

R&S CMU200 (K20,K21,K22,K23,K24), CMUgo

GSM Measurements with the R&S CMU200 and CMUgo

Application Note

This Application Note describes how to test and perform measurements on mobile phones in compliance with the GSM standard using the R&S CMU200 by means of the remote-control program CMUgo or manual operation.



Subject to change without notice - Bernhard Schulz 01.05 - 1CM57

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1 Overview

The Radio Communication Tester R&S CMU200 can be used to perform fast and accurate measurements of various standards such as GSM, IS-136, AMPS, CDMA, cdma2000, 1xEVDO, WCDMA and *Bluetooth*^{®1}.

This Application Note describes how to use CMUgo, a Windows application for remote control of the R&S CMU200 and for measuring and testing mobile phones in compliance with the GSM standard.

2 Introduction

Although the "old" 2nd generation GSM mobile radio standard is threatened by a 3rd generation (WCDMA, cdma2000), it has been expanded by the new functions EDGE and (E)GPRS (2.5 generation), which will surely extend its life-span. Most telephones on the market still use GSM or offer GSM as fallback options.

This Application Note intends to analyze aspects of the CMU in accordance with the pure GSM standard of the 2nd generation. A separat Application Note [3] deals with newer functions such as GPRS and EGPRS.

This Application Note does not attempt to explain the associated theory in full detail but rather simply provides a brief summary of the most important aspects.

3 Manual Operation of the R&S CMU200

Call setup and release

Auxiliary RF generator (AuxTX - option B95)

In the standard GSM environment, a single generator in the CMU is still sufficient for testing the mobile phones. Here, the CMU generates the BCCH in timeslot 0. Timeslots 1 and 7 are disabled due to settling times; timeslots 2 to 6 are therefore available for the TCH (Fig. 1).



Fig. 1 - Downlink on two channels without option B95

Fig. 2 shows the required CMU settings in the **BS Signal** tab. The **BCCH Channel** and **TCH Channel** parameters are particularly important here. The **BCCH Level** and the **Main Timeslot** can also be set here. The **Mode** parameter is only relevant for the conventional GSM mode; the BCCH can be disabled following call setup BCCH or TCH to allow measurements on all timeslots.

¹⁾The *Bluetooth* word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Rohde&Schwarz is under license.

Ch. 1 Ch. 2	5 M 900	Overvie	W		Circuit Switched Single Slot	1	Connect Control
😑 GSM 900 (Connectic	n Control				S	ignal On
Frequency Offset Mode		+0 нz BCCH z	₹CH&&CCH TX Ind TCH	тсн	Single	Slot 🗜	Slot Mode
BCCH Level	- 85.	0 dBm		- 90.0	dBm -	20.0 dB unused	TCH Level
BCCH Channel	32			62	947.4 MHz		TCH Channel
Channel Type		Off	Aux T X		Off		Hopping
				3			Timeslot
Connection		MS Signal	BS Signal	Network	AF/RF ⊕+	Sync.	1 2

Fig. 2 – CMU setup for BS signal without option B95

Since the GPRS mode transmits data only when required instead of continuously, most mobile phones perform a power measurement on the BCCH at undefined points in time. If this measurement fails, the call is automatically released by the mobile phone. The CMU now provides two ways of preventing this:

- BCCH and TCH are on the same channel. This means that an auxiliary generator is not required. However, a channel change or dual-band handover (Fig. 3) cannot be performed.
- If the auxiliary generator is available, a permanent BCCH is generated and channel change and dual-band handover are possible (Fig. 4).

	TS 7	TS 0	TS 1	TS 2	TS 3	TS 4	TS 5	TS 6	TS 7	TS 0	TS 1
CH32	TCH	BCCH	TCH	BCCH	TCH						
CH64											

Fig. 3 - Downlink on the same channel without option B95

	TS 7	TS O	TS 1	TS 2	TS 3	TS 4	TS 5	TS 6	TS 7	TS 0	TS 1
CH32	×					BCCH					
CH64	TCH										

Fig. 4 - Downlink with option B95

Fig. 5 shows the **BS Signal** tab when option B95 is used.

GR. 1 GSM900 Overview	Circuit Switched Single Stot
😑 GSM 💷 Connection Control 📓	Signal On
Frequency Offset + 0 Hz	Single Slot Mode
	- 90.0 dBm - 20.0 dB TCH used unused Level 62 947.4 MHz TCH
Channel Type Aux TX	Off Hopping
BCCH - 75.0 dBm 36 Level Channel	3 Timeslot
Connection MS Signal BS Signal	Network AF/RF 🕑 Sync. 🚺 2

Fig. 5 – CMU setup for BS signal with option B95

A number of restrictions apply if the option B95 is used:

- Max. 2 W RMS can be applied at the RF1 connector.
- RF3 out cannot be used while option B95 is being used.
- A maximum of -60 dBm can be set as the BCCH level at RF2.

Analyzer mode

In GSM, the CMU generally has three modes in the signalling mode, and two of them ensure easy operation. In the **AUTO** mode, the CMU first measures the mobile phone power and automatically adjusts itself to this power. Due to this additional measurement, this mode is slower than the recommended **PCL/Gamma** mode. The CMU thus automatically adjusts to the mobile phone power expected due to the PCL value (Fig. 6). In the **Manual** mode, you have to set the required level manually.

Ch.1 GSM900 Overview	w	Circuit Switched Single Slot		Connect Control
😑 GSM 900 Connection Control 😭			Sign	alOn
- Setup		Analyzer Level /RF	Mode	
Default Al Settings Analyzer Level Default Settings RF Max.Level RF Mode RF Attenuation Meas.Control Multi Slot Default Settings Meas.Slot	□ 30.0 dBm PCL / Gamma Low Noise			
Trigger I/Q-IF Analyzer			Misc.	1 2

Fig. 6 – Analyzer mode

Call setup

Fig. 7 again shows the default state of the CMU. The BCCH is generated and the CMU waits for the mobile phone location update.

Ch. 1 Ch. 2 GSM9	00 Ov	verviev	,		Circuit Switched Single Slot	1	Connect Control
😑 GSM 900 Conne	ction Co	ontrol 🛓				S	ignal On
✓Signalling States Circuit Switched	Signal On	1					Cienal
Packet Data +MS Capabilities MS Revision Level	Idle			mob	Waiting for ile synchroniz	ation	Off
	support.	GMSK-PC	8PSK-PC	ord	all from the n	nobile.	Connect Mobile
GSM 430 GSM 480 GSM 700 GSM 850							Send SMS
✓ GSM 900 P-GSM E-GSM B-GSM					Circuit Sw	itched	Main Service
GSM 1800 GSM 1900 GSM GT 800					GS	Monly 🛓	Network Support
UMTS FDD UMTS TDD CDMA 2000 Wiltislot Class					Peak		Wideband Power
Connection	MS	Signal	BS Signal	Network	AF/RF ⊕+	Sync.	1 2

Fig. 7 – Default state of the CMU

After the location update, the CMU switches to the synchronized state (Fig. 8). Now you can set up a call to or from the mobile phone by pressing **Connect Mobile**.

Ch. 1 Ch. 2 GSM90)0 Ov	/erviev	J		Circuit Switched Single Slot	1	Connect Control
😑 GSM 900 Connec	tion Co	ontrol 🛓				Syr	nchronized
-Signalling States	*						
Circuit Switched	Synchron	ized					Signal
Packet Data	Idle			Make	a call from the	e mobile	Off
MS Revision Level	Phase II				or press the		
▼S.Bands/PowClass	support.	GMSK-PC	8PSK-PC	Co	nnect Mobile	key.	Connect
+ GSM 400							Mobile
GSM 450 GSM 480	H						
GSM 700		1000	2 <u>000</u>				Send
GSM 850		1.000	1.000				SMS
▼G5M 900 P-GSM		4 (33dBm)					Main
E-GSM	I∎	4 (OOGDITI)			Circuit Sw	itched	Service
R-GSM							0011100
GSM 1800		1 (30dBm) 1 (20dBm)		1	00	d and a f	Network
GSM GT 800				0	GSI	monity	Support
UMTS FDD							
► UMTS TDD							Wideband
✓ Multislot Class	L1				Peak		Power
			10				
Connection	MS	Signal	BS Signal	Network	AF/RF 🕀	Sync.	1 2

Fig. 8 - CMU in the synchronized state

Fig. 9 again shows the internal states in the CMU. GSM and (E)GPRS are identical up to the **Attached** and **Synchronized** state, i.e. a circuit-switched call is also possible in the **Attached** state.



Fig. 9– (E)GPRS states in the CMU

If the CMU is in the **Call Established** state, you can perform the individual measurements.

Measurements

The individual measurement menus are displayed in the lower row. Individual connection parameters (e.g. channel, PCL, etc) as well as measurement parameters can be varied in the column at the right edge.

Overview

The **Overview** menu displays the most important mobile phone parameters (Fig. 10).

Ch. 1 Ch. 2 GSM900 Overview		Circuit Switched Single Slot	Connect Control
RUN P/t Norm. GMSK 15(13.0 dBm) Reported Power	Settings ▶Signalling States	<mark>0</mark> 	P/t Norm. GMSK
10.9 dBm Avg. Burst Power (Current) 11.1 dBm Peak Burst Power	Find Capabilities →Signaling Info IMSI IMEI	001.01.9876543210 350780.20.829781.0	Appli- cation
0.33 Sym. Timing Advance Error	Dialled Number -Meas. Control Repetition Stop Condition	- Continuous None	Analyzer Level
Image: Frequency Error 16 Hz Frequency Error 5.8 * Peak T Phase Error (Current)	Display Mode Statistic Count → Analyzer Level	Current 100 Bursts	MS Signal
1.8 * RMS MS Receiver Reports	RF Max. Level RF Mode RF Attenuation Trigger Source	PCL / Gamma Low Noise Signalling	BS Signal
Off Discontinuous Transmission (DTX)	Trigger Slope →MS Signal → Circuit Switched Timing Advance	Rising Edge	Network
Main Stot 3 18 (-93 to -92 dBm) 0 (0.0 to 0.2 %) RX Level RX Quality		15 (13.0 dBm)	
Overview Power Modulation Spectru	m R	eceiver Quality Audio	Menus

Fig. 10 – Overview menu

Power

This section discusses the individual power measurements in detail.

Fig. 11 shows the typical time characteristic of a GSM signal. Fig. 12 shows the **PowerPCL** measurement, which is a quick measurement on three or seven channels across all PCLs.

The measurements required for the 2.5 generation (e.g. 8SPK) are described under [3]. No other measurements are discussed here.





Fig. 11 - Power vs time measurement

Ch. 1 Ch. 2	Meoo	Powe	er			Circuit Switch Single 1	ed Slot	τ.	Connect Control
PCL/Channel	1st 1	2nd 22	3rd 42	4th 63	5th 83	6th 104	7th 124		P/PCL
5 (33.0 dBm)	_ 30 .2	_ 30.1	_ 30.1	🖵 30.0	29.9	- 29 .9	_ 29 .8		
6 (31.0 dBm)	28.6	28.6	28.6	28.5	28.4	28.3	28.3		
7 (29.0 dBm)	27.1	27.1	27.0	27.0	26.9	26 .8	26.8		Applic. 1
8 (27.0 dBm)	25.1	25.0	25.0	25.0	24.9	24.8	24.7		
9 (25.0 dBm)	23.1	23.1	23.0	22.9	22.9	22.8	22.7		Analyzer
10 (23.0 dBm)	21.0	21.0	21.0	20.9	20.8	20.7	20.6		Level
11 (21.0 dBm)	19 .0	19.0	18. 9	18.9	18.8	18.7	18.6		
12 (19.0 dBm)	17.0	16.9	16. 9	16.8	16.7	16 .6	16.5		MS Signal
13 (17.0 dBm)	15.0	15.0	14.9	14.8	14.7	14.6	14.5		-
14 (15.0 dBm)	13.0	12.9	12.9	12.8	12.7	12.6	12.5		BS Signal
15 (13.0 dBm)	11.0	11.0	10. 9	10.9	10.7	10.6	10.5		
16 (11.0 dBm)	9 .0	9.0	8. 9	8.8	8.7	8.5	8.4		
17 (9.0 dBm)	7.0	7.0	6. 9	6.8	6.7	6.5	6.4		Network
18 (7.0 dBm)	5.0	4.9	4.9	4.7	4.6	4.4	4.3		
19 (5.0 dBm)	3.0	3.0	2.9	07	2.5	2.3	2.2		
Channel Count									
				7		all re	sults in dBm		
Repetition	Repetition Stop Channel Count Menus								Menus

Fig. 12 – PowerPCL

Modulation

Fig. 13 shows a GSM modulation measurement



Fig. 13 – Modulation

Spectrum

The CMU offers three spectrum measurements. With the **Spectrum due to Modulation** and **Spectrum due to Switching** measurements, the corresponding time domain is also displayed (Fig. 14 and Fig. 15). The **Spectrum MSW** measurement performs both measurements simultaneously and displays them together in a window (Fig. 16). Note the difference in the measurement displays: spectrum modulation uses dB and switching uses dBm.









Fig. 15 - Spectrum due to switching



Fig. 16 - Combined spectrum measurement

Receiver quality

A pseudo random signal that can be set is generated by the CMU to assess the Receiver Quality. This signal is then sent back by the mobile phone. Pressing the **Meas. Mode** button provides, three different measurement methods. **BER** calculates the BER via the class II bit. **RBER/FER** additionally calculates the frame error rate (FER). **BBB** or **Fast BER** closes the loop without the Channel Coder, i.e. more bits per frame are available for measurement. If the test depth is the same, **BBB** is quicker. To measure the 10000 bits typical for production, **BER** and **FBER** require 129 frames and **BBB** 88 frames.

Ch. 1	ality	Circuit (1988)	Connect
Ch. 2 GSM900 Receiver Qua		Switched Single Slot	Control
Image: Class II O.333 % Class II 0.000 % Class Ib 0.000 % FER 0 CRC Err. Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time Image: CRC Err. Time <	Settings Settings MS Capabilities Signaling Info MSI MEI Dialed Number Meas. Control Stop Condition Frames Test Setup Meas. Mode Analyzer Level MS Signal Circuit Switched Timing Advance Single Slot PCL (MS) Timeslot BS Signal Circuit Switched TCH BER Level used Timeslot	O01.01.9876543210 350780.20.829781.0 - None 100 Test 1 RBER / FER 0 Sym. 15 (13.0 dBm) 3	H BER Appli- cation Analyzer Level MS Signal BS Signal Network
Stop	nes Test M	eas.	Menus
Condition	Setup	Mode	

Fig. 17 - Receiver quality

Audio (option B41 required)

Before audio measurements are performed, the correct path must be set in the CMU. To do this, you must set **Bit Stream** to Speechcoder/Handset both for the uplink and downlink (Fig. 18).

Ch.1 Ch.2 Audio Analyzer/0	Generator @ GSM 900 🖬 🚺 Connect Control
GSM 900 Connection Control	Signal On
Setup	Circuit Switched/Signalling Modes/
Default All Settings	
Network Support	GSM only
Main Service	Circuit Switched
► Network Identity	
▼ <u>Circuit Switched</u>	
 Signalling Modes 	Idle
Traffic Mode	Full Rate Version 1
HalfRate Subchannel	0
Bit Stream	Speechcod./Handset
Starting Time	0
Location Update	Always
► Default IMSI	
Power Change	Fast
Signalling Channel	FACCH
Loop Command	Sensitivity
Connection MS Signal	BS Signal Network AF/RF ()+ Sync. 1 2

Fig. 18 - Audio setting: Bit Stream

Audio uplink

In the uplink, the CMU generates audio signals and provides them at AF OUT. A connected loudspeaker feeds these signals to the mobile phone microphone, which sends the signals via the speech encoder using RF and the speech decoder of the CMU. Finally, the signals are displayed in the **Audio** menu (Fig. 19 and Fig. 20).

Audio Uplink

Bitstream mode "Handset"
 Speechencoder to Handset (A)
 Speechdecoder to Analyzer (B)

 Analyzer (B)
 Analyzer (B)
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Fig. 19 - Audio uplink in the CMU

Ch. 1 Ch. 2	I dio Analyzer/	Generato	or@GSN	900 🖬	ł	Connect Control
😑 GSM 900 (C	Connection Control					Signal On
	AF Connector Overview		RF	Connector Se	tup	
	Analyzer 2 📀 🛛 📀	Generator 2	RF 3 OUT	RF 2	RF 1	RF Output
	°"⊙ ⊙	Generator 1	+0.0 dB	() +0.0 dB	+0.0 dB	Ext. Att. Output
Speech Encoder	Handset	Ŧ	RF 4 IN	RF 2	RF 1	RF Input
Speech Decoder	Analyzer	Ŧ	+0.0 dB	•0.0 ав	+0.0 dB	Ext. Att. Input
				 Peak		R Wideband Power
Connection	MS Signal	BS Signal	Network	AF/RF 🕃	Sync.	1 2

Fig. 20 - Audio uplink setting

Audio downlink

Here, the audio signals generated by the CMU are sent to the mobile phone via the speech coder using RF. The mobile phone decodes the signals and outputs them on the loudspeaker. The measurement values are displayed

in the **Audio** menu by means of a microphone which is connected via AFIN (Fig. 21 and Fig. 22).





Ch. 1 Ch. 2 Audio Analyzer/Generato	or @ GSM 900 🖬 🚺 Connect Control
😑 GSM 900 Connection Control 😭	Signal On
AF Connector Overview ALIX1 ALIX2 Analyzer 2	RF Connector Setup RF 3 OUT RF 2 RF 1 RF
Analyzer 1 O Generator 1	Output +0.0 dB +0.0 dB +0.0 dB
Speech Encoder Generator	RF 4 IN RF 2 RF 1 RF Input
Speech Decoder Handset	+ 0.0 dB + 0.0 dB + 0.0 dB Ext. Att.
	Peak Wideband
Connection MS Signal BS Signal	Network AF/RF 🗇 Sync. 💶 2

Fig. 22 – Audio downlink setting

Measurements

Fig. 23 and Fig. 24 show the audio generator and audio analyzer of the CMU.



Fig. 23 - Audio generator



Fig. 24 - Audio analyzer

AMR

Fig. 25 shows the implementation of AMR in the CMU. The mobile phone measures the signal-to-noise ratio at a specific level and requests a codec at the base station (requested by MS).

Ch. 1 Ch. 2	SM 1800	Receiver Qual	ity	Circuit Switched Single Slot	"I" L	Connect Control
😑 GSM 180	a Connection	n Control 📳			Call E	stablished
AMR Rate Set	AMR Rate Set Codec Mode 4 Mode 3 Mode 2 Mode 1 Threshold Down 4 Up 3 Down 3 Up 2 Down 2 Up 1	Setting 122 kBit/s 7.95 kBit/s 5.9 kBit/s 4.75 kBit/s 16.5 dB 18.5 dB 11.5 dB 13.5 dB 13.5 dB 6.5 dB 8.5 dB	requested by M used by M Spe	AMR Ful	IRate 3 2 Indset	Traffic Mode Codec Mode DL Codec Mode UL Bit Stream
			<i>855/gna/</i> <mark>▲ – 10<mark>6</mark>0</mark>	O dBm - used	- 20.0 dB unused	TCH Level
Connection	Handover	MS Signal BS Signal	Network	AF/RF 🕀	Sync.	1 2

Fig. 25 – AMR

To avoid having to continuously switch back and forth, a hysteresis mechanism can be set (Fig. 25 left and Fig. 26).



Fig. 26 - AMR hysteresis

4 Remote Control of the R&S CMU200 with CMUgo

Software features

CMUgo offers a simple user interface for remote control of the R&S CMU200 both via a GPIB bus (IEEE488.2) and via the RS-232-C interface. CMUgo can handle all standards available on the R&S CMU200.

CMUgo includes a feature for outputting test reports. Moreover, a report of the remote-control commands with the times of the individual steps can be output, and the remote-control commands can be copied directly to the Windows clipboard for further processing.

Hardware and software requirements

Hardware requirements

- CPU: min. 300 MHz
- RAM: min. 64 Mbyte
- Monitor: SVGA with min. 800 x 600 pixels
- Hard disk: 50 Mbyte of free space
- Peripherals: National Instruments GPIB bus or RS-232-C interface, mouse

Software requirements

- Windows 98/ME/2000/XP
- CMUgo V1.51 with GSM modules V1.51 or later

Using CMUgo

Please refer to the CMUgo manual [2] for information on how to connect the computer and the R&S CMU200, as well as how to install, start and operate CMUgo.

With CMUgo, the remote sequence can be output by using the **Demo** function. You can then create your own sequences on the basis of this sequence. CMUgo tries to perform the test sequences as quickly as possible. Since the program is structured as a sequencer (information about the previous module is not available), you may be able to save time by optimizing it further.

GSM Call Setup module

In the **GSM Call Setup** module, all parameters that are relevant for establishing a GSM connection are set in the **Circuit-Switched** mode (Fig. 27). Under **Network**, you select the band in which the BCCH is to be generated, and which will be used for the location update. In the **BCCH** section, you define whether the BCCH is to be generated with AuxTX (option B95); You also set the channel and level of the BCCH here. The channel and level of the TCH that is used are selected under **TCH after call setup**. In addition to pure GSM, you can also select GPRS or EGPRS

under **Support** in **Network Setup**. Thus, the CMU already generates a BCCH here with information about (E)GPRS so that additional (E)GPRS tests can be performed after the GSM test without carrying out another location update. The **Slot** mode differentiates between a single slot (conventional GSM (voice or data) and the **Multislot** mode (data only). If you select **Single Slot**, CMUgo uses the parameters under **Single Slot Configuration;** in the **Multislot** mode, an additional dialog is available (see Fig. 30). Now you have to specify the call direction: **Call to mobile** (MTC) or **Call from mobile** (MOC). Moreover, the phone can automatically be controlled via AT commands here: **from mobile** (voice, AT commands) sends ATD sends and the number listed **under the dialed number should be** to the phone; **from mobile** (data, AT commands) opens an additional dialog box in which you can enter any AT commands (Fig. 28). Finally, **Attenuations** allows you to specify the RF connector and the input and output attenuation.

Call Setup Configuration	CONTRACTOR OF A DESIGN OF A	a ×
	Network	ок
	BCCH use AuxTX (B95)	Cancel
	RF Channel: 30	MultiSlat
	-85	Configuration
	TCH after call setup RF Channel: 62	
	RF Level: -85	
	Network Setup	Configure
	Support GSM	
	Slot Mode Single Slot 💌	
	Single Slot Configuration PCL: 15 Timeslot: 3	
	The dialed number should be: 1234567890	
	Call:	
	to mobile	
	🗖 Send SMS	
	Attenuations	
	Output:	
	CMU Connector: C RF1	

Fig. 27 - Call Setup configuration

	-11
OK	-

Fig. 28 - Call Setup: AT commands

The **Configure** button opens the **Additional Configuration** dialog box (Fig. 29).

	8	×
		Ō
		1
PR 9	2	-
Full Rate V1		-
E		-
Enter your descrip	ption her	e
	OK	
	PR 9 Full Rate V1	PR 9

Fig. 29 - Call Setup: additional configuration

Here, you can set additional parameters such as **MNC**, **MCC**, **Bit Stream** and **Traffic Mode**. Moreover, you can send an AT command to the mobile phone after the location update and before call setup.

The **Multislot Configuration** button allows you to to customize the multislot setting for the call with multiple timeslots .

The survey of th		Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot
	Downlink	Г	Г		ম	Γ	Г	Γ	Г
Reference Level	Data State 1994								
Multi Slot Mode	(dB):	0	-20	-20	0	-20	-20	-20	
		Г					Г		Г
Main Timeslot					5				
	DCI			10	10		15	15	

Fig. 30 - Call Setup: multislot

First, you can set the **Main Timeslot** here. The **Main Timeslot** is automatically activated in the graphical **Multislot** section. The blue slot indicates the BCCH, grey slots indicate deactivated slots without level, dark green slots indicate non-activated slots with a defined level, and light green slots indicate activated slots. In the **Downlink** section, slots can be activated and a level relative to the reference level can be set. In the **Uplink** section, the required slots are activated and the PCL value to be used by the mobile phone can be specified.

Fig. 31 shows a typical Call Setup entry in the test report.

Network: GSM 900, BCCH Channel/Level: 30/-85.0 dBm, TCH Channel: 62, TCH Level (dBm): -85.0, Support GSM, PCL: 15 (Main) Timeslot: 3, Attenuation (In/Out): 0.0/0.0 dB, Slot Mode: Single Slot, Bitstream: PR9, AuxTX: Off Traffic Mode: Full Rate V1

IMSI: 0.0.100000095, IMEI:	0. 0.	0. 0, Revision: PH2P, Numbe	r: 1234567890,	Traffic: FRV1,	Power Class: 4	
Call to Mobile:					passed	-

Fig. 31 - Call Setup report

GSM Call Release module

The GSM **Call Release** module is used to release the active call to the mobile phone; the R&S CMU200 enters the synchronized state (Fig. 32). If **Free all CMU resources** is activated, the instrument changes to the SOFF state.

Call Release Configuration	Туре	
	Call Release: from CMU	
	Free all CMU resources	
	ОК	Cancel

Fig. 32 - Call Release

If the call is not set up or if it has been terminated, the following message window will be displayed (Fig. 33). This query is also performed by all other modules (except for **Call Setup**).

<u>~</u>
he current instrument state!

Fig. 33 - Message: no connection

Fig. 34 shows the **Call Release** entry in the test report.



Fig. 34 - Call Release report

GSM Testset module

The **GSM Testset** module provides the easiest means of performing RX and TX measurements with GMSK modulation as quickly as possible. Only additional measurements such as power versus time measurements for multislot or also 8SPK measurements are performed with additional modules.

Changes in the active connection can be made in the top left-hand section. Being able to perform dual-band handover is of particular importance, i.e. you can change the TCH to another band. To do this, you must select a band under **Network** that differs from the one in the previous module.

- Network		Measurements
I. Strong	20M 000	Power
je	35M 900	Average Burst Power
- ТСН		Peak Burst Power
RF Channel:	62	Template Matching
		Timing Error
PCL:	5	Rurst Graphic
Timeslot:	3	
	ĭ	
	1	Phase Error Peak
DE Laurel		Phase Error RMS
hr Level	-85	V Urigin Uriset
Attenuations		Phase Error Graphia
Input:	0	Friase Entition draphic
Dutout:		Reports
output.	U	RXQual
2		RXLev
The second second		Spectrum
Meas Slot:	3	Spectrum due to Modulation
100		Graphics Spectrum Modulation
		Spectrum due to Switching
		Graphics Spectrum Switching
		- BX Quality
		C No BX Test
		By Test (BEB)
		C RX Test (RFER)
		C RX Test (BBB/Fast BER)
- Description	۰ ۱	
	42.	Enter your description bere
<u> </u>		
·	12.3	OK Curred

Fig. 35 - GSM Testset

The timeslot to be measured is set using Meas Slot.

The individual measurements can be selected from the various sections. Where possible, CMUgo combines the **Power** and **Modulation** measurements to form a common measurement (designation in remote mode: POWer:MPR). To allow this, measurements must be selected under **Power** and **Modulation**. However, **Origin Offset** and/or **IQ Imbalance** must not be selected under **Modulation**. Additionally, graphics can be output for each measurement. If both spectrum measurements are activated (**Spectrum due to Modulation** and **Spectrum due to Switching**), the combined spectrum measurement is used (designation in remote mode: SPECtrum:MSW). Once again, the output of graphics can be activated in each case. All measurements are performed simultaneously to the extent possible in order to save time (see the **Demo** mode or **GSM Testset** in the Appendix).

Clicking the Limits button opens the dialog box shown in Fig. 36.

TX Averagin	a (Bursts):		RX Averaging (Frames):	88
			Dit stream sunch time (s)) 00
Power Lippe	r Limit (dBm):	25	Dit stredin synch time (s.	, 0.2
Personal Per	- Limit (dDm)		Class II Franc (mar. %)	aa
PowerLowe		31	Class II Error (max. %):	0.2
			Class Ib Errors (max. %):	0
Max. Timing	Error (Bits):	2	Erased Frames (max. %)): 0
			Confidence	
max. Freque	ncy Error (Hz):	90	I Enable Confidence	BER
max . Phase	Error RMS (°):	5	Confidence Fail:	99.80 %
max. Phase	Error Peak (*):	20	Confidence Pass:	99.80 %
max. Origin (Offset (dB):	-20	Bad DUT:	1.5
max. IQ Imb	alance (dB):	-20	Result Window:	
🗖 Decodin	, g with guard and tail bits	3	min. Test Time (s):	
 Average 				<u> </u>
C Maximur	n		BXI ev (may)	
			BXLev (Min.):	27
			PVO LOL)	23
			HAQuai (Max.):	1
- Spectrum-			······································	
	Slot Co	ünt:	1	
🔽 Var. Mea	as Point 1 (MHz):	0.8	🔲 Var. Meas Point 2 (Mł	Hz): 1
🗖 Var. Mea	as Point 3 (MHz):	1.4	🔲 Var. Meas Point 4 (Mł	Hz): 1.6
- Spectrum	tue to Modulation			
Spectrum			No of Bursts:	10
Offeeter				
100	200 250 400	600 80	0 1000 1200 1	400 1600 1800
Spectrum	due to Switching:			
			No of Bursts:	10
Offsets:				
400	600 1200 1800			

Fig. 36 - GSM Testset: limits

The parameters for the TX measurements are set in the top left-hand section. First, the desired number of TX bursts must be set under **TX Averaging (Bursts)**. The power limits (**Power Upper Limit** and **Power Lower Limit**), the **Max Timing Error** and the various parameters for the modulation measurement can also be set here. Furthermore, you can activate **Decoding with guard and tail bits** and choose between **Average** and **Maximum**.

The top right-hand section is reserved for RX measurements. The RX measurement limits and the number of the frames to be measured are entered in this section. Moreover, you can activate the **Confidence** mode.

The **Spectrum** section (buttom) is reserved for the two spectrum measurements. Note that it allows you to set the offsets defined by the specification and the number of bursts (**No of Bursts**) for each of the two measurements. Additionally, you can activate and enter four variable offsets (**Var. Meas Point 1** to **Var. Meas Point 4**). The **Slot Count** parameter refers to the **due to Switching** measurement for multislot measurements.

Fig. 37, Fig. 38 and Fig. 39 show the test report entries.

GSM 900, Channel 62, PCL 5, Timeslot: 3, BS RF Level -85.0 dBm, Attenuation (In/Out) 0.0 dB / 0.0 dB, Meas. Slot: 3 Decoding for modulation: Standard, BER Synch time: 0.20 s

Average Power: 10 Bursts	31.00 dBm	35.00 dBm	31.80 dBm	1
Peak Burst Power: 10 Bursts	31.00 dBm	35.00 dBm	32.27 dBm	4
Power Time Template: 10 Bursts			passed	1
Timing Error: 10 Bursts	-2.00 Bit	2.00 Bit	1.55 Bit	1
Phase Error Peak: 10 Bursts	-20.00 °	20.00 °	4.33 °	1
Phase Error RMS: 10 Bursts	L	5.00 °	-4.60 °	1
Origin Offset: 10 Bursts		-20.00 dB	-7.29 dB	-
IQ Imbalance: 10 Bursts		-20.00 dB	-15.33 dB	-
Frequency Error: 10 Bursts	-90.00 Hz	90.00 Hz	44.95 Hz	1
RX Qual:		1	0	1
RX Lev:	23	27	26	-
Spectrum due to Switching:		3	passed	1
Spectrum Switching: @ - 0.6 MHz			-84.62 dBm	-
Spectrum Switching: @ - 0.4 MHz			-32.72 dBm	1
Spectrum Switching: @ 0.4 MHz			-73.42 dBm	~
Spectrum Switching: @ 0.6 MHz			-53.24 dBm	-
Spectrum due to Modulation:			passed	~
Spectrum Modulation: @ - 0.6 MHz	i i i i i i i i i i i i i i i i i i i		-21.96 dBc	1
Spectrum Modulation: @ - 0.4 MHz		1	-60.44 dBc	-
Spectrum Reference Power: @ 0 MHz		1	20.00 dBm	1
Spectrum Modulation: @ 0.4 MHz			-59.77 dBc	~
Spectrum Modulation: @ 0.6 MHz			-34.17 dBc	1
BBB (Fast BER) 88 Frames		0.20 %	0.07 %	1

Fig. 37 – Testset report

Annex: Spectrum due to Modulation

PCL: 5, Channel: 62, Reference Power: 21.8 dBm



Fig. 38 - Spectrum due to modulation (graph)



PCL: 5, Channel: 62, Reference Power: 0.0 dBm



Fig. 39 - Spectrum due to switching (graph)

GSM Call Edge module

The **GSM Call Edge** module is basically the same as the **GSM Testset** module, except that the measurements are performed with 8PSK modulation and without any RX measurements (Fig. 40).

SM Call Edge (8PSK)		
	TCH RF Channet: PCL: Timeslot: BS Signal RF Levet: Attenuations Input: O Output: O	Measurements Power
	Meas Slot: 3	Spectrum Graphics Spectrum Modulation Graphics Spectrum Modulation Graphics Spectrum Modulation Graphics Spectrum Switching Graphics Spectrum Switching
	Description	Enter your description here

Fig. 40 - GSM Call Edge

The timeslot to be measured is set using Meas Slot.

The individual measurements can be selected in the various sections. Additionally, graphs can be output for each measurement. If both spectrum measurements are activated (**Spectrum due to Modulation** and **Spectrum due to Switching**), the combined spectrum measurement is used (designation in remote mode: SPECtrum:MSW). Once again, the output can be activated in each case.

Clicking the Limits button opens the dialog box shown in Fig. 41.

Edge Limits			8
	Power / Modulation		
	Number of Bursts:	O Average	
	Power		
	Power Upper Limit (dBm):	33 max. Frequency Error (Hz):	90
	Power Lower Limit (dBm):	31 max. Origin Offset (dB):	-30
	Max. Timing Error (Bits):	2 max . Phase Error RMS (*):	5
		max. Phase Error Peak (°):	20
		max. Magn. Error BMS (%):	125
		max. Magn. Error Peak (%):	17.7
		max EVM BMS (*):	
		max EVM Peak (*):	3
		max. EVM Fook ().	30
		max. Som perc. Phase En ().	5
		max. 35th perc. Magn Err (%):	5
		max. 95th perc. EVM (%):	15
	Spectrum		
	Slot Count:	1	
	Var. Meas Point 1 (MHz):	0.8 🗖 Var. Meas Point 2 (MHz):	1
	Var. Meas Point 3 (MHz):	1.4 🗆 Var. Meas Point 4 (MHz):	1.6
			1
	Spectrum due to Modulation	No of Bursts:	200
	0ffsets: 100 200 250 400 500	800 1000 1200 1400	L 1600 L 1800 L
	- Spectrum due to Switching		1 1000 1 1000 1
	spectrum due to switching.	No of Bursts:	10
	400 600 1200 1800 1		
			OK

Fig. 41 - GSM Call Edge Limits

First, set the desired number of TX bursts under **No of Bursts** in the **Power/Modulation** section (top). The power limits (**Power Upper Limit** and **Power Lower Limit**), the **Max Timing Error** and the various parameters for the modulation measurement can also be set here. You can also choose between **Average** and **Maximum**.

The **Spectrum** section (buttom) is reserved for the two spectrum measurements. Note that it allows you to set the offsets defined by the specification and the number of bursts (**No of Bursts**) for each of the two measurements. Additionally, you can activate and enter four variable offsets (**Var. Meas. Point 1** to **Var. Meas. Point 4**). The **Slot Count** parameter refers to the **due to Switching** measurement for multislot measurements.

Fig. 42 shows the report; the report for spectrum measurements is identical to that for **GSM Testset**.

Average Power (8PSK): 100 Bursts	31.00 dBm	33.00 dBm	31.00 dBm	4
Peak Burst Power (8PSK): 100 Bursts	31.00 dBm	33.00 dBm	32.34 dBm	
Power Time Template (8PSK): 100 Bursts			passed	4
Timing Error (8PSK): 100 Bursts	-2.00 Bit	2.00 Bit	-0.89 Bit	4
95th percentile EVM (8PSK): 100 Bursts	-15.00 %	15.00 %	-6.35 %	4
95th percentile Magitude Error (8PSK): 100 Bursts	-5.00 %	5.00 %	1.26 %	4
95th percentile Phase Error (8PSK): 100 Bursts	-5.00 °	5.00 °	4.91 °	4
EVM Peak (8PSK): 100 Bursts	-30.00 %	30.00 %	3.80 %	4
EVM RMS (8PSK): 100 Bursts	-9.00 %	9.00 %	-6.54 %	4
Magnitude Error Peak (8PSK): 100 Bursts	-17.70 %	17.70 %	8.25 %	4
Magnitude Error RMS (8PSK): 100 Bursts	-12.50 %	12.50 %	-5.45 %	-
Phase Error Peak (8PSK): 100 Bursts	-20.00 °	20.00 °	14.19 °	
Phase Error RMS (8PSK): 100 Bursts	-5.00 °	5.00 °	-0.68 °	1
Origin Offset (8PSK): 100 Bursts		-30.00 dB	-79.90 dB	4
Frequency Errort (8PSK): 100 Bursts	-90.00 Hz	90.00 Hz	53.33 Hz	1
Spectrum due to Switching (8PSK):		0	passed	1
Spectrum due to Modulation (8PSK):	0		passed	4

Fig. 42 - Call Edge report

GSM Multislot Test module

The **Multislot Test** module allows you to measure the multislot power (Fig. 43).

MultiSlot test				8	×
	Settings No. of Slots: Bursts: Guard Level (dB):	100 3	Multi Slot Power Average Burst Power Peak Burst Power Template Matching Timing Error Burst Graphic		
	Power Upper Limit (dBm): Power Lower Limit (dBm):	35	Attenuations	0	
	Max. Timing Error (Bits):	2	Meas. Slot:	3	
	Description		Enter your descri	ption here	
	1		OK	Cancel]

Fig. 43 - GSM Multislot Test

The number of timeslots to be measured (No of Slots), the number of bursts and the guard level can be set in the Settings section. The limits (Power Upper Limit and Power Lower Limit), Max. Timing Error, the attenuations and the timeslot to be measured can also be set. The measurements to be displayed must then be selected in the Multislot Power section.

Fig. 44 shows a typical report entry. If **Burst Graphic** is enabled, a graph is generated (Fig. 45).

31.00 dBm	35.00 dBm	18.49 dBm	-
31.00 dBm	35.00 dBm	-41.25 dBm	
31.00 dBm	35.00 dBm	-41.06 dBm	-
31.00 dBm	35.00 dBm	-40.86 dBm	
31.00 dBm	35.00 dBm	21.51 dBm	
31.00 dBm	35.00 dBm	-31.68 dBm	-
31.00 dBm	35.00 dBm	-32.01 dBm	
31.00 dBm	35.00 dBm	-33.45 dBm	-
	2 2	passed	~
	8	passed	1
	1	passed	4
		passed	4
-2.00 Bit	2.00 Bit	0.00 Bit	~
-2.00 Bit	2.00 Bit	0.50 Bit	
-2.00 Bit	2.00 Bit	0.50 Bit	4
-2.00 Bit	2.00 Bit	0.50 Bit	-
	31.00 dBm 31.00 dBm 31.00 dBm 31.00 dBm 31.00 dBm 31.00 dBm 31.00 dBm 31.00 dBm -2.00 Bit -2.00 Bit -2.00 Bit -2.00 Bit	31.00 dBm 35.00 dBm -2.00 Bit 2.00 Bit -2.00 Bit 2.00 Bit -2.00 Bit 2.00 Bit -2.00 Bit 2.00 Bit	31.00 dBm 35.00 dBm 18.49 dBm 31.00 dBm 35.00 dBm -41.25 dBm 31.00 dBm 35.00 dBm -41.06 dBm 31.00 dBm 35.00 dBm -40.86 dBm 31.00 dBm 35.00 dBm 21.51 dBm 31.00 dBm 35.00 dBm -31.68 dBm 31.00 dBm 35.00 dBm -31.68 dBm 31.00 dBm 35.00 dBm -32.01 dBm 31.00 dBm 35.00 dBm -33.45 dBm 31.00 dBm 25.00 dBm -33.45 dBm 31.00 dBm 25.00 dBm 0.00 Bit -2.00 Bit 2.00 Bit 0.00 Bit -2.00 Bit 2.00 Bit 0.50 Bit -2.00 Bit 2.00 Bit 0.50 Bit -2.00 Bit 2.00 Bit 0.50 Bit

Fig. 44 – Multislot Test report (table)

Annex: Power Graphic



Fig. 45 – Multislot Test report (graph)

GSM Audio Setting module

The **GSM Audio Setting** module does not perform any measurements. Instead, it is simply used to enter correct settings in the uplink or downlink (Fig. 46).

GSM Audio Settings	<u>e</u>	X
	Audio Uplink (connect loudspeaker to AF OUT) Downlink (connect microphone to AF IN)	
	OK Cancel	

Fig. 46 - Audio setting

For uplink and downlink settings, see page 13.

Fig. 47 shows an entry in the test report.

Audio Uplink

Fig. 47 - Audio Setting report

The actual measurements are performed with the **Audio** module (seeFig. 48). Two modules are available for the two channels of the **Audio** option (B41).

Audio Test Configuration		
	Find Generator RMS Level (V): Frequency (Hz):	☐ 1000 ✓ Activate ☐ Leave Signal
	Analyzer Settings Frequency for Distortion Meter (Hz): Manual Level (V):	1000 1
	Selected Tests AC Voltage (Peak) AC Voltage (RMS) DC Voltage Distortion Frequency Counter	
	Description	Put in your description here
Coupling C AC C DC Fixed Ba D Hz to 21	000 Hz I I I I I I I I I I I I I I I I I I	Variable Filter Center (Hz): 1000 BWidth (Hz): 200 C Activate
	Limits	OK Cancel

Fig. 48 - Audio test

An **Audio** module consists of a generator and an analyzer. The level and the frequency can be set under **Generator** (upper section). Moreover, you have to switch on the generator (**Activate**). In the middle section, you can select the measurements to be displayed. In the lower section, you can set various filters. Clicking the **Limits** button opens the dialog box shown in Fig. 49. Fig. 50 shows a test report entry

Limits			e z
	Limits AC Voltage (Peak): AC Voltage (RMS): DC Voltage:	Lower Limit (V):	Upper Limit (V): 1.7 1.2 0.1
	Limits Frequency Counter (Hz):	Lower Limit: 950	Upper Limit:
	Distortion Upper Limit (%):		5
			ОК

Fig. 49 - Audio test limits

Audia Generator: Frequency 1000.0 Hz, RMS Level 1.0	V			
Analyzer Setting: AC Coupled				
Analyzer Filters: Fixed Bandpass 0 Hz to 21000 Hz, We	eighting: off, Variable: off			
AC Voltage (RMS):	0.80 V	1.20 V	1.09 V	1

Fig. 50 - Audio test report

GSM BER Search module

The **GSM BER Search** module determines the sensitivity of a receiver for a specific limit value (Fig. 51). To do this, you set the channel, PCL and timeslot under **TCH** and set the attenuation under **Attenuation**. In the **Measurements** section, you set the BER type, the number of Frames and the limit value.

TCH RF Channel: PCL: 5 Timeslot: Attenuations Input: 0 Output: 0	Measurements BER BER RX Averaging (Frames): 88 Search Value (%): 1
Description	Enter your description here

Fig. 51 - BER Search

Start with a few frames using large level steps. Later approach the limit with smaller steps and more frames. Fig. 52 shows the test report entry.

Channel 62, PCL 5, Timeslot: 3, Attenuation (In/Out) 0.0 dB/ 0.0 dB, 3	Search Value: 1.	0		
BER Search: 88 Frames		[]	-105.10 dBm	-

Fig. 52 - BER Search report

GSM Call AMR module

The **GSM Call AMR** allows you to test the AMR speech coder characteristics of the mobile phone (Fig. 53). To do this, set the start and stop level, step size as well as **Codec** mode under AMR.

MAMR Configuration		8
MR ICH Level Upper (dBm):	Measurements	
	The second	
CH Level Lower (dBm):	-102	
TCH Level Lower (dBm):	-102	
TCH Level Lower (dBm): Step size (db): Downlink Codec Mode:	-102 1 3 - Description	

Fig. 53 - Call AMR

CMUgo now reduces the level in the individual steps, and the mobile phone requests a **Codec** mode for each level. This mode is displayed in a table in the report. To include the hysteresis loops, the level is then increased back up to the initial state.

Codec Mode requested by MS: @ -95.0 dBm	2	1
Codec Mode requested by MS: @ -96.0 dBm	2	~
Codec Mode requested by MS: @ -97.0 dBm	0	1
Codec Mode requested by MS: @ -98.0 dBm	1	~
Codec Mode requested by MS: @ -99.0 dBm	2	~
Codec Mode requested by MS: @ -100.0 dBm	0	1
Codec Mode requested by MS: @ -101.0 dBm	1	4
Codec Mode requested by MS: @ -102.0 dBm	3	~
Codec Mode requested by MS: @ -102.0 dBm	3	1
Codec Mode requested by MS: @ -101.0 dBm	0	~
Codec Mode requested by MS: @ -100.0 dBm	0	~
Codec Mode requested by MS: @ -99.0 dBm	3	~
Codec Mode requested by MS: @ -98.0 dBm	0	~
Codec Mode requested by MS: @ -97.0 dBm	1	1
Codec Mode requested by MS: @ -96.0 dBm	2	4
Codec Mode requested by MS: @ -95.0 dBm	3	~

Fig. 54 – AMR report

GSM Call Change Multislot module

The **GSM Call Change Multislot** module is used to change call parameters in the multislot mode (Fig. 55). The parameters correspond to those in **Fehler! Verweisquelle konnte nicht gefunden werden.** (see "GSM Call Setup module").



Fig. 55 - Call Change Multislot

Fig. 56 shows the test report entry.

Fig. 56 - Call Change Multislot report

GSM Channel Scan module

The **GSM Channel Scan** module is used to perform power measurements across multiple channels (Fig. 57). To do this, you need to set the following parameters in the **TCH** section: **Start Channel, Stop Channel, PCL** and

Timeslot. You also need to set the level and attenuation values. The CMU now performs the power measurements selected under **Measurements** on the Meas. Slot using the number of bursts.

GSM Channel Scan					a ×
	TCH Start Channel:	124 5	Measurements Power ☑ Average Burs ☑ Peak Burst Po	t Power ower	
	Timeslot:	3	Bursts:		10
	BS Signal RF Level:	-85			
	Output:	0	Meas Slot:		3
	Description		<u>}</u>	Enter your descrip	otion here
				ок	Cancel

Fig. 57 - Channel Scan

the channels with the maximum and minimum power (Fig. 58) and a graph of all values are output (Fig. 59).

 PCL 5, Timeslot: 3, BS RF Level -85.0 dBm, Attenuation (In/Out) 0.0 dB / 0.0 dB, 10 Bursts, Meas Slot: 3

 Average Power Maximum: @ Channel: 20

 Average Power Minimum: @ Channel: 20

 29.99 dBm

Fig. 58 - Channel Scan report

Annex: Power Graphic

PCL: 5, Start Channel: 10, Stop Channel: 20, Average Power: blue, Peak Power: green





GSM Call Echo Test module

The echo test can only be performed in the voice call (Fig. 60). To do this, you can set the usual parameters under **Traffic Channel TCH** and **Attenuations**.

Echo Test Configuration		
	Traffic Channel TCH RF Channel: RF Level: PCL: Timeslot	-85 5 3
	- Attenuations Input: Output:	0
	Description	Enter your description here
		OK Cancel

Fig. 60 - Call Echo Test

CMUgo then waits for your entry (Fig. 61).

User Input		×
	Did the phone pass the audio test ?	
	Yes No	

Fig. 61 - User input for Call Echo Test

Fig. 62 shows the test report entry.

TCH Channel: 62, PCL: 5, TCH RF Level: -85.0dBm, Timeslot: -	3, Attenuation (In/Out): 0.0 / 0.0 d	(B	
Echotest:		passed	1

Fig. 62 - Call Echo Test report

GSM PowerPCL module

The **GSM PowerPCL** module is used to simulate the CMU's powerversus-PCL measurement in CMUgo (Fig. 63)**Fehler! Verweisquelle konnte nicht gefunden werden.** Although this measurement is not required by the specification, it quickly covers all PCLs on three or seven user-selectable channels.

and the second second		Channels	
The second se	 General Schannels 	1st Channel:	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	C 7 channels	2nd Channel:	22
	Timeslot:	3 3rd Channel:	42
and the second	PS Signal	4th Channel:	63
	RF Level:	-90 5th Channel:	83
	_	6th Channel:	104
	Attenuations Input:	0 7th Channel:	124
	Output:	0 Graphics	
	Description		
		Enter y	our description here

Fig. 63 - PowerPCL



Fig. 1 – PowerPCL graph

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Remote Sequences

GSM Call Setup

PCL mode and status query: LEV:MODE PCL SIGN:STAT? Network settings, connector and attenuation:

CONF:NETW:NSUP GSM

CONF:NETW:SMOD:TRAF FRV1

CONF:NETW:SMOD:BITS PR9

CONF:RXQ:BITS PR9

CONF:NETW:IDEN:MCC 1

CONF:NETW:IDEN:MNC 1

INP:STAT RF2

OUTP:STAT RF2

SENS:CORR:LOSS:INP2 0.0 SENS:CORR:LOSS:OUTP2 0.0

Base station settings: BCCH channel 30, level -85 dBm, TCH 62, timeslot 3, PCL 15, level -85 dBm:

CONF:BSS:CCH:MODE BATC

CONF:BSS:CCH:CHAN 30

CONF:BSS:CCH:LEV -85.0

CONF:BSS:CHAN 62

CONF:BSS:MSL:MTIM 3

CONFigure:BSSignal:CSWitched:TCH:SSLot:TIMeslot 3

CONF:BSS:MSL:LMOD IND

CONF:MSS:MS:PCL 15

CONF:BSS:LEV:UTIM -85.0

CONF:SIGN:SMOD SSL

CONF:BSS:MSL:SCON:IND OFF,OFF,OFF,OFF,OFF,OFF,OFF,0,0,-20.0,

CONF:MSS:MSL:SCON OFF,OFF,OFF,OFF,OFF,OFF,OFF,15,15,15,15,15,15,15,15

Activation of BCCH and status query in loop up to SYNC status:

PROC:SIGN:ACT SON;*OPC?

SIGN:STAT?

Call to the mobile phone and status query in loop up to CEST status: PROC:SIGN:ACT MTC;*OPC?

SIGN:STAT?

Query of mobile phone parameters:

MSS:IMSI:MCC? MSS:IMSI:MNC? MSS:IMSI:MSIN? MSS:IMEI:FAC? MSS:IMEI:TAC? MSS:IMEI:SVN? MSS:IMEI:SVN? MSS:REV? MSS:DNUM? MSS:TRAF? MSS:POW:CLAS?

GSM Call Release

SIGN:STAT? PROC:SIGN:ACT CREL SIGN:STAT?

GSM Testset

Status query, attenuation (0 dB) and BER parameters:

SENS:SIGN:STAT?

SENS:SIGN:PDAT:STAT?

CONF:SIGN:SMOD?

INP:STAT?

SENS:CORR:LOSS:INP2 0.0

SENS:CORR:LOSS:OUTP2 0.0

CONF:RXQ:CONT:HTIM 0,0.20

CONF:RXQ:BER1:CONT:REP NONE,NONE

Changing of call parameters (level -85 dBm, channel 62, timeslot 3, PCL 5), meas. slot 3:

PROC:BSS:TCH:LEV:UTIM?

PROC:BSS:TCH:LEV:UTIM -85.0

PROC:SIGN:CHCC?

PROC:SIGN:CHCC 62,3,5;*OPC?

CONF:MCON:MSL:MESL 3

Power measurement (singleshot, 10 bursts).

CONF:POW:CONT:REP SING,NONE,NONE

CONF:POW:CONT ARR,10

READ:POW?

FETC:ARR:POW?

Modulation measurement (singleshot, 10 bursts, standard decoding):

CONF:MOD:XPER:CONT:REP SING,NONE,NONE

CONF:MOD:XPER:CONT ARR,10

CONF:MOD:XPER:TIME:DEC STAN

READ:MOD:XPER?

FETC:ARR:MOD:XPER?

Spectrum measurement (modulation: points 4 and 5 ON, 10 bursts, singleshot; switching: points 1 and 2 ON, 10 bursts, combined measurement):

CONF:SPEC:MOD:CONT:MPO1:ENAB OFF

CONF:SPEC:MOD:CONT:MPO2:ENAB OFF

CONF:SPEC:MOD:CONT:MPO3:ENAB OFF

CONF:SPEC:MOD:CONT:MPO4:ENAB ON

CONF:SPEC:MOD:CONT:MPO5:ENAB ON

CONF:SPEC:MOD:CONT:MPO6:ENAB OFF

CONF:SPEC:MOD:CONT:MPO7:ENAB OFF

CONF:SPEC:MOD:CONT:MPO8:ENAB OFF

CONF:SPEC:MOD:CONT:MPO9:ENAB OFF CONF:SPEC:MOD:CONT:MPO10:ENAB OFF CONF:SPEC:MOD:CONT:MPO11:ENAB OFF CONF:SPEC:MOD:CONT ARR,10 CONF:SPEC:MOD:CONT:REP SING,NONE,NONE CONF:SPEC:MSW:CONT ARR CONF:SPEC:MSW:CONT:REP SING,NONE,NONE CONF:SPEC:SWIT:CONT:MPO1:ENAB ON CONF:SPEC:SWIT:CONT:MPO2:ENAB ON CONF:SPEC:SWIT:CONT:MPO3:ENAB OFF CONF:SPEC:SWIT:CONT:MPO4:ENAB OFF CONF:SPEC:SWIT:CONT ARR,10 CONF:SPEC:SWIT:CONT:REP SING,NONE,NONE CONF:SPEC:SWIT:NOSL 1 INIT:SPEC:MSW FETC:SPEC:MSW? FETC:ARR:SPEC:MSW?

GSM Call Edge

The spectrum measurements are identical to those for GSM testset. Status query, attenuation (0 dB), meas. slot (3): SENS:SIGN:STAT? SENS:SIGN:PDAT:STAT? CONF:SIGN:SMOD? **INP:STAT?** PROC:SIGN:PDAT:TCH:MSL:SCON? SENS:CORR:LOSS:INP2 0.0 SENS:CORR:LOSS:OUTP2 0.0 CONF:MCON:MSL:MESL 3 Edge power measurement (filter 600 kHz, 10 bursts, singleshot): CONF:POW:EPSK:FILT B600 CONF:POW:EPSK:CONT ARR,100 CONF:POW:EPSK:CONT:REP SING,NONE,NONE INIT:POW:EPSK FETC:POW:EPSK? Edge modulation measurement (100 bursts, singleshot): CONF:MOD:OVER:EPSK:CONT ARR,100 CONF:MOD:OVER:EPSK:CONT:REP SING,NONE,NONE INIT:MOD:OVER:EPSK FETC:MOD:OVER:EPSK? **GSM Multislot Test**

Status query SENS:SIGN:STAT?

SENS:SIGN:PDAT:STAT?

Multislot measurement (meas. slot 3, singleshot, 100 bursts, 4 slots, ANY modulation, filter 500 kHz, guard level 3):

CONF:MSS:MCON:MESL 3 CONF:POW:MSL:CONT:REP SING,NONE,NONE CONF:POW:MSL:CONT ARR,100 CONF:POW:MSL:SCO 4 CONF:POW:MSL:MVI ANY,ANY,ANY,ANY CONF:POW:MSL:FILT G500 CONF:POW:MSL:LIM:LINE:GLEV 3.0 INIT:POW:MSL FETC:POW:MSL?

GSM Audio Settings

Status query, bit stream handset, speech encoder handset, speech decoder analyzer: SENS:SIGN:STAT? PROC:BSS:BITS HAND ROUT:SPEN HAND ROUT:SPEN HAND ROUT:SPEN ANAL *OPC?

GSM AMR

Status and traffic query: SENS:SIGN:STAT? CONF:NETW:SMOD:TRAF? Uplink and downlink code setting: PROC:NETW:AMR:FRAT:DLCM CM3 PROC:NETW:AMR:FRAT:ULCM CM3 Routine: level setting, requested code query: PROC:BSS:LEV:UTIM -95.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -96.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -97.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -98.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -99.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -100.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -101.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -102.0;*OPC?

MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -102.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -101.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -100.0:*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -99.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -98.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -97.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -96.0;*OPC? MSS:AMR:FRAT:DLCM? PROC:BSS:LEV:UTIM -95.0:*OPC? MSS:AMR:FRAT:DLCM?

GSM Change Multislot

Querying SENS:SIGN:STAT? CONF:BSS:CCH:MODE? CONF:SIGN:SMOD?

Setting of multislot and channel:

GSM Channel Scan Querying SENS:SIGN:STAT? CONF:SIGN:SMOD? INP:STAT? SENS:CORR:LOSS:INP2 0.0 SENS:CORR:LOSS:OUTP2 0.0 Setting of parameters: level -85 dBm, timeslot 3, PCL 5: PROC:BSS:TCH:LEV:UTIM? PROC:BSS:TCH:LEV:UTIM -85.0 PROC:SIGN:TCH:TIM 3 PROC:SIGN:TCH:TIM 3 PROC:SIGN:MS:PCL 5 CONF:BSS:CCH:CHAN?

CONF:MCON:MSL:MESL 3

Routine: Measuring and channel change, for example: CONF:POW:MPR:CONT:REP SING,NONE,NONE CONF:POW:MPR:CONT SCAL,10 PROC:SIGN:CSW:TCH:CHAN 10;*OPC? CONF:BSS:CCH:CHAN? CONF:MCON:MSL:MESL 3 CONF:POW:MPR:CONT:REP SING,NONE,NONE CONF: POW: MPR: CONT SCAL, 10 INIT:POW:MPR FETC:POW:MPR? PROC:SIGN:CSW:TCH:CHAN 11;*OPC? CONF:BSS:CCH:CHAN? CONF:MCON:MSL:MESL 3 CONF:POW:MPR:CONT:REP SING,NONE,NONE CONF:POW:MPR:CONT SCAL,10 INIT:POW:MPR FETC:POW:MPR? PROC:SIGN:CSW:TCH:CHAN 12;*OPC? CONF:BSS:CCH:CHAN? CONF:MCON:MSL:MESL 3 CONF:POW:MPR:CONT:REP SING,NONE,NONE CONF: POW: MPR: CONT SCAL, 10 INIT:POW:MPR FETC:POW:MPR? **GSM Call Echo Test** SIGN:STAT? **INP:STAT?** SENS:CORR:LOSS:INP2 0.0 SENS:CORR:LOSS:OUTP2 0.0 PROC:BSS:TCH:LEV:UTIM? PROC:BSS:TCH:LEV:UTIM -85.0 PROC:SIGN:TCH:TIM? PROC:SIGN:TCH:TIM 3 PROC:SIGN:TCH:CHAN? PROC:SIGN:TCH:CHAN 62 PROC:SIGN:MS:PCL? PROC:SIGN:MS:PCL **GSM PowerPCL** Querying and settings: SENS:SIGN:STAT? **INP:STAT?**

SENS:CORR:LOSS:INP2 0.0 SENS:CORR:LOSS:OUTP2 0.0 PROC:BSS:TCH:LEV:UTIM? PROC:BSS:TCH:LEV:UTIM -90.0 PROC:SIGN:TCH:TIM? PROC:SIGN:TCH:TIM 3 Measurement settings: 3 channels: 1, 22 and 42: CONF:POW:PCL:CONT:REP SING,NONE,NONE CONF:POW:PCL:CONT:REP SING,NONE,NONE CONF:POW:PCL:CO C3 CONF:POW:PCL:CCO C3 CONF:POW:PCL:CHAN 1,22,42 INIT:POW:PCL FETC:POW:PCL CALC:POW:PCL:LIM:MATC?

Abbreviations

CS	Coding Scheme
EDGE	Enhanced Data Rates for GSM Modulation
EGPRS	Enhanced General Packet Radio Service
GPRS	General Packet Radio Service
HSCSD	High Speed Circuit Switched Data
MCS	Modulation and Coding Scheme
RLC	Radio Link Control
TBF	Temporary Block Flow
USF	Uplink State Flag

References

[1] Rohde & Schwarz: Manual for CMUgo Windows Application (V1.00), 12/2002, 1136.3971.00

[2] Rohde & Schwarz: **Operating Manual for Software Options K20, K21, K22, K23, K24, K42, K43** (1115.5900.02, 1115.6007.02, 1115.6107.02, 1115.6207.02, 1115.6307.02, 1115.4691.02, 1115.6907.02) *Revision 1115.6088.12-13-*)

[3] Rohde & Schwarz: Application Note: (E)GPRS Measurements with the R&S CMU200 and CMUgo

Additional information

Please send any comments or suggestions concerning this Application Note to <u>CMUApplication@rsd.rohde-schwarz.com</u>.

Ordering information

Communication Tester

R&S CMU200		1100.0008.02
CMU-B21 ⁽¹⁾	Versatile signalling unit	1100.5200.02
CMU-B21v14 ⁽¹⁾	Universal signalling unit	1100.5200.14
Option B41 (optional)	Audio generator and analyzer	1100.5300.02
CMU-K20	SW options for GSM400	1115.5900.02
CMU-K21	SW options for GSM900	1115.6007.02
CMU-K22	SW options for GSM1800	1115.6107.02
CMU-K23	SW options for GSM1900	1115.6207.02
CMU-K24	SW options for GSM850	1115.6307.02
CMU-K42	SW GPRS extension for GSM	1115.4691.02
CMU-K43	SW EGPRS extension for	1115.6907.02
	GSM	

⁽¹⁾ CMU-B21 or CMU-B21v14 with CMU-B54v14 is required.



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