

Testing cdma2000 data applications

With the commercial launch of third-generation mobile radio network standards, there is an increasing demand for test equipment to verify the proper functioning of data applications. This presents a new challenge to mobile radio testers that falls between pure RF parameter tests and sophisticated protocol tests. Standard cdma2000 mobile radio networks have already been in commercial use since 2000 in many Asian countries (e. g. Japan and South Korea), the Americas (e. g. the USA and Canada), as well as in Eastern Europe. The R&S®CMU 200 [1] now offers extensive test capabilities for data applications for this important global 3G standard.

Extensive test capabilities

The cdma2000 1x mobile radio standard, which was developed by the 3GPP2 standardization body, is officially recognized by the ITU as an IMT-2000 standard for the third mobile radio generation (3G). Revision 0 (or A), which is now in commercial use, allows data rates of up to 307.7 kbit/s in a 1.25 MHz frequency channel. Once further optimization stages have been completed, Revision D (also known as 1xEV-DV) will allow a maximum data rate of 3.09 Mbit/s in the forward link (base station to mobile station) and 1.53 Mbit/s in the reverse link (mobile station to base station).

In 3G networks, data links based on the Internet protocol are playing a more and more significant role. This calls for new test procedures designed to verify the functionality of IP-based links. For example, the TIA/EIA standard TIA-898 [2] specifies data rate measurements for FTP links.

Numerous test scenarios are conceivable, including data rate measurements under ideal RF conditions, as well as with fading or during handoff, and var-

ious application tests (e. g. access to mail servers, web meetings, etc). In the past, such tests required access to a real network. Now, you can perform these tests without a network by using the Universal Radio Communication Tester R&S®CMU 200, which offers a wide range of configuration options.

Service Option 33

In its Service Option 33, the TIA/EIA standard IS-707-A-1 [3] specifies IP-based data links for the cdma2000 standard. The R&S®CMU 200 provides all parameters required for this service option, ranging from traffic channel configuration (data rates of up to 153.6 kbit/s can be set for the supplemental channel (SCH) both for the forward and the reverse link) through to the parameters for mobile IP and authentication (FIG 1).

PPP authentication

For setting up a point-to-point protocol (PPP) link, the R&S®CMU 200 can be configured to request PPP authentication from the mobile phone. The R&S®CMU 200 supports two methods of authentication: CHAP (challenge handshake authentication protocol) and PAP (password authentication protocol). ▶

Required options for cdma2000 application tests

R&S®CMU-B83	cdma2000/IS-95 signalling unit
R&S®CMU-U65	3G measurement DSP and performance accelerator
R&S®CMU-B87	message monitor
R&S®CMU-K83 to -K86	software options for the various cdma2000 bands: 450 MHz/cellular/PCS/IMT-2000
R&S®CMU-K87	cdma2000 data test

- ▶ On receiving the authentication request, the mobile phone returns the user name and the password entered for the link setup. The tester checks whether the user name and password are valid. For the CHAP protocol, periodically repeating authentication can be configured. For mobile IP links, the mobile IP standard stipulates that authentication be deactivated.

Mobile IP

Mobile IP is an addition to the conventional Internet protocol. It makes the movements of a mobile computer (mobile node, i.e. in this case a mobile phone) transparent for data applications and the higher protocol layers. In addition to its home IP address, to which all data packets are sent, the mobile phone is assigned a care-of address when changing to a foreign network. The mobile phone automatically registers with its home agent, i.e. a computer in

its home network, by using this care-of address. All data packets received at the home IP address are then forwarded to the care-of address by the home agent.

A mobile IP environment involves two new network elements – the home agent and the foreign agent. The home agent is located in the mobile phone's home network; it knows the mobile phone's current location and "tunnels" data packets directed to the mobile phone's home address to the mobile phone's current location. The foreign agent assigns the mobile phone a temporary address (foreign agent care-of address) in the foreign network and functions as the terminal point of the tunnel departing from the home agent.

The IP addresses for the mobile phone's foreign agent and home agent can be defined on the R&S®CMU 200, thus allowing data packets to be exchanged

between the foreign agent and the mobile phone.

Alternatively, the R&S®CMU 200 can simulate part of the mobile phone's IP functionality when no external foreign or home agent is available. A stand-alone mode for mobile IP links can thus be implemented, substantially simplifying test setup.

PPP link status

During periods in which the mobile phone is not transmitting or receiving data, it switches to an idle state referred to as dormant mode. In this mode, the PPP link is maintained, but no traffic channel connections are set up in the cdma2000 network. The R&S®CMU 200 indicates the various PPP states the mobile phone can assume:

Registered mobile phone is registered, no PPP link is established

FIG 1 Data link configuration options of the R&S®CMU200.

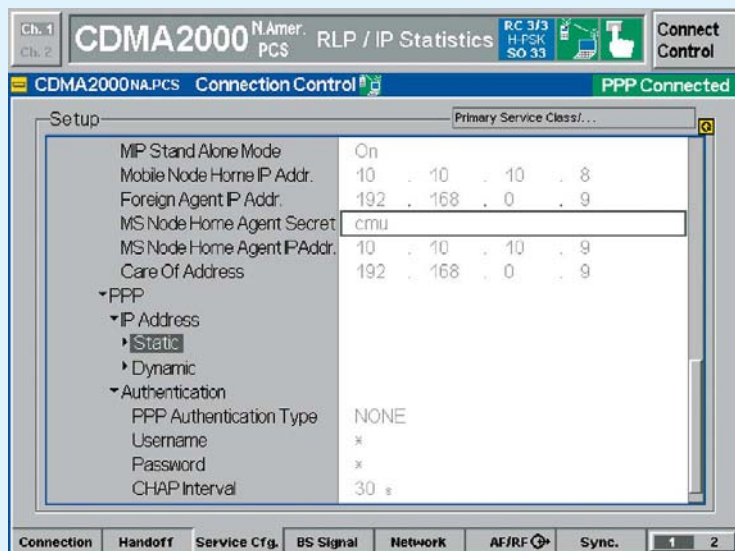
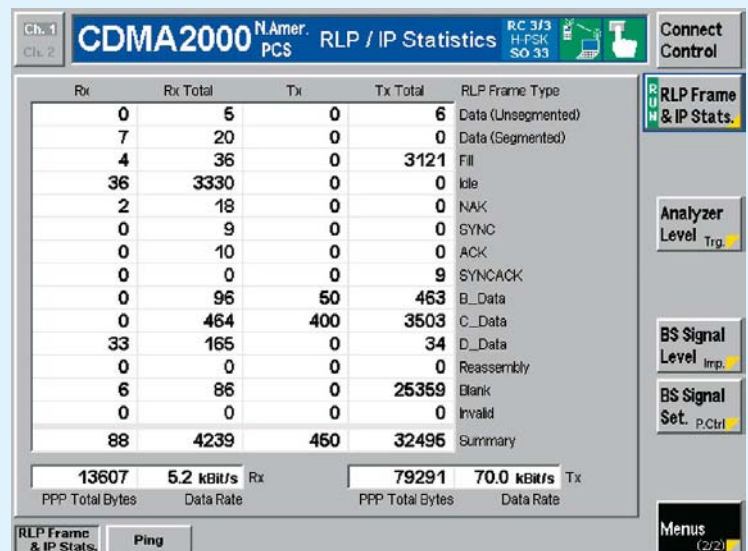


FIG 2 Generation of RLP statistics with the R&S®CMU200.



PPP Connected PPP link is established, traffic channel connections are set up, mobile phone transmits/receives data

PPP Dormant PPP link is established, no traffic channel connections are set up, mobile phone does not transmit/receive data

TX/RX RLP frame and IP packet statistics

A statistical evaluation based on counts of the different parameters makes it possible to track the data flow through the base station, i.e. the R&S[®]CMU 200. The following types of data are counted separately for the TX and RX directions (FIG 2):

- ◆ RLP frames
- ◆ The different RLP frame types (IDLE, FILL, ACK, etc)
- ◆ Total PPP bytes
- ◆ Total PPP packets
- ◆ Total TX/RX data rate

Application scenarios

The R&S[®]CMU 200 allows different test setups to be implemented for different application scenarios. In the simplest case, you can operate the tester in the standalone mode to perform data rate measurements on the mobile phone under test. For this purpose, the tester incorporates an internal FTP server that allows test files to be exchanged.

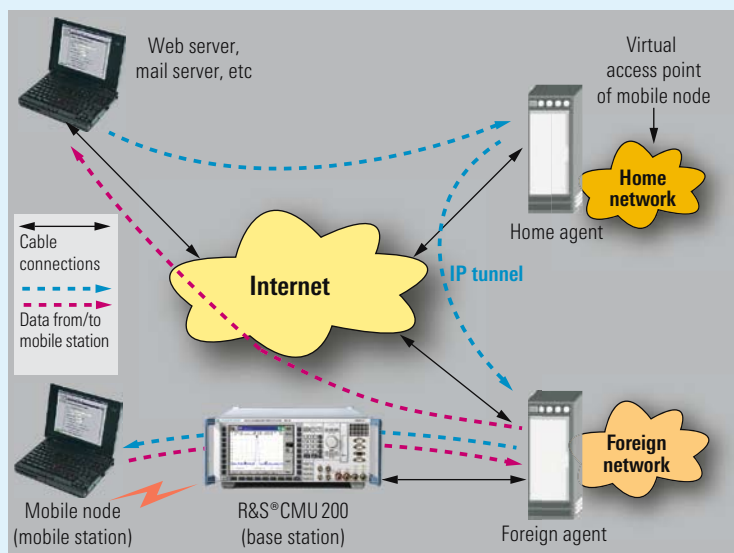
By using a more complex test setup including an external home agent and foreign agent, you can set up mobile IP links to points such as a web server or a mail server, enabling you to test complex applications (FIG 3). You can verify whether links to individual network nodes can be established by using the R&S[®]CMU 200's PING function.

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Important terms used in data application tests

CHAP	Challenge handshake authentication protocol
PAP	Password authentication protocol
Mobile node	Network node that can change between networks without having to change its IP address
Home agent	Unit in the mobile node's home network (typically a router) that tracks the mobile node's current location and tunnels IP data packets to the care-of address
Foreign agent	Unit in the foreign network in which the mobile node is currently located (typically a router). This unit assigns the mobile node a care-of address, forwards data packets sent to the care-of address to the mobile node, and in most cases also acts as a default router for the mobile node.
Care-of address	Address of the tunnel terminal point currently valid for the mobile node. The IP interprets this address to be the current location of the mobile node.

FIG 3 Typical test setup for mobile IP link.



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

REFERENCES

- [1] Universal Radio Communication Tester R&S[®]CMU 200: cdma2000 – a new challenge for 3G mobile radio testers. News from Rohde & Schwarz (2002) No. 173, pp 4–8
- [2] TIA-898 Signaling Conformance Tests for cdma2000[®] Spread Spectrum Systems (2001)
- [3] TIA/EIA/IS-707-A-1 Data Service Options for Wideband Spread Spectrum Systems, Addendum 1 (1999)