
Base Station Adjacent Time Slot Rejection Measurement with CMD and SME

Application Note 1GPAN26E

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Products:

**Signal Generator SME
Radio Communication Tester CMD54/57**



ROHDE & SCHWARZ

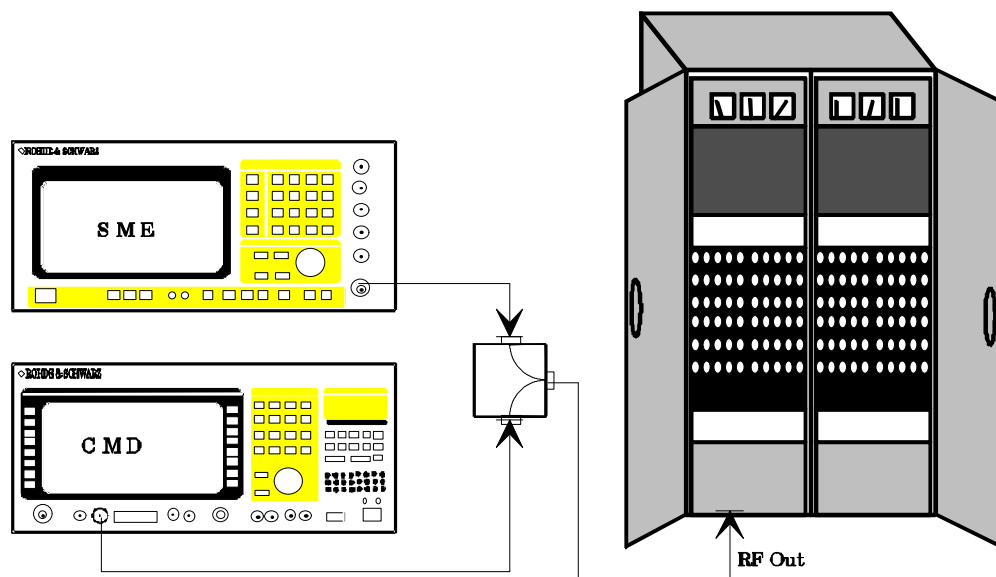
General

In radio networks using TDMA, such as GSM, PCN (DCS1800) and PCS (DCS1900), reception and demodulation of data transmitted in a time slot may be impaired by signals and data of the adjacent time slots. This could be the case if a mobile which is far away from the base station is using time slot e.g. 4, while two other mobiles very close to the base station are using the time slots 3 and 5.

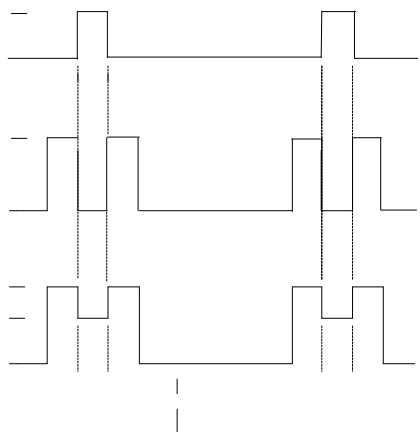
In order to get highest performance measurements the suppression of adjacent time slot signals are prescribed for base station receivers. For instance,

GSM specifications (ETSI/GSM 11.20) stipulate for base stations BER tolerances for a used time slot in the presence of a 50-dB higher level in the adjacent time slots while all other time slots are switched off. This measurement problem can be solved with the signal generator SME synchronised on the base station radio communication tester CMD 54 or CMD 57.

The picture below shows the general test set-up. The detailed test set-up is shown in the related chapter in this document.



The following signals are generated:



Signals provided by the CMD

The time slot carrying level P1 is the time slot of the used physical channel. This signal can be generated by the CMD once it is synchronised to the timing of the base station. It is either possible to synchronise to a TTL trigger signal which has to be connected to the CMD multifunction connector on the front panel or to a C0 (BCCH) carrier generated by the base station. For a detailed description how to synchronise to a base station please refer also to the CMD manual chapter "getting started".

The shown signal is generated by the CMD in the menu "traffic channel test" or in the menu "BER

test". In both menus it is possible to freely adjust the output level of the CMD between -35 dBm and -110 dBm. (With modification kit CMD-U2/3 installed: between +10dBm and -60dBm).

While in the "traffic channel test" menu the CMD acts as a pure generator transmitting a known bit stream, in the menu "BER test" it is possible to calculate the bit error rates caused by the base stations receiver.

Please find below pictures of both menus.

ADDT. MEAS.	TRAFFIC CHANNEL TEST		
POWER RAMP	Avg. Burst Power: <input type="text" value="42.7 dBm"/>	TRAFFIC CHANNEL: 43 dBm	EXPECTED POWER
PHASE FREQ.	Power Ramp: <input type="text" value="OK"/>	70	RF CHAN.
SPECTRUM MOD.	Timeslot: <input type="text" value="5"/>	5	TIMESLOT
SPECTRUM SWITCH.	Freq. Error: <input type="text" value="-57 Hz"/>	-50.0 dBm	MS SIGNAL RF LEVEL
BER TEST	Phase Error (PK): <input type="text" value="-15°"/>	PSR 2E9-1	SPEECH MODE
	Phase Error (RMS): <input type="text" value="4°"/>		

SINGLE BER MEAS.	CONTINUOUS BIT ERROR RATE		
RESTART	CLASS II	RBER 0.705%	TRAFFIC CHAN. LEVEL: -103.0 dBm
	IB	0.000%	Relative to USED TS: -20.0 dB
	CLASS ERASED FRAMES	FER 0.000%	
MEAS. MODE	BER <input type="text" value="0.02"/>		
AVERAGE	100 Frames	INDICATOR <input type="text" value=""/>	
			USED TIMESLOT
			UNUSED TIMESLOT

Signals provided by the SME

P2 is the output level set on the SME. P0 is obtained when the internal pulse modulator of the SME is switched off. P0 is always more than 80 dB below P2.

The dynamic range between P2 and P0 is freely adjustable and covers at least the recommended 50dB.

The SME has an internal memory (optional: options SME-B11 and SME-B12) which can be filled with data that are modulated on the RF carrier. Furthermore this memory holds information when the output stage should be switched on and off.

Power combiner

A lot of power combiners can be used to combine the output signals of the CMD and the SME. Attention should be paid to the power loss of the combiner and the connecting cables because this may influence the results obtained during the BER measurements very much in particular when setting low levels at the CMD.

In addition the frequency range of the combiner should be checked. When using the CMD and the

Please find attached to this application note also a file which can be downloaded to the SME by the aid of the software tool SME-K1. The memory is then programmed in a way that the data in the two bursts generated by the SME contain a fixed bit pattern as well as a midamble. The bursts shape has been programmed in accordance to the GSM power ramp tolerance masks and the tolerances of spectrum due to switching. The file contains the settings for all eight possible time slot combinations which can be selected by setting the related start address of the memory (details below).

SME with the required option fitted then it is also possible to perform measurements at PCS(DCS1900) base stations.

Setting levels of e.g. -100dBm at the CMD and >> -50dBm at the SME easily cover more than the required adjacent time slot dynamic range of 50dB.

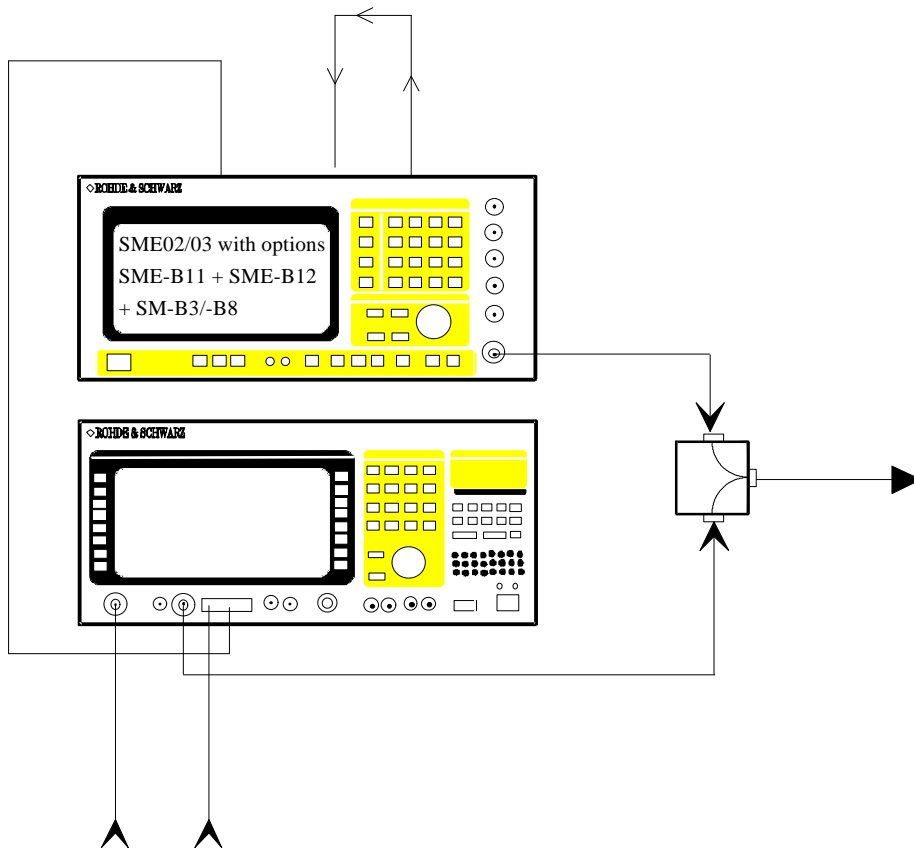
Synchronisation between CMD and SME

Once the CMD is synchronised to the timing of the base station (via TTL or RF) it will generate an internal frame TTL trigger signal of which the rising edge marks the begin of the time slot 0 for the CMD.

The SME and CMD need to be synchronised via this frame trigger for time correct measurements on the base stations. The frame trigger signal can be

obtained at PIN 9 from the multifunction connector on the front panel of the CMD and is fed into the external trigger input at the rear panel of the SME. The frame trigger signal can also be used to trigger a spectrum analyser externally in order to monitor the combined RF output signal which is connected to the base stations receiver.

Detailed test set-up



CMD and SME hard- and software requirements

A CMD 54/57 with software version 1.85 or higher and option CMD-B3 fitted is needed for this application.

The current instrument settings can be found when selecting the following: MENU HOME; CONFIG; OPTIONS.

The SME should have at least built in the following options with the listed hardware and software versions:

SME-B11	Digital Modulation Coder VAR≥2; REV≥5
SME-B12	Memory Extension VAR≥2; REV≥2
SM-B3/B8	Puls Modulator SME02/03 no limitation
OPU1	VAR=10; REV≥1 (Version with internal GSM filter)

The hard and software versions can be checked in the menu "UTILITIES; DIAG; CONFIG"

SME settings

Once the data sequence of the file ADJ_TIME.SEQ is downloaded to the SME by using the SME-K1 the following settings have to be performed:

- Switch on digital modulation with
GMSK - SOURCE = DATA
- Select the internal GSM-Filter with
LEVEL ATTENUATION MODE=GSM-SLOPE
- Select data source to memory extension SME-B12:
SELECT LIST = XMEM

Afterwards the SME menu should look like as follows:

FREQUENCY	<input checked="" type="checkbox"/> GMSK	SOURCE	OFF EXT PRBS <input checked="" type="checkbox"/> DATA
LEVEL	GFSK	PRBS	<input checked="" type="checkbox"/> 9 15 20 21 23 BIT
MODULATION	QPSK	CLOCK...	<input checked="" type="checkbox"/> POS/COUP
<input checked="" type="checkbox"/> DIGITAL MO	FSK	LEVEL ATTENUATION MODE	NORM MAX <input checked="" type="checkbox"/> GSM-SLOPE
LF OUTPUT	4FSK	LEVEL ATTENUATION	0.0 dB
SWEEP	FFSK	SELECT STANDARD...	CURRENT: GSM/PCN
LIST	ERMES	BIT RATE / FILTER	<input checked="" type="checkbox"/> RATE=270.833kbps / B*T=0.3
MEM SEQ	FLEX	DIFF ENCODER	OFF <input checked="" type="checkbox"/> ON
UTILITIES		MOD POLARITY	<input checked="" type="checkbox"/> NORM INV
HELP		SELECT LIST...	CURRENT: XMEM
		DELETE LIST...	
		CONFIG XMEM...	

- Configure the memory extension
CONFIG XMEM
START ADDRESS = 1
LENGTH = 1250
MEM MODE = 1M*3
EXT TRIGGER = ON
EXT TRIG SLOPE = POS

This menu looks now as follows:

START ADDRESS	1
LENGTH	1250
MEM MODE	8M*1 <input checked="" type="checkbox"/> 1M*3
EXT TRIGGER	OFF <input checked="" type="checkbox"/> ON
EXT TRIG SLOPE	<input checked="" type="checkbox"/> POS NEG
RECORD DATA	◆
ABORT RECORDING	◆

"Start address" is automatically set to 10 000 after the download of the data file. By selecting different start addresses according the table below you can choose which time slot combinations shall be generated by the SME:

time slot	start address
0	1
1	1251
2	2501
3	3751
4	5001
5	6251
6	7501
7	8751
calculation:	$n * 1250 + 1 (n = 0 \dots 7)$

- Switch on pulse modulator
- PULSE - SOURCE - EXT
- PULSE - POLARITY - INV
- PULSE - EXT IMPEDANCE - 10 k

All settings can be done automatically via the IEEE with the help of the program 'IECSME.EXE'. This program is included in the application note file '1GPAN26E.EXE'. You need a PC with an IEEE card from National Instruments or R&S to run this tool. Run the program from the directory in which you have copied all the files of '1GPAN26E.EXE'. Connect a SME to the IEEE bus. Start the program with the command: *IECSME SET_SME*.

Programming example

The DATA and BURST signal have to be programmed on the SME-B12 for data generation and level switching. For this purpose use the enclosed SME-K1 sequence file named "ADJ_TIME.SEQ". The table below shows an

example of a GSM frame with time slot 4 and 6 being active (relative to the frame trigger of the base station). A detailed description how to program the SME data generator can be found in the SME user manual, chapter 2.6.3.

Bit position	Number of bits	DATA	LEV ATT	BURST	Remarks
1 to 624	624	don't care	don't care	1	Slots 0 to 3 off
625	1	1	don't care	1	guard slot 4
626 to 628	3	000	don't care	000	Tail
629 to 685	57	PRBS	don't care	0 to 0	Data (PRBS)
686	1	1	don't care	0	Flag
687 to 712	26	00100101110000100010010111	don't care	0 to 0	Training sequence Midamble 0
713	1	1	don't care	0	Flag
714 to 770	57	PRBS	don't care	0 to 0	Data (PRBS)
771 to 773	3	000	don't care	000	Tail
774 to 775	2	1 to 1	don't care	0	Guard
776 to 780	5	11111	don't care	11111	Guard
781 to 936	156	don't care	don't care	1 to 1	Slot 5 off
937	1	1	don't care	1	guard slot 6
938 to 940	3	000	don't care	000	Tail
941 to 997	57	PRBS	don't care	0 to 0	Data (PRBS)
998	1	1	don't care	0	Flag
999 to 1024	26	00100101110000100010010111	don't care	0 to 0	Training sequence Midamble 0
1025	1	1	don't care	0	Flag
1026 to 1082	57	PRBS	don't care	0 to 0	Data (PRBS)
1083 to 1085	3	000	don't care	000	Tail
1086 to 1087	2	1 to 1	don't care	0	Guard

1088 to 1092	5	11111	don't care	11111	Guard
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