

R&S®TS8970 WiMAX Radio Conformance Test System

Benchmark for the certification of WiMAX end products

The WiMAX Forum™ (WMF) has selected Rohde & Schwarz as a manufacturer of radio conformance test testers (RCTT) in compliance with the IEEE 802.16e mobile WiMAX standard. The R&S®TS8970 test system (FIG 1) uses validated test cases to certify WiMAX end products that are manufactured in accordance with the IEEE 802.16e-2005 specification.

WiMAX – the mobile broadband access

WiMAX (worldwide interoperability for microwave access) is the synonym for the implementation of the IEEE 802.16 standard, which enables wireless broadband access to data networks (e. g. to IP or ATM networks). WiMAX was originally planned as a wireless alternative for wireline broadband access (e. g. ADSL), thus as a cost-efficient last-mile solution in the form of a radio interface. Accordingly, the IEEE 802.16-2004 specification initially defined this air interface only for stationary operation. However, the standard was soon expanded for mobile applications, yielding the IEEE 802.16e-2005 recommendation.

The IEEE 802.16 WiMAX standard describes the two lowest layers of the open system interconnection (OSI) reference model for communications, also known as the PHY(sical) layer and MAC layer (data link layer). WiMAX specifies various transmission technologies for the PHY layer on the air interface. In addition to two single-carrier (SC) methods for the frequency range from 10 GHz to 66 GHz and sub 11 GHz, the OFDM and OFDMA variants of the multi-

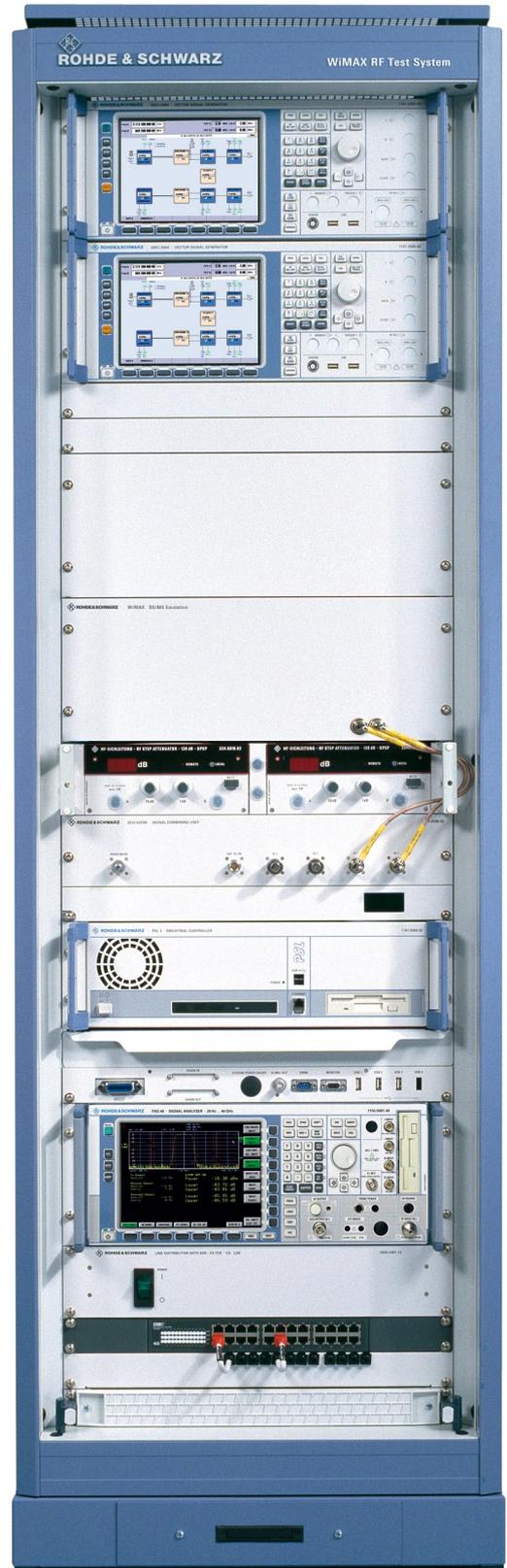


FIG 1
The R&S®TS8970 WiMAX test system covers the frequency range from 400 kHz to 6 GHz.

carrier method are very useful for mobile applications in the frequency range up to 6 GHz. FIG 2 shows the scope of the IEEE 802.16 specification; FIG 3 lists the different WiMAX PHY variants.

This functional expansion not only gives mobile WiMAX the potential to expand second-generation (e.g. GSM, GPRS, EGPRS) and third-generation (UMTS, C2K) cellular mobile radio technologies to include mobile broadband access types. As an application of its own, it also stands ready to offer all voice and data applications that are common in cellular systems. The first commercial networks in accordance with the IEEE 802.16e-2005 mobile WiMAX standard are currently being set up in Korea and the USA.

WiMAX Forum™ ensures conformance

The objective of the WiMAX Forum™ (www.wimaxforum.org) is to deploy the IEEE 802.16 standard in real applications. As an industry association consisting of manufacturers and network operators, the WiMAX Forum™ handles all aspects not covered in the purely technical IEEE specification. The certification program for WiMAX products constitutes a major part of the forum's work (base stations and subscriber stations) and its purpose is to ensure worldwide availability and reliability of WiMAX services. A related

certification working group (CWG) is specifically responsible for the following:

- ◆ Defining certification and test procedures
- ◆ Specifying test cases
- ◆ Selecting test houses
- ◆ Selecting conformance test systems

WiMAX products are tested for compliance with three criteria: protocol conformance, radio conformance, and interoperability. With regard to the last of these three criteria, products from different manufacturers are evaluated for interoperability in one test network. In contrast, the first two criteria require specific test systems.

R&S®TS8970 – the WiMAX radio conformance test system

When selecting a radio conformance test tester (RCTT) for the IEEE 802.16e-2005 mobile WiMAX standard, the WiMAX Forum™ chose the R&S®TS8970 test system from Rohde & Schwarz. Accordingly, the test system was first presented to the public at the WiMAX conferences in Vienna and Korea in May 2006. Concurrently with the ongoing specification work by the WiMAX Forum™, Rohde & Schwarz is implementing all necessary test cases on the R&S®TS8970.

Of course, with respect to signal generation (R&S®SMU200A) and signal analy-

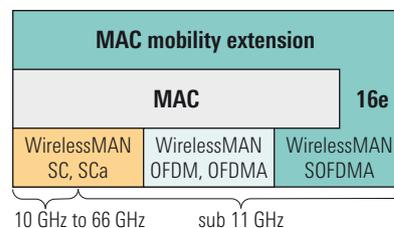


FIG 2 IEEE 802.16 layers 1 and 2 in accordance with the OSI reference model.

sis (R&S®FSQ), the R&S®TS8970 test system is based on high-end instruments from Rohde & Schwarz and exclusively uses their WiMAX-specific options: R&S®SMx-K49 and R&S®FSQ-K93 [1], [2]. An OEM base-station and mobile-station emulator is used for the required signaling. A fully automatic RF switching matrix up to 6 GHz ensures test-case-specific signal switching between the test system and the DUT.

Just like the R&S®TS895x 2G and 3G certification test systems from Rohde & Schwarz, the R&S®TS8970 is operated using the tried-and-tested R&S®RS-PASS system software [3], [4]. Owing to its modular and standard-independent architecture, the soft-

FIG 3 The WiMAX PHY variants.

IEEE 802.16 PHY	Transmission technology	Operating frequency	Application
WirelessMAN-SC (2004)	Single-carrier method	10 GHz to 66 GHz	Backhaul network microwave links
WirelessMAN-SCa (2004)	Single-carrier method	<11 GHz	Stationary subscriber access
WirelessMAN-OFDM (2004)	256 FFT OFDM	<11 GHz	Stationary subscriber access
WirelessMAN-OFDMA (2004)	2048 FFT OFDMA multiple access via subchannels	<11 GHz	Stationary subscriber access
WirelessMAN-SOFDMA (2005)	Scalable OFDMA: 128 FFT, 512 FFT, 1024 FFT	<11 GHz	Mobile subscriber access

ware was able to be implemented in the R&S®TS8970 immediately. The system-specific applications (e. g. fully automatic RF path compensation, system selftest), as well as all administrative and control programs (e. g. version browser, test and sequence editor, parameter and result administration) were able to be used straightaway. Additionally, initial WiMAX-specific test cases were quickly developed using the basic R&S®RS-PASS routines (FIG 4). Moreover, the R&S®TS8970 features another first: complete instrument control via Ethernet.

Summary

The R&S®TS8970 test system expands the Rohde & Schwarz product portfolio for mobile radio certification at just the right time and for a promising technology. The use of tried-and-tested test system architectures as well as the company's outstanding range of self-manufactured products enabled Rohde & Schwarz to make its RCTT solution available in line with WiMAX Forum™ expectations. The thoroughly modular hardware and software architecture offers the necessary flexibility for the test cases to be implemented and makes the R&S®TS8970 a reliable platform for a successful future in mobile WiMAX.

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More information at
www.rohde-schwarz.com
 (search term: TS8970)

REFERENCES

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- [2] Signal Generators R&S®SMx / Analyzers R&S®FSQ / R&S®FSL: WiMAX goes mobile – new T&M solutions are required. News from Rohde & Schwarz (2006) No. 190, pp 24–27
- [3] RF Test Systems R&S®TS8950G / TS8955G: Reliable RF testing of GSM, GPRS and EDGE mobile phones. News from Rohde & Schwarz (2002) Nr. 174, pp 4–7
- [4] Prequalification Tester R&S®TS8955: GSM, EGPRS and WCDMA receiver measurements at a mouse click. News from Rohde & Schwarz (2004) No. 181, pp 4–7

FIG 4 R&S®RS-PASS operating interface on the R&S®TS8970 test system.

	1	2	3	4	5	6	7	8
Enabled	x	x	x	x	x	x	x	x
Temperature	Normal							
Voltage	Normal							
Adj. Ch. Diff. Low in dB	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40	-0.40
Adj. Ch. Diff. High in dB	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
+50 Subtone. Flatness in dB	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
+(50 to 100) Subtone. Flatness	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
-(50 to 100) Subtone. Flatness	-4.00	-4.00	-4.00	-4.00	-4.00	-4.00	-4.00	-4.00
Centre carrier rejection in dB	-15.00	-15.00	-15.00	-15.00	-15.00	-15.00	-15.00	-15.00
DL Level (DUT) Type	Normal							
UL Level (DUT) Type	Max							
DL Freq Type	Band Lo	Band Lo	Band Lo	Band Lo	Band Hi	Band Hi	Band Hi	Band Hi
DL Carrier Offset in Hz	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UL Freq Type	Band Hi	Band Hi	Band Hi	Band Hi	Band Lo	Band Lo	Band Lo	Band Lo
UL Modulation Scheme	BPSK 1/2	QPSK 3/4	16QAM 3/4	64QAM 3/4	BPSK 1/2	QPSK 3/4	16QAM 3/4	64QAM 3/4
Cyclic Prefix Ratio	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
BS Range Req. Response	Normal							
Payload Message	Short BPSK							