

# Maximize WiMAX™ data throughput Application

Reaching the physical throughput limits with the R&S®CMW270 WiMAX™ communication tester

The R&S®CMW270 WiMAX™ communication tester is a unique all-in-one solution for in-depth testing of mobile terminals.



## Your task

Mobile WiMAX™ in line with IEEE 802.16™ enables wireless Internet access at high data rates. Network operators and end users alike require maximum data throughput for typical IP-based applications. This challenges design engineers to optimize their WiMAX™ mobile terminal designs to get as close as possible to the physical throughput limits from SISO up to 2x2 MIMO Matrix B.

The achievable data rate is basically determined by the capacity of the interfaces involved. The capacity of the critical air interface depends on the OFDMA signal structure and the duplexing scheme. Both are determined by the physical layer (PHY).

To discover possible throughput limitations, communications data handling between the base station and the mobile terminal must be carefully evaluated. Only application-based testing enables the full functionality of a mobile terminal to be verified. However, the test equipment must measure the real data throughput of the device under test (DUT) without limiting the measurement results.

## T&M solution

The R&S®CMW270 is the ideal solution for extended end-to-end (E2E) performance tests and enables throughput measurements up to the physical limit of 31.6 Mbit/s in DL, 2x2 MIMO. This is possible because the WiMAX™ signaling stack of the R&S®CMW270, consisting of PHY and protocol (MAC) layer, supports maximum data rates in downlink and uplink.

WiMAX™ is designed primarily for Internet applications, most of which are based on the Internet protocol (IP) and a client-server-architecture, which is also used for throughput measurements.

A typical test setup consists of a network server that processes and sends IP data of common WiMAX™ applications via Ethernet to the R&S®CMW270. The tester operates as a WiMAX™ base station emulator and transmits the data packages over the air interface to the DUT. The client, integrated in the DUT or connected to it, decodes and displays the received data stream.

Dedicated application performance tests are used to carry out detailed throughput evaluation between the server, the R&S®CMW270 and the client. A UDP-based measurement, for example, results in about 30.6 Mbit/s for a WiMAX™ 2x2 MIMO downlink signal with 64QAM 5/6 modulation. The difference between the measured UDP and the physical throughput value is due to the protocol overhead added to the data in the upper layers. This shows the R&S®CMW270 fully supports the maximum throughput rates.

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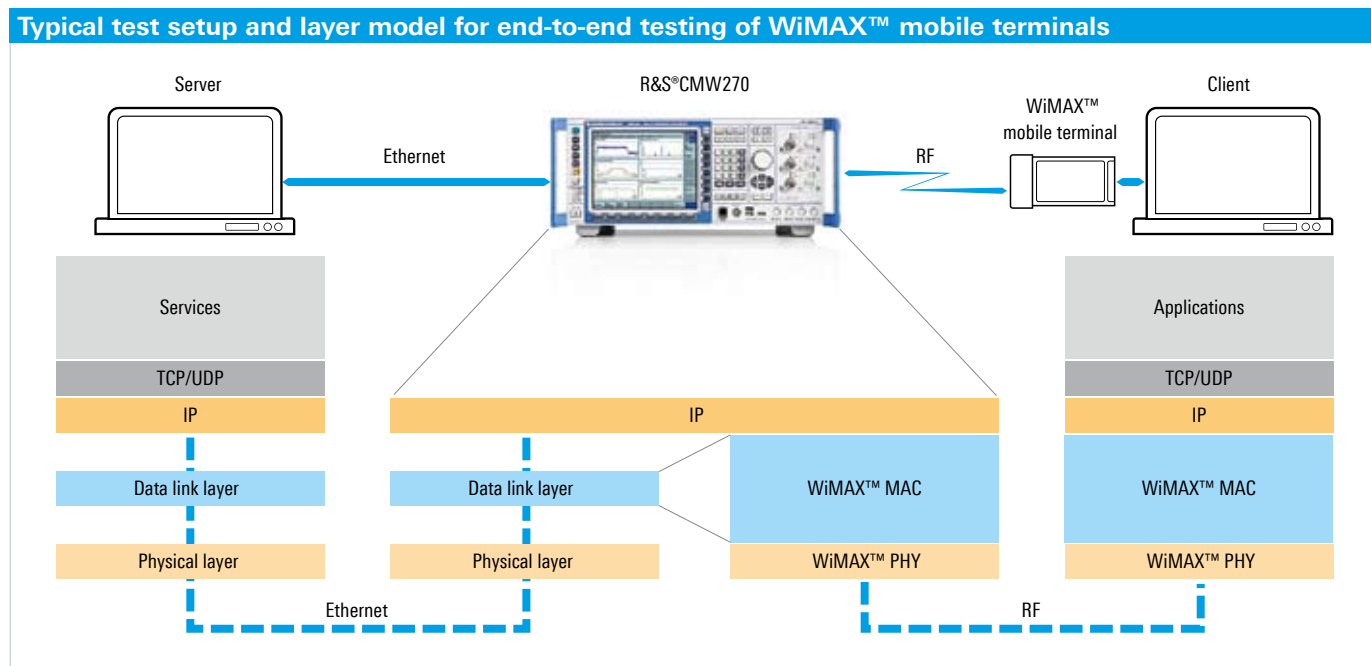
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Maximize WiMAX™ data throughput

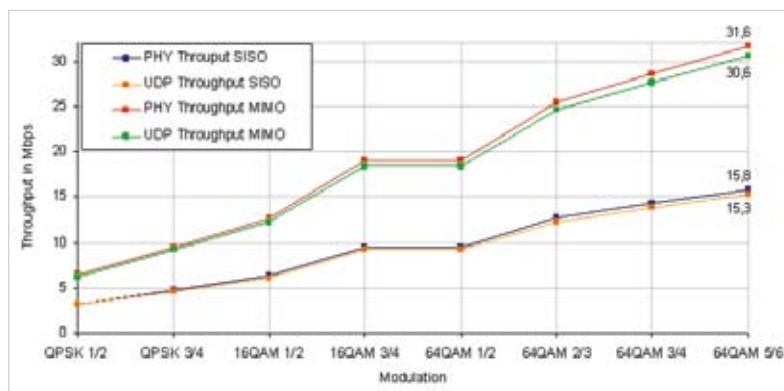
The R&S®CMW270 combines extensive E2E tests with simultaneous in-depth analysis of MAC and PHY layers. Main RF parameters, including EVM and spectral flatness, are measured in parallel, saving time and resources. The capability to modify PHY and MAC layer parameters and to generate test cases that simulate a realistic WiMAX™ network, enable faster and easier detection and location of the source of a performance limitation. By using the R&S®CMW270, engineers can optimize the performance of their mobile terminal designs.

The R&S®CMW270, a unique all-in-one solution, is based on a future-ready platform, which is prepared for MIMO tests and for tests under channel fading conditions. This makes the R&S®CMW270 a cost-efficient WiMAX™ test solution that yields reliable and reproducible results for all stages of mobile terminal testing – from R&D through to production.

For further information see also Application Note **1SP10**: WiMAX™ Throughput Measurements using R&S®CMW270.



Modulation & coding rate	PHY throughput [Mbit/s]		UDP throughput [Mbit/s]	
	SISO	MIMO	SISO	MIMO
64QAM 5/6	15.8	31.6	15.3	30.6
64QAM 3/4	14.3	28.6	13.8	27.6
64QAM 2/3	12.7	25.4	12.3	24.6
64QAM 1/2	9.5	19.0	9.2	18.4
16QAM 3/4	9.5	19.0	9.2	18.4
16QAM 1/2	6.3	12.6	6.1	12.2
QPSK 3/4	4.7	9.4	4.6	9.2
QPSK 1/2	3.2	6.4	3.1	6.2



Maximum PHY and UDP throughput versus modulation and coding for DL, TDD operation at 10 MHz bandwidth and DL:UL symbol ratio of 35:12.

The R&S®CMW270 enables UDP data throughput measurements up to the physical limit. The small difference compared to the physical throughput is due to the upper layer overhead.

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