Universal Radio Communication Tester R&S®CMU 200

CMU goes Internet: Testing data applications for WCDMA

In addition to testing data applications for CDMA2000® [1] and (E)GPRS [2], the R&S®CMU 200 can now also test these applications on WCDMA mobile phones. The highly successful mobile radio tester, which was originally designed as a pure RF tester, now enables additional user groups to test video telephony and data applications.

Appealing compact solution

Both developing and providing data applications for mobile radio present a multitude of new challenges. Most applications in data communications are based on the Internet protocol (IP), which in turn is based on the client-server principle. This means that a client uses a mobile phone to request services that are provided by a server in the communications network. The software for these applications is usually developed on PCs; after its implementation and extensive computer simulations, the software is ported to the mobile phone. To perform further tests on the mobile phone itself, a public mobile radio network or the simulation of such a network is required.

Up to now, radio networks could usually be simulated only with the aid of complex setups. This is remedied by the R&S®CMU 200, which is a very interesting alternative for such tasks. Due to the extensive possible settings it offers, tests can also be performed on frequency bands, for example, that are not necessarily part of an available public radio network.

Before communications services can be launched on the market, network operators must subject them to interoperability tests to ensure that they operate smoothly. With the multimedia message service (MMS), for example, the correct exchange of messages with the server implementation in the network

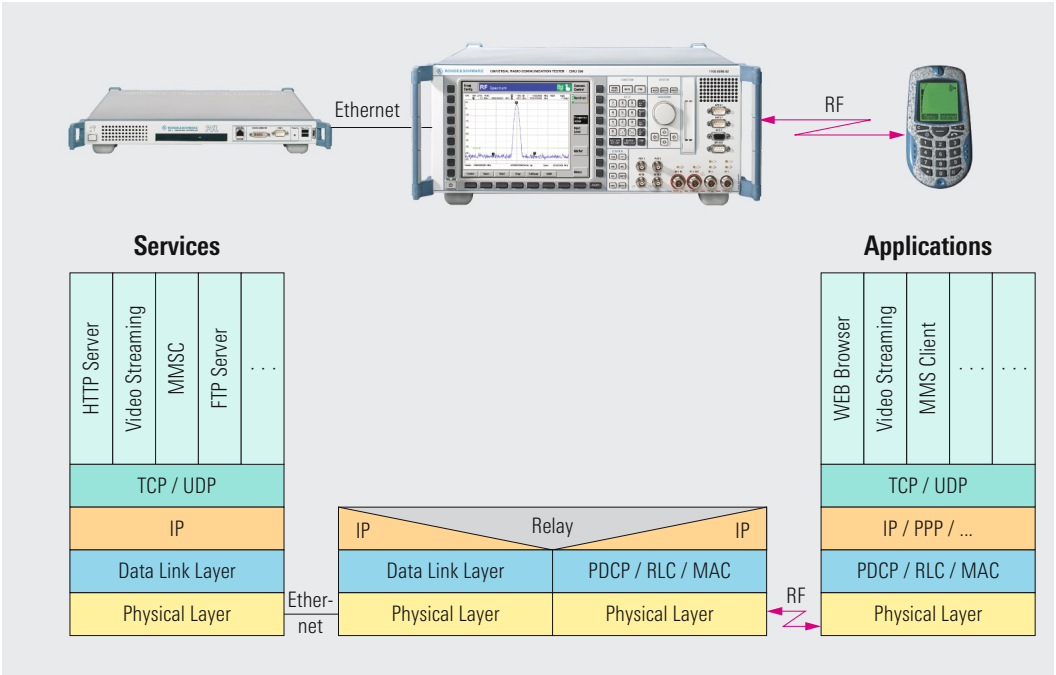


FIG 1
WCDMA application test setup and protocol stack.

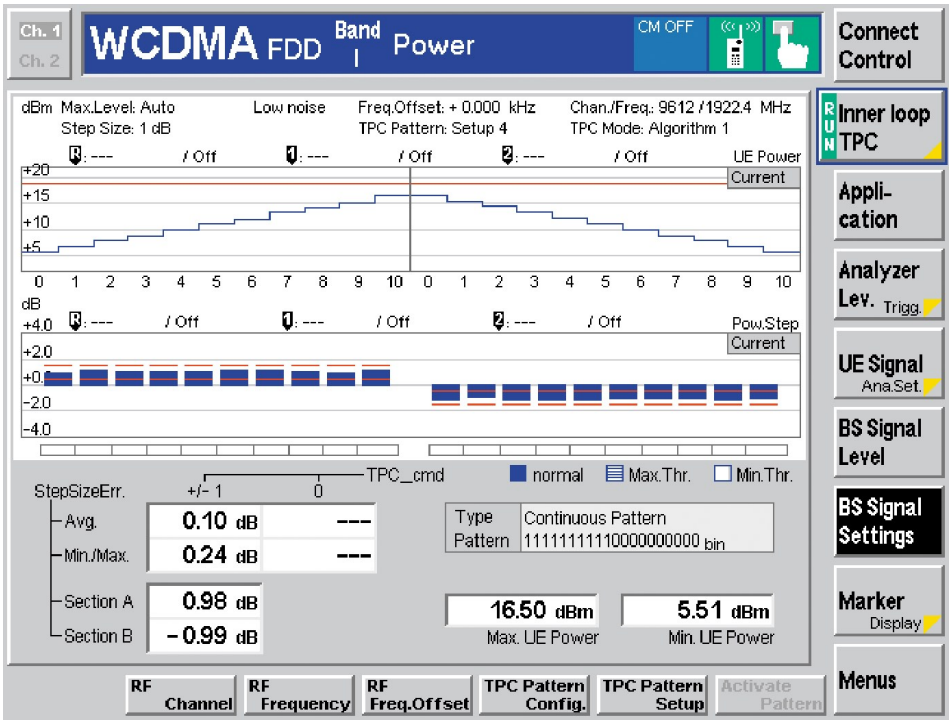


FIG 2 Example of a transmitter measurement.

or between mobile phones from different manufacturers is checked. Moreover, making objective comparisons under user-definable and randomly reproducible operating and test conditions is another pivotal function this target group needs.

Test setup

Application test setups basically consist of a mobile phone, the R&S®CMU 200 and a PC (FIG 1). The mobile radio tester, which is connected to the mobile phone via the radio interface, simulates the mobile radio network. Via an Ethernet connection, it accesses the IP-based computer world, which can be either a local area network (LAN), the Internet or, at its simplest, a controller, where the servers providing the communications services can be accessed. The user usually accesses these services from the mobile phone via mobile originated calls. The R&S®CMU 200 bridges the gap between wired data communications and radiocommunications across various protocol layers.

Versatile test scenarios

Go / NoGo tests start an application on the mobile phone and test the operation from the user's viewpoint. These tests differ from RF measurements performed with the R&S®CMU 200 by covering the entire operating system of a phone and subjecting it to the appropriate stress. After an application passes this basic test, performance measurements are usually carried out; their aim is to analyze the achievable data transmission rates in the downlink and the uplink.

Another noteworthy criterion that helps determine the practical value of mobile phones is their operating time with rechargeable batteries. To minimize a phone's power consumption, you need to measure the consumption while an application is active so that you can find out more about possible optimization procedures. If required, the mobile radio tester simultaneously records detailed information about the processed protocol layers in a log file, which is then available for future evaluation and analysis.

Interaction tests analyze how different, simultaneously active applications on a mobile phone affect each other. These tests analyze, for example, what will happen if an SMS arrives while a video is being downloaded and the calendar function is outputting an alarm.

Interoperability tests check whether mobile phones function smoothly within a network, for example when interacting with the network operator's MMS server, or when two phones from different manufacturers interact with each other. In the simplest case, just one phone is used in the loop-back mode to perform a combined transmission/reception test.

Settings and measurement results

To configure the WCDMA radio network for application tests, the R&S®CMU 200 parameter settings known from the RF measurements can be used and dynamically adjusted during testing. Changing the channel numbers triggers an intracell handover, for example. Since a reduced transmit level increases the bit error probability at the receiver end, an application function on a mobile phone can also be tested under adverse receive conditions. If the application test is performed in compressed mode, the mobile phone is subjected to additional stress, which allows you to check the quality of the UE report transmitted from the mobile phone to the tester. While an application is running on the mobile

phone, the known transmitter measurements such as power, code domain power and modulation can still be performed (FIG 2). The block error ratio (BLER) determined by the R&S®CMU 200 is used to evaluate the receiver in the mobile phone.

In combination with an additional fading simulator such as the R&S®ABFS, the function of an application can be simulated at different speeds in vehicles and in varying environments.

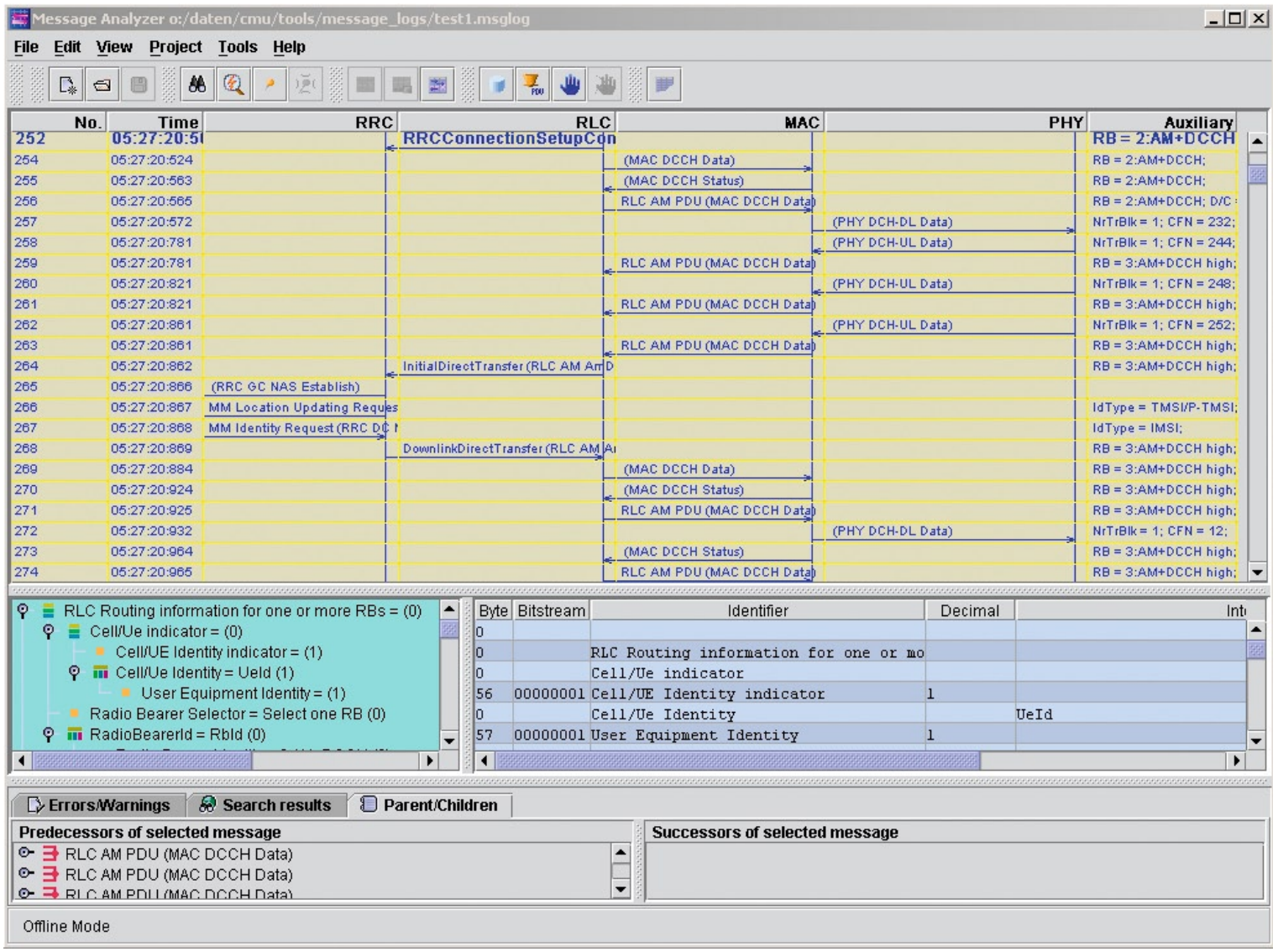
Remote control and automation

To remote-control the R&S®CMU 200 during application tests, an IEC/IEEE bus interface is available; it can be used, for example, to automatically obtain measurement results and measurement values – a prerequisite for program-controlled sequences. Such automatically running tests can be repeated at any time and as often as necessary without staff intervention, thus helping to increase the system's efficiency.

Protocol analysis

After the software has been ported to the mobile phone, users often want to record protocols to optimize internal processes or to perform an error analysis that may be necessary. The R&S®CMU-Z46 WCDMA message analyzer and recorder option allows all universal terrestrial radio access network (UTRAN) protocol layers to be recorded, which can then be used for more detailed analysis (FIG 3). This powerful tool permits in-depth analyses, including transport layer analyses.

FIG 3 The R&S®CMU-Z46 WCDMA message analyzer and recorder option records all UTRAN protocol layers.



TCP/IP services

The clients on the mobile phone require suitable servers at the controller end as a counterpart for application tests. The R&S®CMU-K96 WCDMA application testing option allows IP-based data applications to be tested on a mobile phone; in addition, it includes several TCP/IP servers, for example an HTTP server, which allows you to start a web browser on a mobile phone. Another server is the MMS center (MMSC) with basic functionality, which can be used to test the transmission and reception of multimedia messages on a mobile phone.

The R&S®CRTU-AA01 option helps develop or test the MMS features on a mobile phone; this option is a powerful development tool for analyzing and synthesizing MMS and is equipped with an MMSC plus integrated viewer, parser and composer.

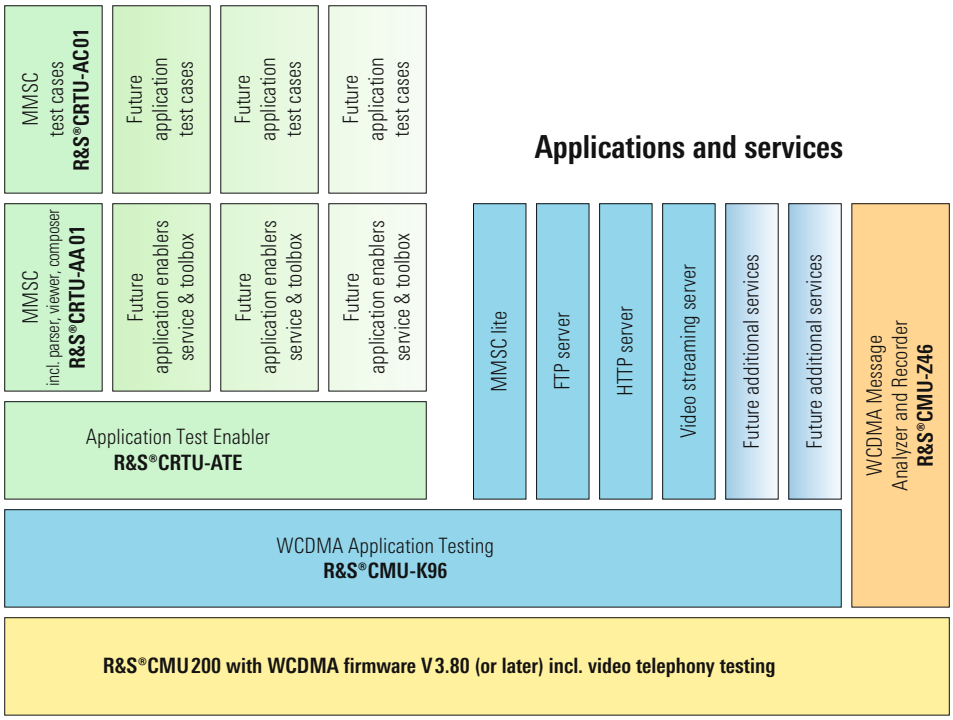


FIG 4 Overview of the range of options to complement the R&S®CMU200 for testing WCDMA data applications.

Test cases relevant for certification

To ensure a uniform MMS standard, test cases that verify the correct reproduction of various multimedia content [3] were defined on behalf of the Global Certification Forum (GCF). The application test on the R&S®CMU200 can be further expanded by the R&S®CRTU-AC01 MMSC test cases option with validated test cases. These need to be certified for all mobile phones that support MMS (FIG 4).

Video telephony

In all likelihood, video telephony is the most spectacular new WCDMA application. It is unique in that it is circuit-switched, and not IP-based like the previously described applications. The WCDMA firmware checks this functionality without requiring optional extensions. The test is performed in echo mode, where the transmission and reception of video and audio signals can be checked with just one mobile phone. The video telephony signals transmitted by the phone to the R&S®CMU200 are looped back from the radio tester and displayed by the phone as would-be video and audio signals of a called station.

Future prospects

The application test is the latest add-on to radiocommunications testing and sure to gain increasing importance over the next few years. Rohde&Schwarz will continue to enhance the functional scope of the R&S®CMU200's current test functions to match market requirements. The next steps to be taken include the expansion to high speed downlink packet access (HSDPA) and, once a uniform worldwide standard has been specified, to test cases for push to talk over cellular (PoC).

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More information and data sheet at www.rohde-schwarz.com (search term: CMU200)

REFERENCES

[1] R&S®CMU200: Testing CDMA2000® data applications. News from Rohde&Schwarz (2004) No. 182, pp 11–13

[2] R&S®CMU200: Versatile application tests in (E)GPRS mobile radio. News from Rohde&Schwarz (2004) No. 184, pp 10–13

[3] Protocol Tester R&S®CRTU-G/-W: MMS tests on multimedia mobile phones. News from Rohde&Schwarz (2005) No. 185, pp 4–6