Complex TX measurements due to expanded trigger capabilities

The mixed modulation modes occurring in 8PSK-EGPRS measurements are a new challenge for mobile terminals and T&M equipment. With firmware version 3.80, the Universal Radio Communication Tester R&S®CMU 200 can now also handle these complex transmitter measurements.

Detecting control ACKs

In EGPRS / GPRS networks, mobile phones can request control ACKs in the form of short access bursts or as normal, GMSK-modulated bursts. This can be done both in a GMSK connection and an 8PSK connection. The modulation mode used for the connection depends on the coding scheme. Since the R&S®CMU 200 can request both types of control ACKs, you can choose the one you need.

The control ACKs are generated at a relatively large interval of approx. one second. To detect these events, the measurements are selectively triggered. When multiple uplink timeslots are involved, the multislot power ramp measurement displays control ACK bursts in addition to 8PSK or GMSK bursts. FIGs 1 and 2 show the combination of access burst and 8PSK burst for a connection with two uplink timeslots. You do not have to concern yourself with the special triggering of the measurement since it is adapted by the R&S®CMU 200 as soon as the modulation type you have selected for display corresponds to the control ACK mode. To monitor bursts of different modulation modes simultaneously in a multislot connection, the tester requests the control ACKs at different points in time. On the main timeslot, the control ACKs are received one radio block earlier than on the other active timeslots.

Access bursts and timing advance

In the packet mode, the R&S®CMU 200 is now an excellent choice for timing advance measurements. During an established connection, you can check

FIG 1 Multislot power ramp measurement with two uplink timeslots. Triggering occurs in response to the access burst in the first timeslot. The second timeslot is 8PSK-modulated. Timing advance has a value of 0 here.

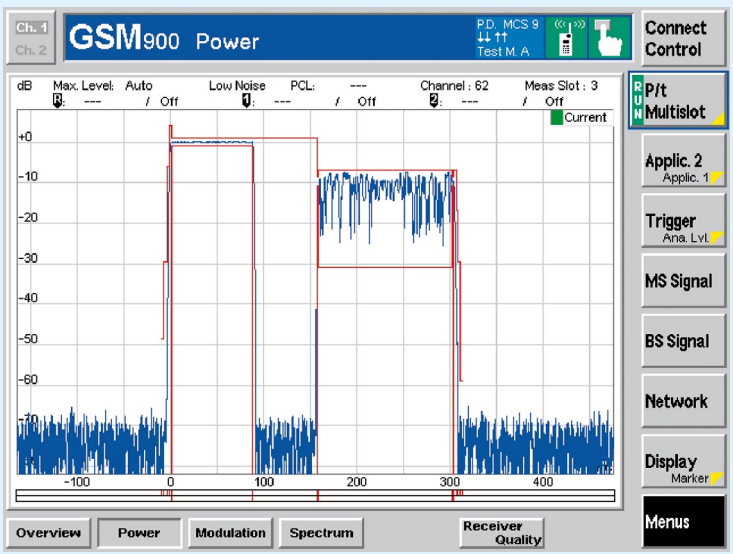
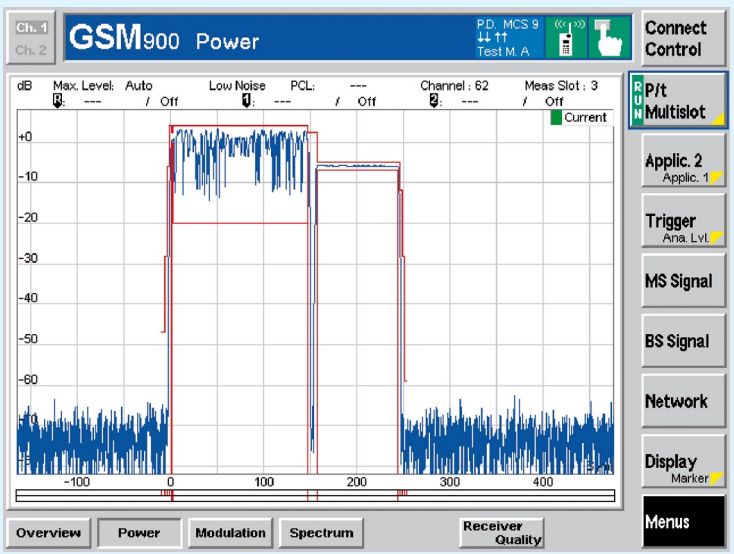


FIG 2 Triggering in response to access burst in the second timeslot.



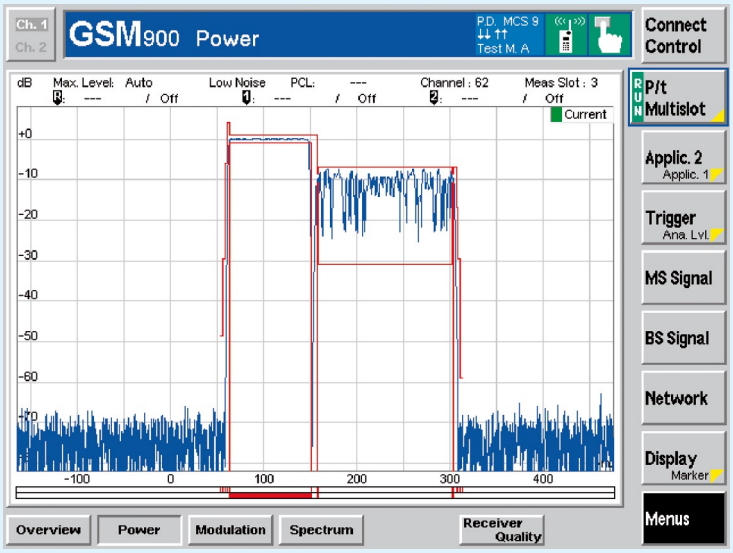


FIG 3
Access burst and 8PSK burst at maximum timing advance of 63 (in the GSM 900 band). The time shift of the access burst compared to FIG 1 is evident.

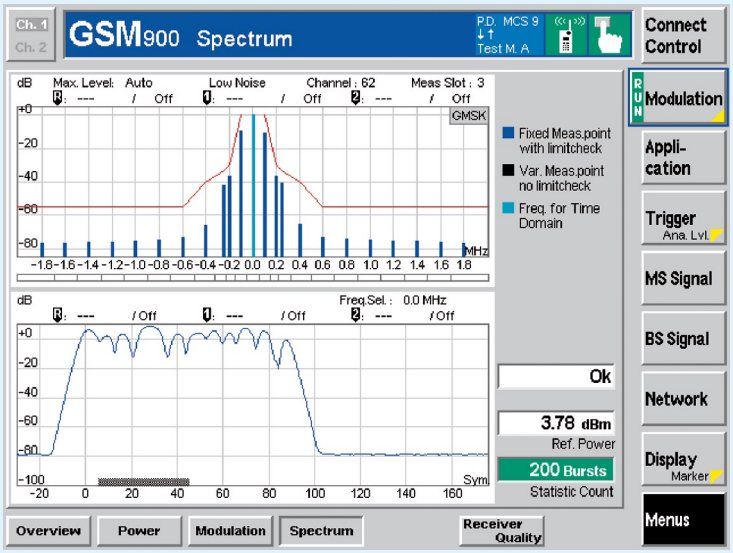


FIG 4
Modulation spectrum of an access burst.

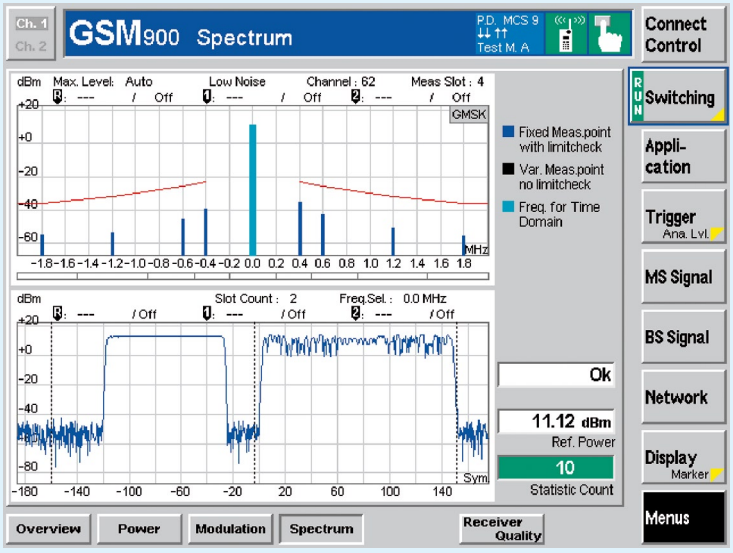


FIG 5
Switching spectrum of access burst and 8PSK burst with timing advance 40.

the transmit and receive timing adaptation of a mobile terminal, especially the critical case of access bursts in addition to normal bursts. By means of timing advance, you can compensate for the distance-dependent delay of the radio signal between the base station and the mobile terminal. The longer the signal path, the closer together the transmit and receive windows have to move on the mobile terminal end. This prevents connections on adjacent timeslots from being impaired. However, access bursts are not affected by timing advance. Access bursts are so narrow that they can also be transmitted at the maximum distance within an uplink timeslot. They are therefore transmitted at the beginning of a timeslot and arrive at the base station with a time delay. The R&S®CMU 200 displays this clearly in the multislot power ramp measurements. FIGs 1 and 3 show the location of the access burst and 8PSK burst with and without maximum timing advance. FIG 3 clearly shows that the access burst directly approaches the 8PSK burst at maximum timing advance. The measurement is thus an ideal way to also test difficult timing scenarios of several timeslots.

The spectrum measurements now also offer enhanced trigger capabilities. The problem with these measurements is that different modulation modes affect the result. Especially GMSK bursts corrupt the spectrum of an 8PSK measurement. For this reason, the R&S®CMU 200 now only selects bursts of the same modulation, i.e. in a normal measurement the GMSK-modulated control ACKs are not included in the evaluation. The tester also suppresses idle frames. However, the R&S®CMU 200 also offers inverse triggering in the spectrum, allowing you to specifically detect the control ACKs. FIGs 4 and 5 show access burst spectra.

External triggers

The new trigger capabilities of the R&S®CMU 200 are not restricted solely to the internal transmitter measurements; the R&S®CMU 200 also offers a number of external trigger signals:

- Frame clock trigger
- Ctrl ACK main slot trigger
- Ctrl ACK other slots trigger
- Hopping trigger
- 26, 52, 104 multiframe trigger

The tried-and-tested frame clock trigger is particularly useful for controlling external spectrum analyzers. It blanks out idle frames and control ACKs.

The control ACK triggers enable you to filter all TDMA frames with corresponding bursts and analyze them on the spectrum analyzer, for example. As described above, the control ACKs on the main timeslot are not generated at the same time as on the other timeslots. The two trigger signals allow them to be specifically selected.

The R&S®CMU 200 can synchronize an external signal generator such as the R&S®SMU or the R&S®SMIQ to its own frequency hopping method by means of the hopping trigger. This makes it possible to also simulate an interferer with this method, not just with stationary frequencies.

The multiframe triggers make synchronizing to the BCCH unnecessary. In an active traffic channel (the R&S®CMU 200 also allows connection setup without signaling), a multiframe trigger establishes synchronization with the GSM time grid and thus permits the measurement of the bit error ratio (BER), for example. Triggers for multiframes with 26, 52 and 104 TDMA frames are available.

All external triggers can be delayed on a timeslot basis and thus be adapted to your own needs. The simultaneous output of two different triggers supports parallel measurements.

Jörg Füßle

Universal Radio Communication Tester R&S®CMU 200

Innovative enhancement of GSM functionality

The Universal Radio Communication Tester R&S®CMU 200 is one of the most successful mobile radio testers. The latest GSM software adds numerous innovative functions to its scope of capabilities.

Dual transfer mode

Mobile phones are evolving more and more into communications centers: In the beginning, you simply used them to make phone calls. Today, mobile data communications via e-mail and Internet are gaining increasing importance. At work, for example, you want to use the time and make a call while data is being downloaded. Until now, however, you could not do both simultaneously with GSM; you had to choose between making a call and setting up a data link.

The standardization committees have now remedied this problem by specifying the dual transfer mode (DTM). This mode allows you to make a call via a circuit-switched connection while simultaneously transmitting data via a packet data connection (GPRS or EGPRS). Leading mobile radio manufacturers are currently implementing the dual transfer mode in their mobile phones. The R&S®CMU 200 will be able to support this undertaking, since the R&S®CMU-K44 option expands the R&S®CMU 200 into a full-fledged DTM tester.