Measurement of Modulation Spectrum on GSM/DCS/PCS Mobiles acc. to GSM 11.10-1

Application Note 1MA01_1E

Subject to change

Roland Minihold 98-03

Products:

Application Firmware FSE-K10

Spectrum Analyzer FSE + FSE-B7

Digital Radiocommunication Tester CMD 52/55/65

ROHDE&SCHWARZ

Contents

1. Overview

Fast and correct measurement of the spectrum due to modulation of GSM900/DCS1800/PCS1900 mobile phones according to GSM 11.10-1 is problematic due to the IDLE bursts. The suggested solution using Radiocommunication Tester CMD and Option CMD-B17 allows fast measurement of the spectrum due to modulation with the FSE and the Application Firmware FSE-K10 in the complete frequency band without the measured values being affected by the IDLE burst.

2. Problem

For measurements on GSM/DCS/PCS mobile phones using the FSE and Application Firmware FSE-K10, correct triggering is a precondition for accurate measurement of the spectrum due to modulation according to GSM 11.10-1.

General trigger capabilities of FSE with FSE-K10:

VIDEO:
Internal triggering to the video signal is only possible with measurements at the channel frequency (phase/frequency error, carrier power, power vs time).

The internal video trigger cannot be used for out-of-channel measurements (transient spectrum, spectrum due to modulation and spurious measurement).

RF POWER:
The internal trigger to RF power often is not sufficiently sensitive or broadband for measurements of the spectrum due to modulation in the TX or RX band.

EXTERN:
Using the FRAME trigger (eg of CMD) as an external trigger leads to incorrect results of the spectrum due to modulation measurement.

The reason is the IDLE burst which occurs at every 26th frame (the mobile is IDLE at every 26th frame, see Fig. 1). This is a problem especially when measuring the spectrum due to modulation where invalid measurement results will also be averaged (ie values measured during the IDLE burst).

Using the 26 MULTIFRAME signal of the CMD as an external trigger allows correct measurement of the spectrum due to modulation, but the measurement time would be increased significantly (the period of the 26 MULTIFRAME signal is 120 ms).

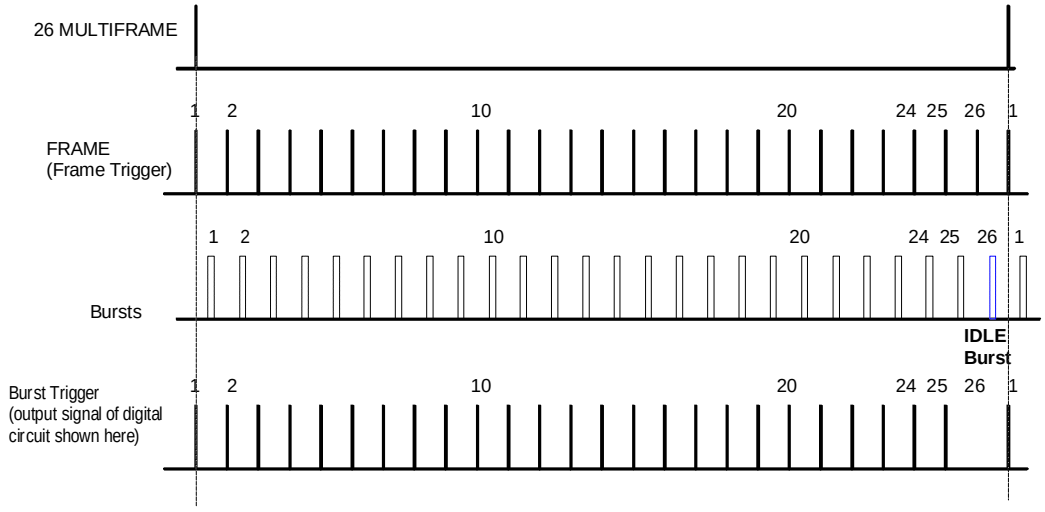


Fig. 1: Timing of the CMD signals 26 MULTIFRAME, FRAME, the bursts and the burst trigger shown here. The bursts are delayed by 3 slots (577 µs each) relative to the FRAME signal. Every 26th burst is an IDLE burst.

3. Solution

A possible solution is the new option CMD-B17 for the CMD. It comprises a digital circuit which suppresses the IDLE burst and produces a real burst trigger. The CMD is used to configure the mobile phone according to the requirements and in addition it supplies the burst trigger signal for the FSE at the rear BNC connector RAMP/TRIG. Thus fast measurements can be made with the aid of FSE and FSE-K10, with the IDLE burst being suppressed.

NOTE:

The jumper at X1 on this option has to be changed from position 1 - 2 to 1 - 3 (factory setting is 1 - 2).

The option CMD-B17 can also be retrofitted by any R&S service center.

This BURST TRIGGER signal can of course be used to advantage for all the other TX measurements on the mobile that can be carried out with the FSE/FSE-K10 (phase/frequency error, carrier power, power vs time, transient spectrum and spurious measurement).

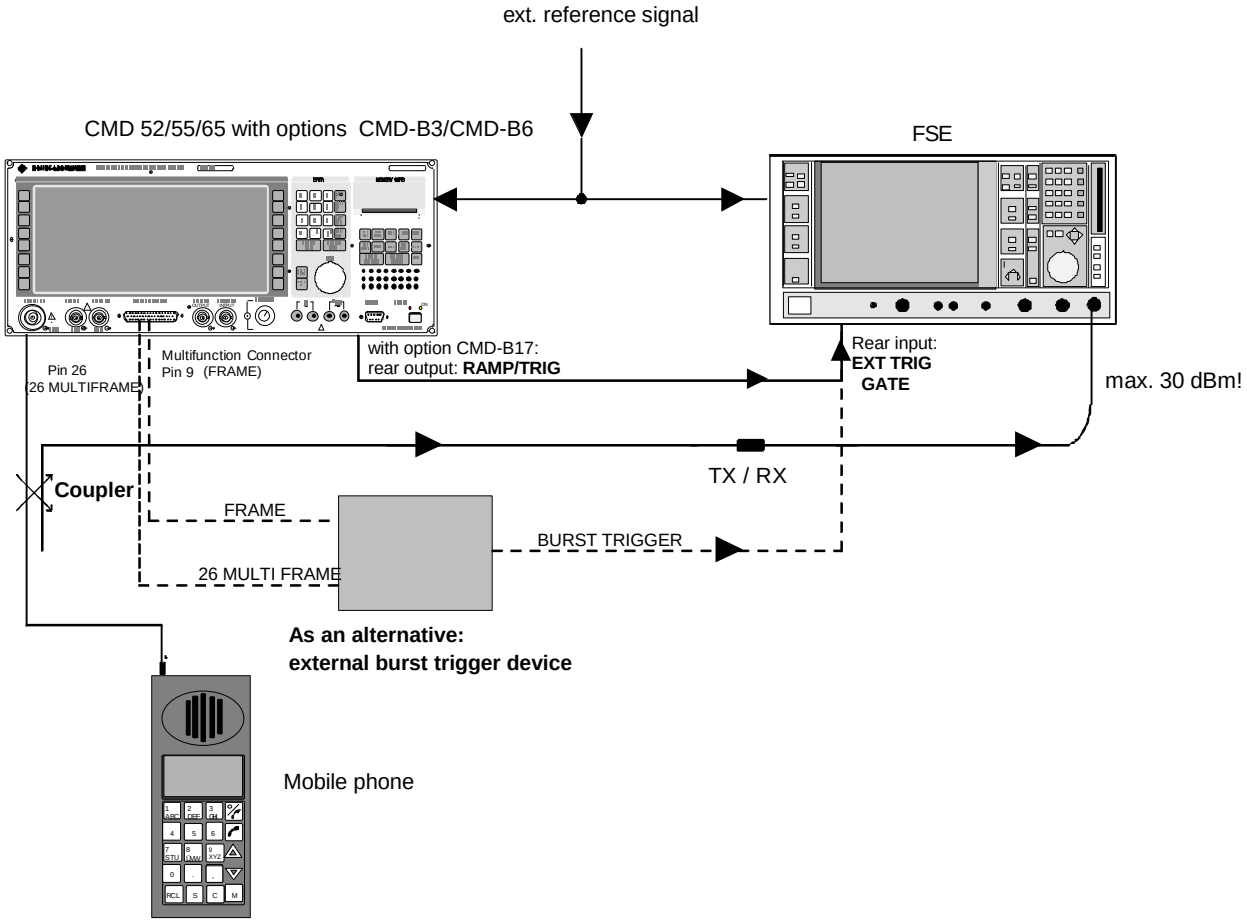


Fig. 2: Block diagram of test setup with option CMD-B17 or alternatively with external burst trigger device. The coupler shall be designed so that the FSE input will not be overdriven (coupling 10 dB to 25 dB, depending on maximum output power of the mobile phone).

4. Activating the Burst Trigger Output on Option CMD-B17

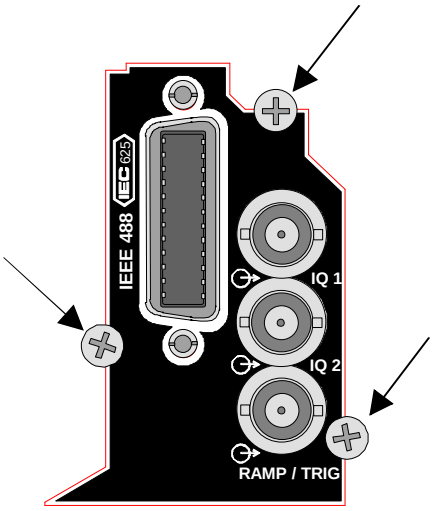


Fig. 3: Rear-panel detail of CMD with Option CMD-B17. After undoing the marked screws, the option can be withdrawn for changing the jumper position.

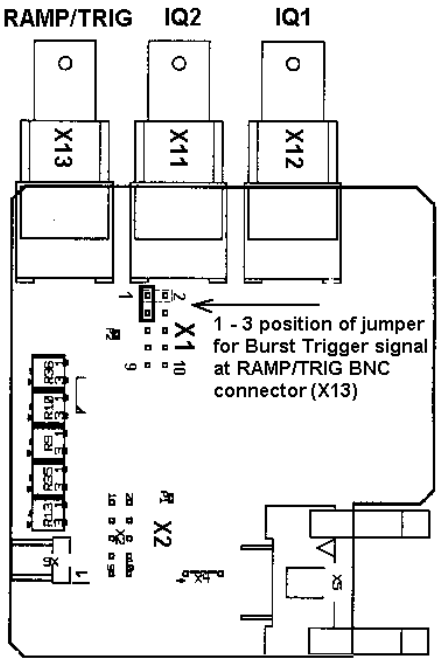


Fig. 4: The jumper on option CMD-B17 must be changed from position 1 - 2 (factory setting) to position 1 - 3.

Should option CMD-B17 not be available, an external trigger circuit can be configured. The required information can be found in the Annex.

5. Ordering Information

Spectrum Analyzer	FSEA 30 [1)]	1065.600.30 [1)]
Application Firmware	FSE-K10	1057.3092.02
Digital Radio-communication Tester	CMD 55 [2)]	1050.9008.55 [2)]
I/Q Outputs	CMD-B17 [3)]	1099.3003.02

1) All FSE 30 models (FSEA30, FSEB 30, FSEM 30, FSEK 30) can be used.

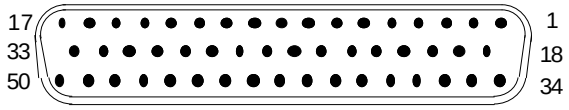
2) Depending on the system (GSM 900/DCS1800 or PCS 1900), other CMD models can also be used.

3) If in the CMD both the options CMD-B8/U8 and CMD-B2 are fitted, option CMD-B17 cannot be installed for reasons of space. (In this case the external trigger circuit has to be used.)

ROHDE & SCHWARZ GmbH & Co. KG · P.O.B. 80 14 69 · D-81614 München
Telephone +49 89 4129 -0 · Telefax +49 89 4129 - 3777 · Internet: http://www.rsd.de

6. **Annex:** Setting Up an External Trigger Circuit

Pin assignment of 50-pin MULTIFUNCTION connector of CMD 52/55/65 (Option CMD-B6 required):



Pinbelegung Frontplatten-Draufsicht

Pin 9 of the 50-pin multifunction connector delivers the FRAME signal, pin 26 the 26 MULTIFRAME signal. Reference ground is available at pin 11.

Pin	Signal designation	Function
1 18 34	HANDSET OUT Ground HANDSET IN	Handset connection (Function only available with specific configurations)
2 3 19 35 36	Ground DPG HFF DPG EXTRST DPG EXTD DPG EXTW	Data pattern generator (Function only available with specific configurations)
4 5 6 7 20 21 22 23 37 38 39	SER DSR SER TXDATA SER RXDATA SER RTS Ground SER RLSD SER TXCLK SER RXCLK SER DTR SER RI SER CTS	Serial data interface (I/O) (Function only available with specific configurations)
8 24 40 41	BICLK BIDATA Ground BIFRAME	Bit interface (Function only available with specific configurations)
9 10 11 25 **26** 27 42 43	**FRAME** 51 MULTIFRAME Ground BITCLK **26 MULTIFRAME** USERTRIGGER SLOTOUT SUPERFRAME	GSM-specific clock outputs (USERTRIGGER is input). Time reference is the CMD transmitter (only with option CMD-B6)
12 13 14 28 29 30 31 44 45 46 47	SER DUTRLSD SER DUTTXCLK SER DUTRXCLK SER DUTDTR SER DUTRI SER DUTCTS Ground SER DUTDSR SER DUTTXDATA SER DUTRXDATA SER DUTRTS	Serial data interface (I/O). (Function only available with specific configurations)
15 48	not assigned not assigned	
16 32 49	PRI EXTQ PRI EXTI Ground	**1)** I/Q modulation inputs (synthesizer 1)
17 33 50	AQ EXT AI EXT Ground	I/Q demodulator outputs (level is set to max. ± 2.5 V peak value via software, AC coupling)

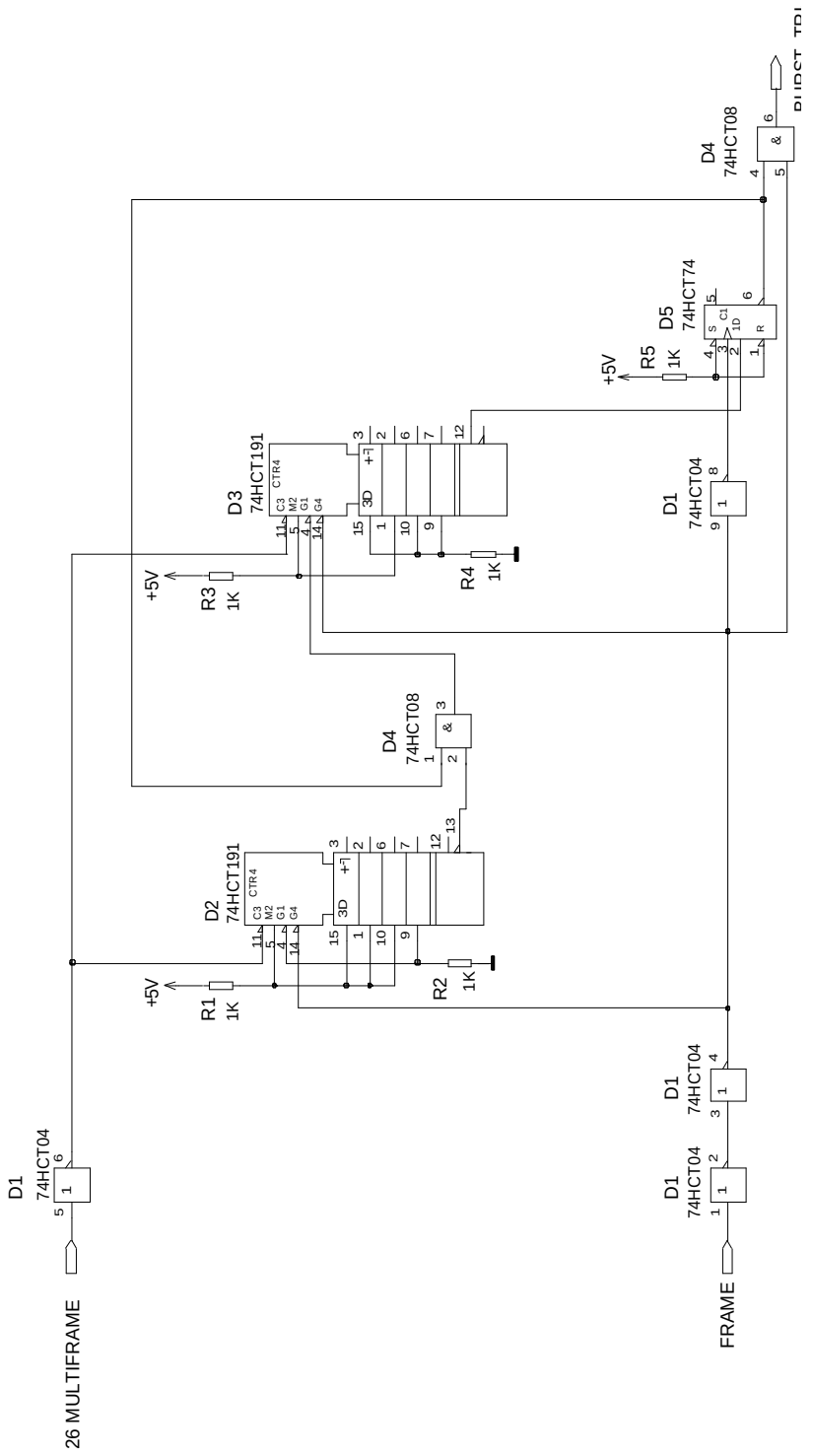


Fig. 3: Circuit diagram of external trigger device

Setting up the circuit

The trigger device can easily be set up on a bread-board.

Unused inputs should be connected to ground via 1 kΩ resistors. Ground should be low impedance (wire diameter ≥1 mm or ground line of sufficient width).

The +5 V supply voltage should be carefully blocked by soldering 100 nF capacitors between the IC's supply pin and ground.