The R&S® CMU 200 now also supports discontinuous transmission (DTX) in the downlink, as well as the important “performance of bad frame indication” (BFI) test case.

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

REFERENCES

R&S®CMU 200 Universal Radio Communication Tester

Downlink DTX

Telephone calls as a rule do not utilize the full capacity of a duplex link. In most cases, the two subscribers speak alternately, i.e. only 50% of the link capacity is utilized on average. Practical experience has shown that in some cases no more than 20% of the link capacity is used for speech transmission.

To reduce this waste of resources, discontinuous transmission (DTX) has been introduced for GSM. This method causes the mobile phone to stop transmitting when there is a pause in the conversation, i.e. there is no voice input to the mobile phone. This also saves battery power in the mobile phone. During pauses, the mobile phone only sends the minimum information required to maintain the link. To this effect, the phone transmits data via a control channel (SACCH) and sends SID speech frames at regular intervals (FIG 1).

The receiver uses the information from the SID frames to generate comfort noise during speech pauses by simulating the noise that would be present during speech transmission. This is considerably more pleasant for the subscriber at the receiving end than the total silence that would occur with the loudspeaker switched off completely.

The R&S®CMU 200 previously supported DTX only in the uplink. As already mentioned, the information from the SID frames transmitted by the mobile phone during a speech pause (referred to as DTX period in the following) causes the speech codec in the R&S®CMU 200 to generate comfort noise. With firmware V4.20 installed and the R&S®CMU-B21v14 signaling unit

FIG 1  104 TDMA multiframes without DTX (top) and with DTX for full-rate speech channel.
and R&S®CMU-B52v14 speech codec options fitted, the R&S®CMU 200 can now send SID frames also in the downlink.

In the echo/loop mode this works even if the optional speech codec is not installed. The R&S®CMU 200 previously transmitted neutral FACCH filler frames during speech pauses of the mobile phone to replace the missing speech frames. The R&S®CMU 200 was, however, not able to return received SID frames in half-rate and adaptive multi-rate (AMR) operation due to the channel structure. This problem has been overcome with the R&S®CMU 200 now supporting DTX in the downlink. The mobile radio tester now returns to the mobile phone exactly the information it has received, i.e. a speech frame, an SID frame, or a speech pause.

The downlink DTX is configured via three additional parameters (FIG). “Handset DTX Enable” switches DTX in the optional speech codec on or off. With DTX switched on, the codec will generate either speech or SID frames, depending on the audio input signal. Irrespective of whether the speech codec option is installed, the filler signal sent by the R&S®CMU 200 during a speech pause can be configured by means of the other two parameters. “BFI/DTX Filling Signal – Type” defines the signal to be sent during a speech pause; either a pseudorandom sequence or dummy bursts can be sent. “BFI/DTX Filling Signal – Level” defines the level of the filler signal relative to the useful signal. The signal thus defined is also used for the test case described below, which relies on the support of downlink DTX.

**BFI test**

Supporting downlink DTX, the R&S®CMU 200 can now also perform the bad frame indication (BFI) test. This test is an integral part of the 3GPP TS 51.010 GSM test specification (section 14.1.x). The R&S®CMU 200 performs it on all known speech channels (FIG 3). According to the test specification, a mobile phone may fail to detect maximally one speech frame per second during a DTX period. The R&S®CMU 200 simulates a base station in DTX operation, i.e. it generates a signal as shown in FIG 1. The test is performed using the mechanisms known from BER measurements. For the test, loop A in the mobile phone is closed. If the phone receives speech frames containing non-correctable class 1a bit errors – caused by the filler signal sent by the tester – while the loop is closed, it will return these frames as erased frames. In a normal BER measurement, these frames would increase the frame error rate (FER) [*]. The BFI test, however, basically functions like an inverse FER measurement. It is not the erased frames that are counted but the number of times the mobile phone erroneously returns a speech frame while it is expected to return erased frames.

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