

# Radio network scanner with two receiver frontends and a digital I/Q data interface

The new R&S®TSMW universal radio network analyzer is a high-performance radio network scanner for optimization of all current wireless communications networks. It has been specially developed for applications requiring fast measurement and analysis of digital baseband data. Equipped with two highly sensitive frontends for any input frequencies between 30 MHz and 6 GHz, it provides unsurpassed performance.



## Compact, upgradable platform for mobile baseband measurements

The new R&S®TSMW universal radio network analyzer (FIG 1) is a versatile and powerful platform for measuring digital baseband data via the air interface in mobile operation. In addition to its basic application as a wireless communications analyzer in conjunction with the R&S®ROMES coverage measurement software, the R&S®TSMW can be equipped with a high-performance digital I/Q data interface (R&S®TSMW-K1 option) for the direct measurement of baseband data. This opens up a wide range of customer-specific applications in test & measurement as well as in research & development.

The analyzer is controlled via Gigabit Ethernet from a host PC running Windows XP®. The digital I/Q data interface is implemented as a universal and high-performance software interface using a C++ DLL. For example, it provides convenient functions to start parameterized measurements or download measurement data in various formats. In addition, the option includes an equivalent MATLAB® interface. This opens up virtually unlimited capabilities for analyzing measured baseband data, or for the fast and simple creation of signal processing algorithms. These algorithms can then be ported to C++ with next to no effort in order to achieve higher performance. The analyzer can also be used for performing calibration measurements on tools used for radio network planning.

**A tabular overview of the various radio network analyzers available from Rohde & Schwarz is given in the article on page 9. This article describes a complete test solution for WiMAX™ provided by the R&S®TSMW in conjunction with the R&S®ROMES software.**

The core of the R&S®TSMW is formed by an FPGA board that is configured by means of a CompactFlash card. This future-oriented SDR technology (SDR = software defined radio) enables a wide range of applications and also ensures that this versatile platform can be used as the basis for future developments.

## Two independent frontends, each featuring 20 MHz bandwidth

At the RF end, the R&S®TSMW is equipped with two highly sensitive frontends, each with a bandwidth of 20 MHz and a preselection. This allows both independent measurements at different center frequencies and synchronized measurements at the same center frequency. The integrated preselection provides sufficient protection against intermodulation products and, with its preamplifier and attenuator, ensures a wide dynamic range. For example, at a center frequency of 3.5 GHz, the R&S®TSMW achieves a typical noise figure of 7 dB when set to maximum sensitivity, but can also handle extremely high input levels.

## Time-synchronized and frequency-synchronized measurements also from MATLAB®

The strengths of the R&S®TSMW lie not only in its excellent RF performance, but also in its versatile capabilities regarding measurement configuration, triggering and filtering. The frontends cannot only be driven internally via the built-in GPS receiver or externally in synchronism with a 10 MHz source. The R&S®TSMW can also perform time-synchronized measurements. The measured baseband data is time-stamped by means of internal I/Q clock counters. Once a periodic signal such as a WiMAX™ downlink burst has been recorded and its start time and repetition period have been determined, a measurement on one of the subsequent downlink bursts can be triggered exactly at the desired time, i.e. with the accuracy of the clock signal. This type of measurement can even be triggered from an environment that offers virtually no realtime capabilities such as MATLAB®. If no exact time information is available on the controlling host PC for the start of a measurement, a measurement can be triggered directly on the R&S®TSMW if a pulse is present at one of its trigger inputs.



FIG 1 The R&S®TSMW is an SDR-based high-performance radio network analyzer for optimizing all current radio networks.

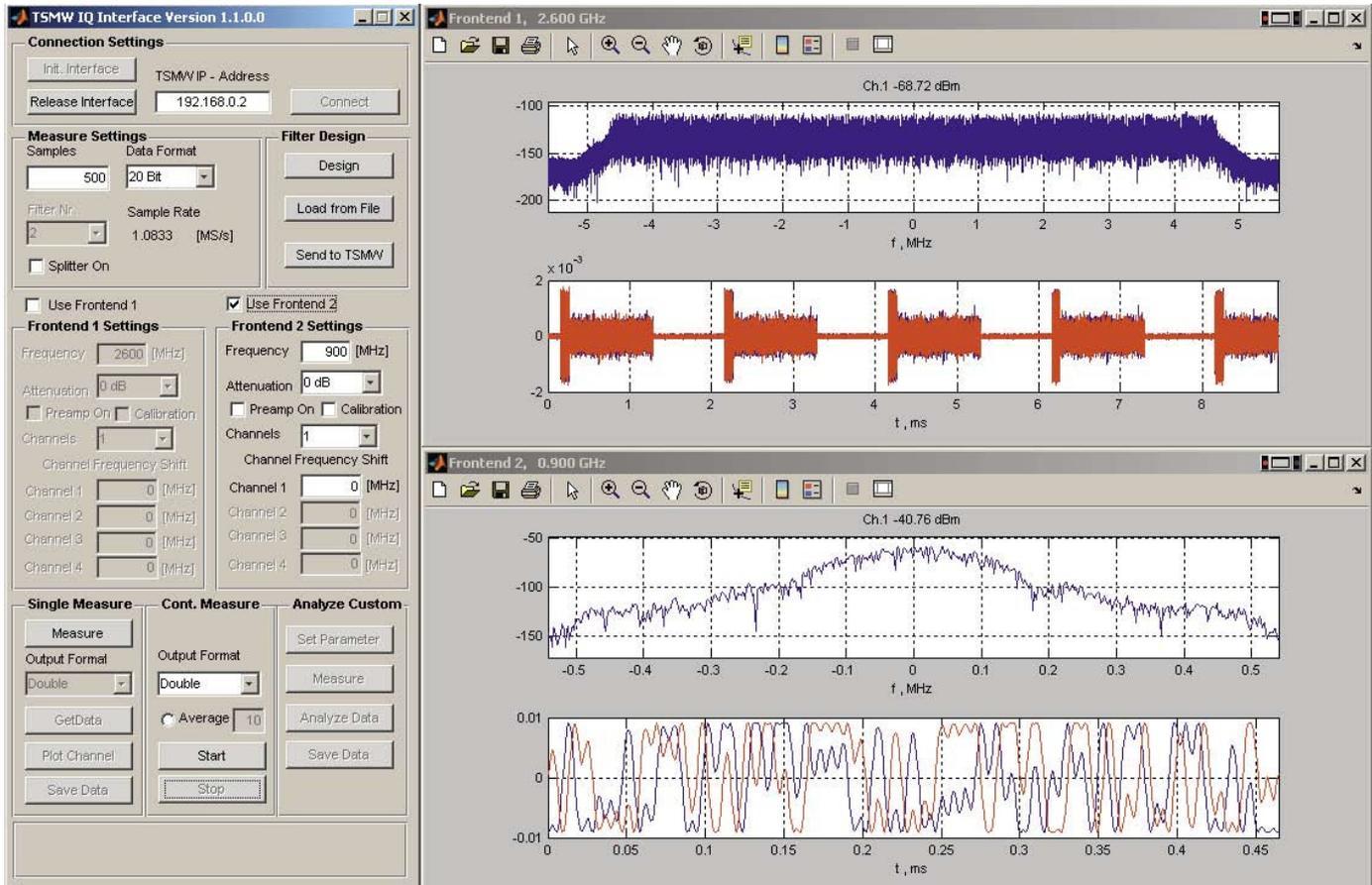


FIG 2 Example application in MATLAB® for the I/Q data interface of the R&S®TSMW: measurement of a 10 MHz WiMAX™ signal with a sampling rate of 11.2 Msamples/s with frontend 1, and a GSM signal with 1.0833 Msamples/s with frontend 2 (in each case with appropriate filtering and fractional sampling rate reduction).

## Wide streaming bandwidth due to Gigabit Ethernet and data compression

To maximize measurement rates – even when using a notebook – measured data can be compressed into blocks of  $2 \times 8/12/16/20$  bits per complex I/Q sample before it is transmitted to the host PC. Measurements can thus be configured either for maximum dynamic range or maximum measurement rate. This is particularly important for applications in which I/Q data has to be recorded over several minutes or even hours. A sampling rate of 5 Msamples/s and compression into  $2 \times 8$  bits per sample, for example, would generate only around 80 Mbits of measured data per second, a volume that can easily be handled by the Gigabit Ethernet interface.

## High-sensitivity GPS receiver

The R&S®TSMW has an integrated, highly sensitive GPS receiver that can also easily be addressed via the C++ interface or MATLAB®. In addition to position determination, the GPS information can also be used for frequency and time synchronization. The inherent deviation of the local oscillators in the R&S®TSMW frontends from those in the wireless communications transmitters can thereby be significantly reduced, which simplifies and speeds up synchronization with the radio network.

## Compact design and flexible power supply

Despite the high versatility of the R&S®TSMW, its designers have managed to produce a compact device for mobile applications. The analyzer's wide input voltage range from 9 V to 18 V DC enables operation in vehicles. For battery operation, its total power consumption of approx. 70 W can be significantly reduced by using an optional operating mode that activates only one of the frontends.

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