&S® ZVT 8 	<ul style="list-style-type: none"> • Component measurements at physical layer • Very high dynamic range for high-blocking filters • All-round support in measuring active components • Unlimited measurements on frequency-converting DUTs such as mixer, amplifier, receiver and transceiver frontends • Measurements on multiport and balanced components • Optimized for R&D and for use in production
Power supply	<ul style="list-style-type: none"> • Analyzer/Power Supply R&S® NGMO 1/2 	<ul style="list-style-type: none"> • Highly stable output voltage due to fast load regulation • High-resolution current measurement for detecting leakage currents when mobile device is in off state • Current-transient recorder with high time and magnitude resolution for isolating faults in mobile devices and for optimizing switching • Long-term power consumption analysis for determining and optimizing operation

Further publications on wireless connectivity/mobile radio



Part of a world on the move
Test and measurement solutions for mobile radio

ROHDE & SCHWARZ

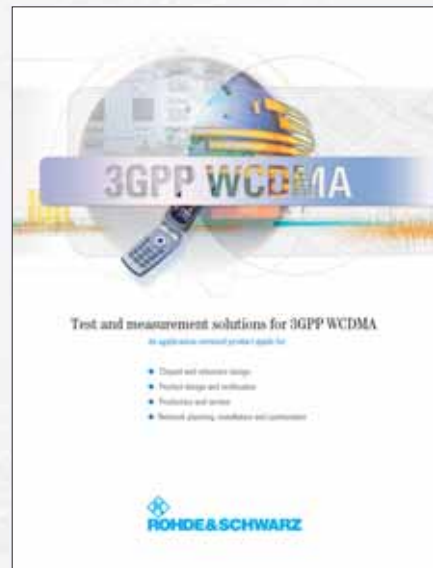


3GPP HSDPA

Test and measurement solutions for 3GPP HSDPA
An application-oriented product guide for

- Design and reference design
- Production and service
- Network planning, installation and optimization

ROHDE & SCHWARZ



3GPP WCDMA

Test and measurement solutions for 3GPP WCDMA
An application-oriented product guide for

- Design and reference design
- Production and service
- Network planning, installation and optimization

ROHDE & SCHWARZ



GSM/GPRS/EDGE


Test and measurement solutions for GSM/GPRS/EDGE (EGPRS)
An application-oriented product guide for

- Design and reference design
- Production and service
- Network planning, installation and optimization

ROHDE & SCHWARZ



Video goes mobile - with DVB-H



CDMA2000[®] 1xEV-DO

Test and measurement solutions for CDMA2000[®] and 1xEV-DO
An application-oriented product guide for

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Wireless Communication Standards



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ROHDE & SCHWARZ

www.rohde-schwarz.com

Europe: +49 1805 12 4242, customersupport@rohde-schwarz.com
USA and Canada: 1-888-837-8772, customer.support@rsa.rohde-schwarz.com
Asia: +65 68463710, customersupport.asia@rohde-schwarz.com