Reduced Measurement Time for Testing GSM Base Stations through Parallel Use of CMD and FSE/FSE-K11

Application Note 1MA06_0E

Subject to change

Roland Minihold 98-01

Products:

Digital Radiocommunication Tester CMD 54/57/59

Spectrum Analyzer FSE

Application Firmware FSE-K11

ROHDE&SCHWARZ

Contents

1. Overview

In addition to accuracy and reproducibility of results, measurement speed is a key factor in testing GSM900/1800/1900 base stations in production.

The parallel use of CMD and FSE/ FSE-K11 helps to save valuable time in testing. Moreover, the additional measurement capabilities of FSE such as measurement of spurious emissions or of the modulation spectrum in the TX band can be used to advantage to improve the test depth.

2. Measurements to be Performed

The following measurements have to be carried out on a base station transceiver module in production:

Transmitter measurements:

- Phase error and mean frequency error
- Mean transmitted RF carrier power
- Transmitted RF carrier power versus time
- Spectrum due to switching transients
- Spectrum due to modulation

Receiver measurements:

- Bit error rate (BER)

The measurements have to be carried out at different channel frequencies.
Radiocommunication Tester CMD performs these measurements sequentially and needs approx. 5 min per test frequency including setting time of the base station.

3. Parallel Measurements Using CMD/FSE

Through the additional use of FSE and GSM Application Firmware FSE-K11 measurements can be carried out in parallel to significantly reduce the total measurement time of a base station as shown in the following example.

Prior to measurement, the CMD is used for configuration of the BTS (base transceiver station) via the Abis interface. The time-intensive BER measurements are then carried out by the CMD. During this time, FSE can be used to perform the following transmitter measurements:

- Carrier power
- Spectrum due to transients
- Spectrum due to modulation

Vector Signal Analyzer Option FSE-B7 is not required for these measurements.

If the FSE is additionally fitted with the Vector Signal Analyzer Option, it is also able to measure the phase/frequency error as well as the power versus time.

Usually, the receiver of a BTS transceiver module is tested in production by measuring the BER at low input level. To obtain a reproducible result, a sufficient number of frames has to be evaluated due to the random bit error distribution. Assuming 3000 frames to ensure sufficiently small variations, the CMD takes approx. 1 min for the measurement. Modern transceivers have two receiver inputs (normal and diversity) at which measurements have to be carried out separately so that the total receiver measurement of a transceiver takes about 2 min.

Measurement of the carrier power (200 bursts), modulation spectrum (ARFCN±1.8 MHz, 100 bursts) and transient spectrum (50 bursts) using the CMD takes about 1 min altogether.

If all these measurements on the transmitter are carried out with the FSE while the CMD performs the measurements on the base station receiver, the measurement time can be cut down by 1 minute per test frequency.

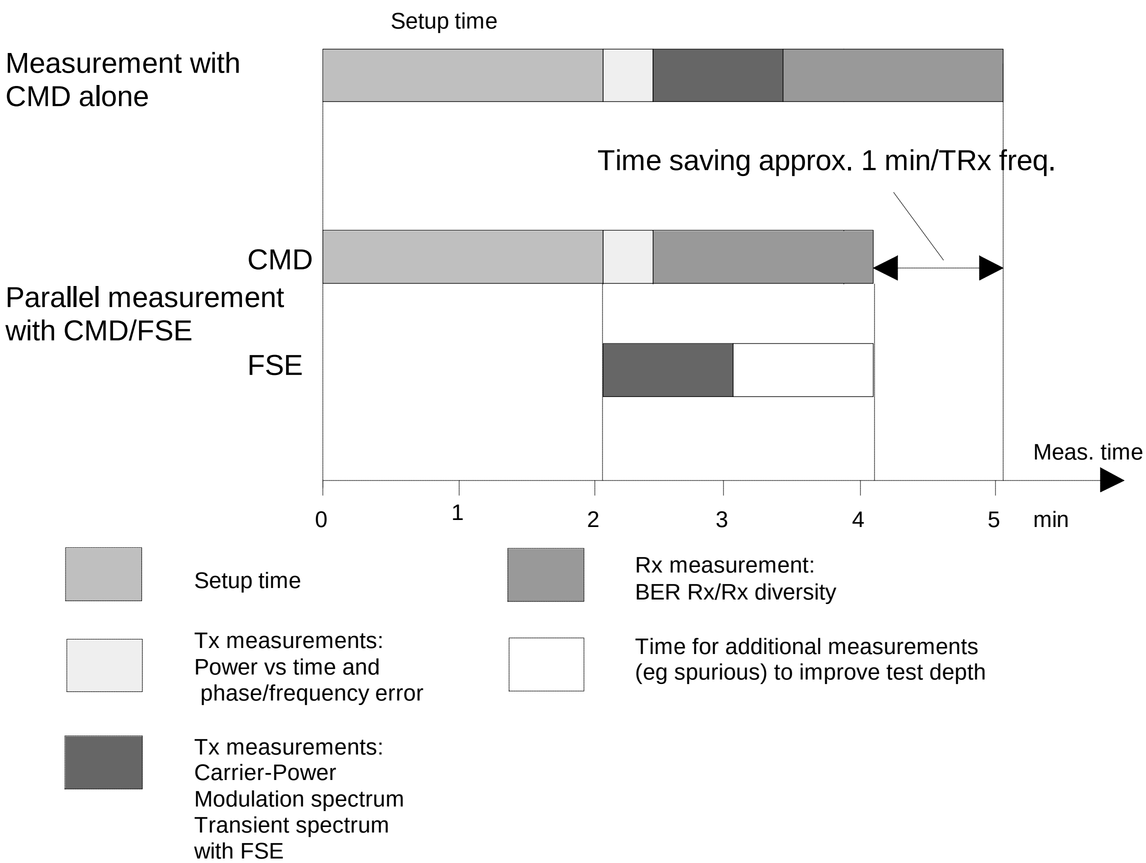

Fig. 1: Measurement of GSM base station using CMD and FSE/FSE-K11 in parallel

By optimizing the measurements with the aid of FSE-K11, a measurement time of 64 s is achieved for the FSE measurements. In the remaining time window additional measurements, eg measurement of spurious emissions or of spectrum due to modulation in the transmit band can therefore be carried out and the test depth thus improved without increasing the total measurement time. Due to the high sensitivity of the FSE, the spurious measurement in the TX band can be performed without any additional devices (such as bandstop filters) in accordance with the GSM 11.20/11.21 limits.

The time saving of approx. 1 min per transceiver frequency (approx. 20 % of total measurement time) is many times more since measurement at three frequencies per transceiver is prescribed by the standards and two, six or more transceivers are integrated depending on the type of base station.

4. Test Setup

It is recommended to use the following test configuration:

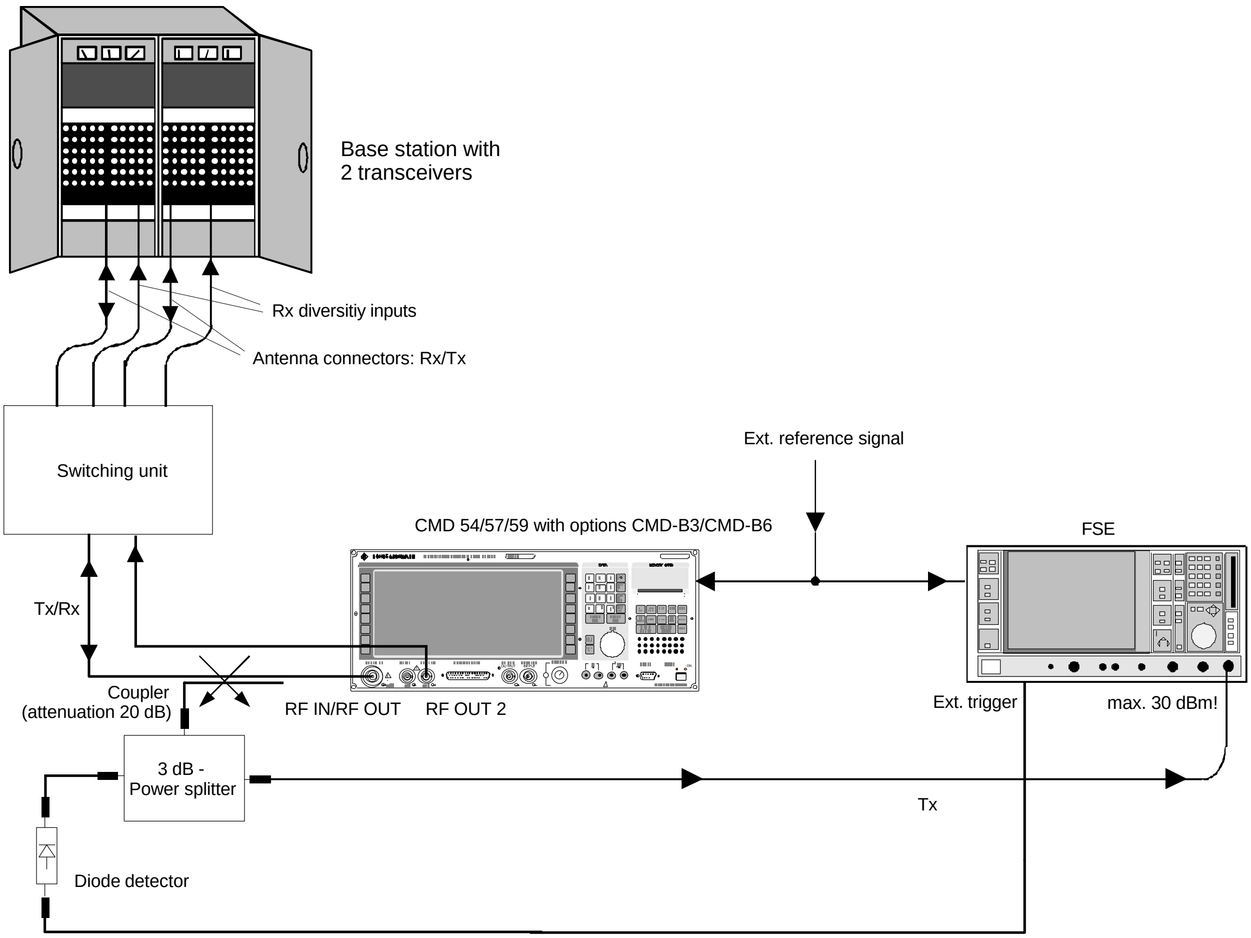

Fig. 2: Typical test setup for BTS measurements using CMD and FSE/FSE-K11 in parallel and triggering the FSE with the aid of an external diode detector

The easiest way to obtain a suitable [1)] trigger signal (especially important for measuring the spectrum due to modulation) is to use a commercial diode detector. A precondition for the use of a diode detector is that only one slot per frame is active, or that it is not a specific slot that has to be measured with the FSE if there are several active slots per frame. If during the measurement of the TCH (traffic channel) the BCCH (broadcast control channel) is also active, the level of the latter has to be reduced as against the TCH (≥12 dB) so that the diode detector can supply an unambiguous trigger signal.

1) Suitable trigger signal in this case means: a trigger signal that only occurs with an active burst. This is for instance not the case with frame trigger, since this signal also occurs with IDLE frame (every 26th frame is an IDLE frame; all slots are inactive during the IDLE frame). This means that invalid results (ie values measured during the IDLE frame) will also be averaged in modulation spectrum measurements. If synchronization to the midamble is switched off during carrier power measurement or measurement of power versus time (which is inevitably the case if the FSE is used without FSE-B7), again erroneous measurements are obtained through an unsuitable trigger signal.

It is recommended to use a detector with high video impedance (eg MACOM Part No. 2087-6001-00, Rv = typ. 6 kΩ) in order to minimize the distortion of the RF signal.

When using a 3 dB power splitter (typ. 20 dB decoupling) and an additional attenuator (6 to 10 dB) connected ahead of the detector, if required, the distortion caused by the detector may only be problematical in harmonic measurements (spurious measurements outside the transmit band). Spurious measurement with the FSE however does not need a trigger signal and can also be performed in FREE RUN mode - in this case without detector however.

The level at the detector should not fall below a minimum value of -3 dBm in order to ensure sufficient detector output voltage. The typical output voltage of commercial detectors is 150 to 200 mV with 0 dBm (1 mW) input level and usually of negative sign.

In the FSE-K11 setting menu the external trigger threshold and the trigger slope have to be set appropriately (eg to -100 mV, slope negative with burst level 0 dBm at the detector and a detector with output voltage -200 mV/mW).

5. Glossary

List of abbreviations and acronyms used:

ARFCN:	Absolute Radio Frequency Channel Number
BCCH:	Broadcast Control Channel
BER:	Bit Error Rate
BTS:	Base Transceiver Station
Rx:	Receiver
TCH:	Traffic Channel
TRx:	Transceiver
Tx:	Transmitter

6. References

The Application Note refers to the following standards:

GSM 11.20 (Version 3.19.0)

GSM 11.21 (prI-ETS 300609-1, Third Edition)

J-STD-007

7. Ordering Information

Spectrum Analyzer	FSEA30 1)	1065.6000.30
Application Firmware	FSE-K11	1057.3092.02
Digital Radiocommunication Tester	CMD 57 2)	1050.9008.57

1) All FSE 30 models (FSEA30, FSEB30, FSEM30, FSEK30) are suitable analyzers.

2) Depending on the system - GSM900/DCS1800 or PCS1900 - other CMD models (CMD 54/CMD 59) may also be used.

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