



Conformance test system with unique test coverage

With its combination of test coverage and usability, the next-generation R&S®TS8980 conformance test system outperforms any other solution on the market. For RF and RRM* tests on wireless user equipment, it meets all current, relevant requirements established by the GCF and PTCRB certification authorities and the most prominent network operators. And it is the only system to cover all standards from GSM to LTE-Advanced.

* Radio resource management



Fig. 1: The R&S®TS8980 (shown here in various configurations) is optimized for 24/7 operation and offers full remote control combined with exceptional measurement accuracy. More than 20 reference test systems operate around the clock at Rohde & Schwarz for the development, test and support of 140 customer systems.

New wireless communications standards set the pace

The growth of the wireless communications market continues unabated. To ensure that the required resources are available, network operators are equipping their base stations with an economical mix of established wireless communications standards (e.g. GSM) and new developments (e.g. LTE). The various demands placed on user equipment (UE) have grown in parallel, because these devices must ensure the best possible access to services provided by the network operator, both within the home network and while roaming. And they must accomplish all this via whatever wireless communications standards are currently in place. As a result, user equipment in most countries now handles GSM, WCDMA, LTE and lately also LTE-Advanced.

While GSM utilizes a very manageable four frequency bands, LTE has increased to more than 25 and is trending higher. LTE-Advanced adds numerous band combinations that must be tested. This alone is enough to increase the number of conformance tests needed for UE. But the sheer number of devices that must undergo these tests is also growing, as UE expands to encompass not only mobile phones, but also notebooks, tablets and integrated modules, such as those found in motor vehicles.

Moreover, special requirements are continually introduced by network operators, who request additional tests for their specific network situations. To improve the quality of their services even further, operators require, for example, adjacent channel immunity tests for two bands located in very close proximity to one another.

All of these requirements call for easy-to-use conformance test systems that can perform needed tests quickly and fully automatically. Ideally, the conformance test systems support all required tests so that the device under test (DUT) needs to be configured and connected only once.

Development teams additionally need access to the entire range up to the limits so that they can find ways to implement highest performance at lowest cost. This requires functions such as margin search, sweep mode and simultaneous control of a connected climatic chamber with a temperature range from $-50\text{ }^{\circ}\text{C}$ to $> +50\text{ }^{\circ}\text{C}$.

Unique test scope and usability

The R&S®TS8980 conformance test system (Figs. 1 and 2) is the only system in the world that already meets these extensive requirements today. It covers not only the established wireless communications standards with its GSM and WCDMA support, but also their leading edge successors LTE and LTE-Advanced. Moreover, these standards can all be tested on the same test system and in a single test sequence. The system is designed for fully automated, round-the-clock operation, with full remote control and continual transmission of test results to any selected database server. It independently sends configurable e-mail notifications to the operator when user intervention is required, and it automatically repeats tests as needed based on defined criteria.

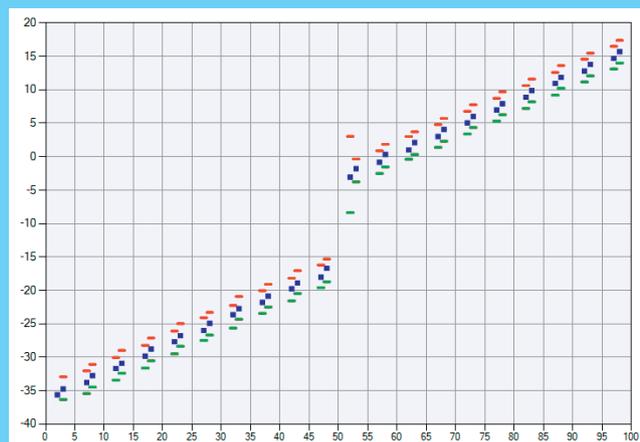
This extensive scope of functions brings distinct advantages to the operations of the three largest user groups of the R&S®TS8980:

- **Test houses** can already begin processing of results during the test run, inform their customers about any necessary rework and compile the information needed for certification
- **Chipset or UE manufacturers** can already set their global development teams to work on future developments during the test run, then update the DUT firmware from any site and immediately test changes
- **Network operators** can fully concentrate on their bottom line by running acceptance tests on new devices efficiently, with the most automation and the least effort possible

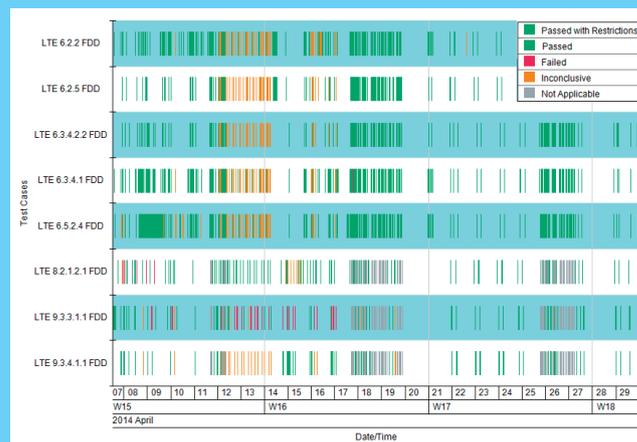


Fig. 2: Depending on customer requirements, the R&S®TS8980 test system can be delivered in a space-saving configuration (on the left) or in a configuration with wider test coverage – both configurations support LTE-Advanced. See Fig. 1 for additional configurations.

Examples of new measurement functions provided by the R&S®TS8980



Power vs. subframe measurement. During the test sequence, the test results are displayed on the screen in realtime together with the limits defined by the 3GPP standard. (Blue: power in dBm, with upper and lower limit in red and green).



The R&S®CONTEST sequencer software offers a wide variety of analysis functions. For example, the verdict vs. time function shows the effect of new DUT firmware version versus time.

RF and RRM on one system

In addition to RF tests on the physical layer, a single test plan can also include handover and cell reselection tests as part of radio resource management (RRM). In particular, test sequences for smartphones with their advanced functions benefit from this expanded test coverage. The supplemental CDMA2000® and TD-SCDMA standards available for RRM additionally facilitate acceptance testing for divergent target markets without requiring separate test systems. Even speech and data quality tests (SVLTE and SGLTE) are available when simultaneously using CDMA2000® and LTE, for example.

Support for LTE TDD and LTE FDD

A special characteristic of LTE and LTE-Advanced is the availability of two modes: LTE FDD and LTE TDD. Frequency bands for both modes have meanwhile been put into service in all large markets, and leading manufacturers have already announced that all future wireless devices will include both modes.

Rohde&Schwarz is the only manufacturer that has placed great emphasis on developing both modes from the outset, so that today the R&S®TS8980 is the system with the most comprehensive test coverage for these two LTE modes. The strong commitment of Rohde&Schwarz to LTE TDD was recognized by the largest network operator in the world, China Mobile, which honored the R&S®TS8980 with the distinguished GTI Award this year.

Thanks to its modular design the test system can be precisely customized to any application. For example, customers who initially only need test capacity for GSM and LTE can later easily add WCDMA and LTE-Advanced – with minimal impact on the hardware (Fig. 2).

The most compact system in its class

Although the R&S®TS8980 has already been the most compact test system in its class, the introduction of tunable filters made it possible to further reduce the space requirements. A single rack now provides complete RF test coverage for GSM, WCDMA, LTE and LTE-Advanced, including two downlink component carriers. As a result, valuable space is made available in shielded chambers for additional test equipment.

The new tunable filters (Fig. 3) can be combined with the existing band filters to increase the available frequency range to values between 450 MHz and over 3500 MHz, providing a wider bandwidth than any other conformance test system of this type.

Full automation for more complex designs

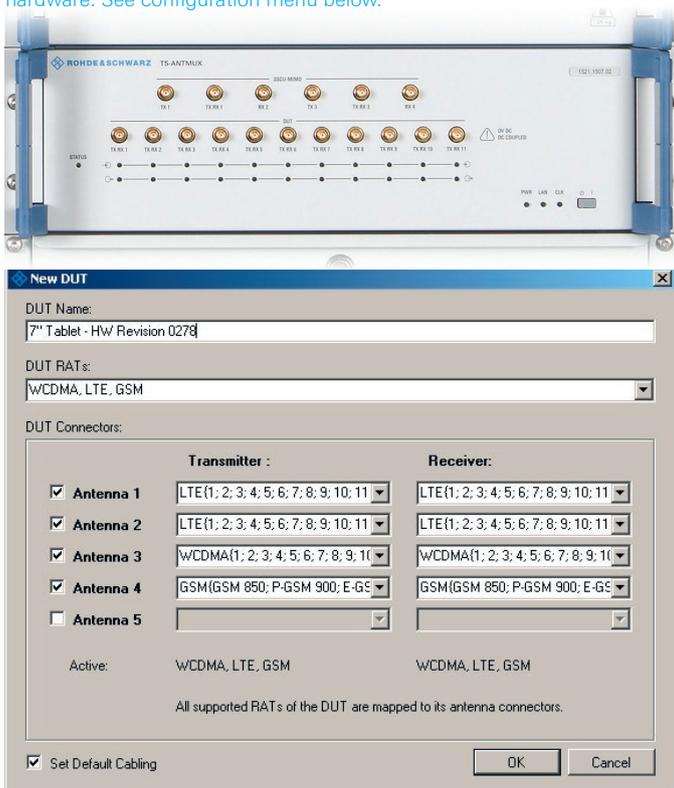
With the introduction of carrier aggregation in LTE-Advanced, wireless communications modules have become more complex than ever before, making it necessary to redesign the RF path between the amplifier and the antenna. One way that manufacturers are dealing with this new complexity is

to assign the frequency bands or standards to the various antennas in the wireless devices. Until recently, this required a manual reconfiguration of the RF cabling during the test sequence – bringing with it an additional source of errors as well as requiring manual intervention, for which the time cost cannot be estimated.



Fig. 3 (detail from Fig. 1): A single, tunable filter replaces more than 25 individual filter modules from the previous design – and still fulfills the higher UE output power requirements for GSM or LTE HPUE (high-power user equipment).

Fig. 4 (detail from Fig. 1): The new antenna multiplexer makes it possible to test even complex antenna configurations without additional external hardware. See configuration menu below.



These problems are avoided with the new antenna multiplexer (Fig. 4), which can be used to assign the frequency bands and wireless communications standards to the available antennas in just about any configuration. This permits manufacturers more flexibility with design and allows full and unrestricted automation during conformance testing.

The leader in new wireless communications standards

As early as 2013, the R&S®TS8980 took the next big step in public wireless communications with the introduction of initial tests for LTE-Advanced. As a result, the scope of tests has been expanded to cover three major topics from 3GPP Release 10:

- Carrier aggregation for two downlink carriers (CA 2DL)
 - Permits data rates of up to 300 Mbit/s – on a single UE
- Enhanced inter-cell interference coordination (eICIC)
 - In today’s advanced, heterogeneous networks consisting of large and small cells, this is a key feature for achieving higher data rates by optimized interference management
- Enhanced downlink multi-antenna transmission (eDL-MIMO)
 - The newly defined transmission mode 9 permits for the first time up to eight MIMO layers in the downlink, plus multi-user MIMO

The next developments are already being prepared, so that customers can verify and certify the latest technologies on their wireless UE:

- Carrier aggregation for two uplink carriers (CA 2UL)
- Carrier aggregation for three downlink carriers (CA 3DL)
- Coordinated multipoint transmission (CoMP)

Summary

Through the use of the latest Rohde & Schwarz T&M instruments, including the R&S®FSW signal and spectrum analyzer and the R&S®SMW200A vector signal generator, plus continually updated switching and filter technologies, the R&S®TS8980 conformance test system has become the gold standard for testing next-generation wireless devices. The wide range of upgrade options allows customers to use and expand their investment flexibly over many years. Just as its predecessor, the R&S®TS8950, set the pace for GSM and WCDMA, the R&S®TS8980 has taken on the same role for LTE and LTE-Advanced while remaining a high-quality replacement for the previous generation of test systems.

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