FIG 1 Universal Radio Communication Tester R&S CMU 300.

Universal Radio Communication Tester R&S CMU 300

WCDMA generator for tests on 3GPP base station receivers

The new options R&S CMU-B76 und R&S CMU-K76 add WCDMA generator functions to the R&S CMU 300 (FIG 1), thus making it ideal not only for receiver measurements on GSM/EDGE base stations, but also for unprecedented receiver measurements on 3GPP base stations.

Options at a glance

The R&S CMU 300 [1] is the world's first instrument to support all reference measurement channels (RMC) defined in the 3GPP specification TS 25.141 [2] up to a data rate of 2 Mbit/s. The WCDMA options (FIG 2) provide all key functions for production tests. The major innovations are the following:

- Support of data rates up to 2 Mbit/s
- Signal generation in realtime with a test data length up to PRBS16 for continuous receiver measurements
- Near-realtime response to changing RF parameters, preventing long power-off phases and allowing high-speed measurements
- Compact tester with GSM, GPRS, EDGE and WCDMA standards in a single instrument

FIG 2 New options for the R&S CMU 300.

Model/option	Designation	Functions
R&S CMU 300	Basic unit	
R&S CMU-B76	Hardware option WCDMA layer 1 board	Layer 1 board for receiver measurements on 3GPP base stations
R&S CMU-K76	Software option; WCDMA transmitter for R&S CMU 300	Software for receiver measurements on 3GPP base stations
R&S CMU-U76	Hardware upgrade; WCDMA generator for R&S CMU 300	Includes WCDMA Layer 1 Board R&S CMU-B76 and Power Supply R&S SN 250

Abbreviations: see page 20

Sensitivity measurements on base station receivers

WCDMA generators are used to test receivers in base stations (Node B) as well as their modules (FIG 3). The bit error rate (BER) of the signal generated by the R&S CMU300 can be measured in the base station, in the connected radio network controller (RNC) or via an external analyzer.

For BER measurements, the analyzer must be synchronized to the received signals. Particularly for reference measurement channels, the transmitter must emit them in a defined format at a specific time transmission interval (TTI) at the physical layer. For this purpose, the R&S CMU300 provides the frame trigger input. After the WCDMA generator is started, the requested channel is transmitted once the frame trigger (10 / 20 / 40 / 80 ms) has been received.

The base station receiver synchronizes to the RF signal of the R&S CMU300 and then calculates the BER from the deviation of the received signal from the expected PRBS. In 3GPP base station production, the BER can be measured without connection setup, thus keeping loss of time to a minimum.

Functions and operating modes

The generator parameters defined in the 3GPP specification TS25.141 ensure standardized measurements. The WCDMA generator of the R&S CMU300 supports all data rates defined for the reference measurement channels, i.e. 12.2 / 64 / 144 / 384 / 2048 kbit/s (FIG 4).

If one of these RMCs is selected, essential parameters for BER measurement such as coding, slot format or time transmission interval are defined. Moreover, the user can also set customized channel combinations. In addition to the RMC mode, the new WCDMA generator supports the physical channel mode (FIG 5). In this case, the generator creates one dedicated physical control channel (DPCCH) and up to six data channels (DPDCH). The associated data rates can be flexibly selected in the range 1×15 kbit/s to 6×960 kbit/s.

The test data is applied either to the reference measurement channels at the transport channel layer or directly to the physical channels (FIG 6). Pseudo-random bit sequences PRBS9 / 11 /15 and 16 as well as fixed data (00000…, 11111…, 010101…) are available as test data.

The signal power in particular can be set in almost any manner designed for BER measurements. The user is able to set the total power as well as the power

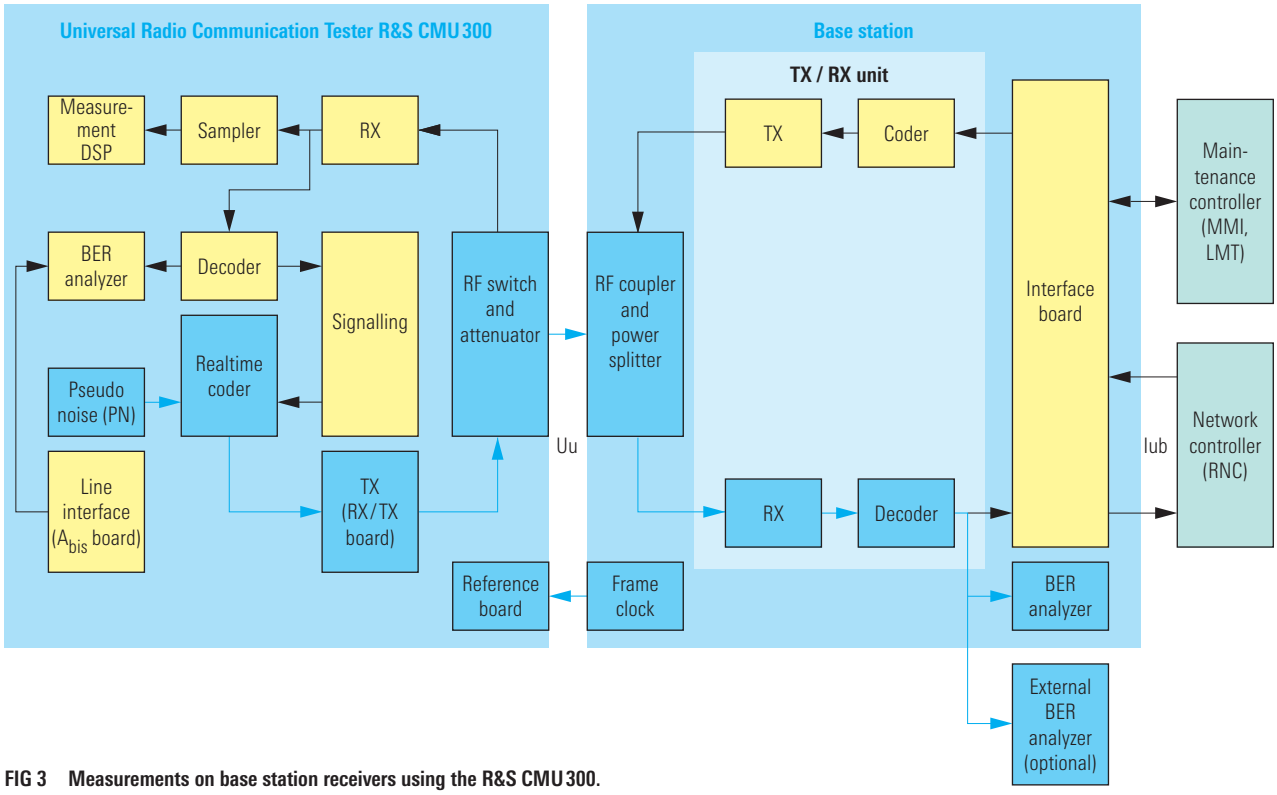

FIG 3 Measurements on base station receivers using the R&S CMU300.

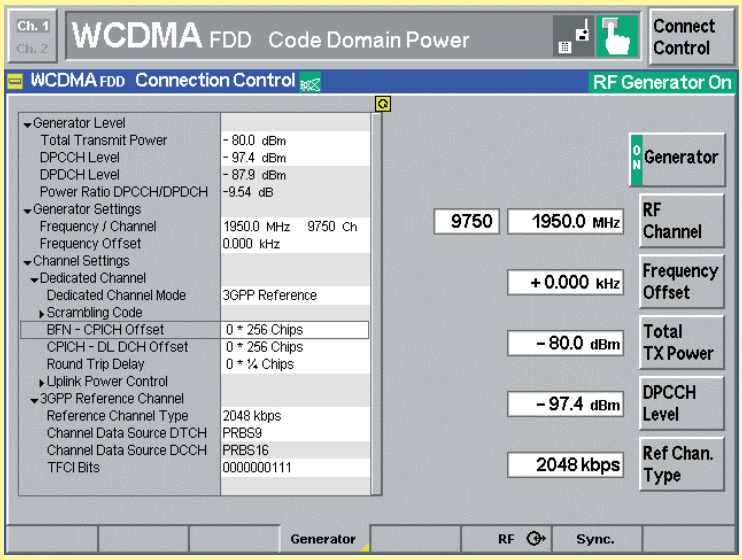

FIG 4 Generator menu of the R&S CMU300 in the reference channel mode with selected 2 Mbit/s channel.

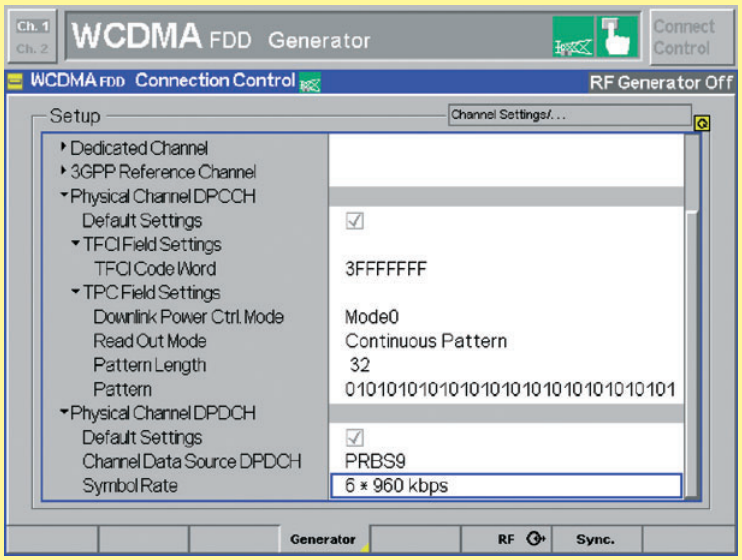

FIG 5 Generator setup menu of the R&S CMU300 with set physical channel mode.

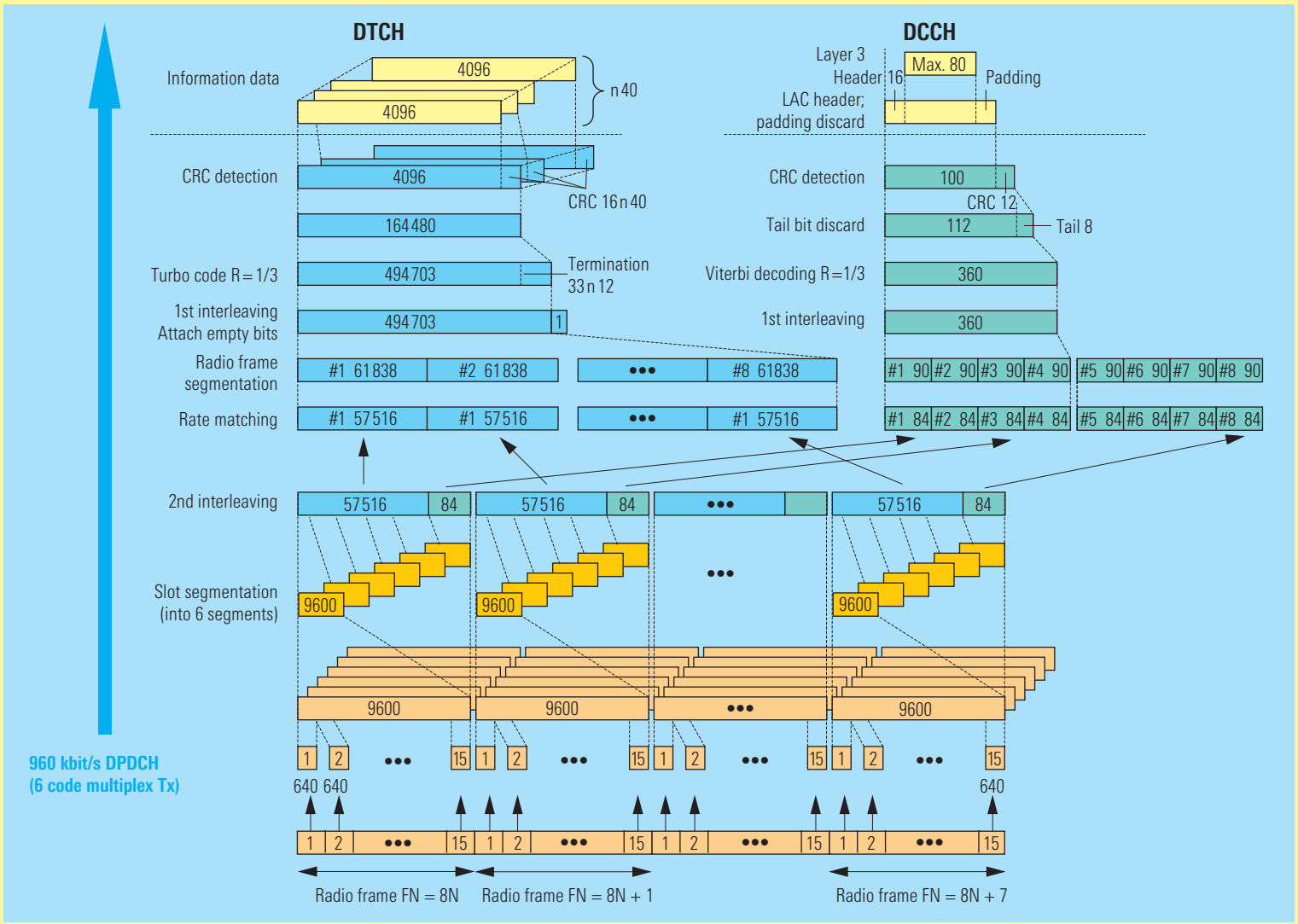

FIG 6 Example of 3GPP uplink channel coding using a reference measurement channel with 2048 kbit/s (1 × DPCCH and 6 × DPDCH).

of the control channel and the power ratio of the DPCCH and the DPDCH. The R&S CMU300 offers a wide variety of further settings which by far exceed the RMCs defined by 3GPP.

At the physical layer, the TFCI code word and the TPC bit pattern can be varied. If channel coding has been activated, the generator calculates the TFCI code word with the associated TFCI bits. These settings allow the control of a base station receiver via the uplink signal. The base station receiver receives the TPC bits and controls the power according to the selected downlink power control mode.

At the transmitter end, the R&S CMU300 supports power control modes 1 and 2.

In mode 1, the transmit power of the generator changes in every alternating slot, increasing or decreasing by 1 dB or 2 dB. In mode 2, transmit power is constant.

Future functions

In addition to the above WCDMA generator functions for BER measurements, WCDMA transmitter measurements on 3GPP base stations are currently being developed for the R&S CMU300.

Choosing the R&S CMU300 base station tester is a sure decision in favour of a compact radio communication tester that embraces tomorrow's applications.

Anne Stephan; Karsten Friedrich

Main abbreviations

3GPP	3rd Generation Partnership Project
BER	Bit error rate
BTS	Base transmitter station (base station)
CRC	Cyclic redundancy checksum
DCCH	Dedicated control channel
DPCCH	Dedicated physical control channel
DPDCH	Dedicated physical data channel
DSP	Digital signal processor
DTCH	Dedicated transport channel
LAC	Location area code
Iub	3GPP interface between base station and RNC
LMT	Local maintenance terminal
MMI	Man-machine interface
Node B	3GPP definition for BTS
PN	Pseudo noise
PRBS	Pseudo random bit sequence
RMC	Reference measurement channels
RNC	Radio network controller
RX	Receiver of a base station
TFCI	Transport block combination identifier
TPC	Transmitter power control
TTI	Time transmission interval
TX	Transmitter of a base station
Uu	Interface between R&S CMU300 and base station

More information and data sheet at www.rohde-schwarz.com (search term: CMU300)

Data sheet R&S CMU300

REFERENCES
[1] Universal Radio Communication Tester R&S CMU300: RF tests on base stations – comprehensive, fast and accurate. News from Rohde&Schwarz (2001) No. 170, pp 4–6
[2] 3GPP specifications: www.3gpp.org.

Condensed data of the WCDMA options for R&S CMU300

Standard	3GPP FDD
Symbol rate	3.84 MHz
Trigger input	sub-D connector AUX 3, pin 6, TTL level
Recommended trigger signals	physical channel mode: 10 ms frame trigger reference channel mode: TTI trigger (20 ms, 40 ms, 80 ms)
Physical channels	15 / 30 / 60 / 120 / 480 / 1×960 / 2×960 / 3×960 kbit/s, 4×960 / 5×960 / 6×960 kbit/s
Power ratio DPCCH	15/15, 14/15, 13/15, 12/15, 11/15, 10/15, 9/15, 8/15,
DPDCH	7/15, 6/15, 5/15, 4/15, 3/15, 2/15, 1/15, DPDCH off
Reference measurement channels	12.2 / 64 / 144 / 384 / 2048 kbit/s (to 3GPP TS 25.141)