

R&S CMU200 (K20,K21,K22,K23,K24,K42, K43), CMUgo

(E)GPRS Measurements with R&S CMU200 and CMUgo

Application Note

This application note describes how to test and perform (E)GPRS-related 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 – Bernhard Schulz 06.04 – 1CM52

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1 Overview

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

One aspect of GSM are the packet-oriented services GPRS and EGPRS.

This application note describes how to use CMUgo, a Windows application for remote control of the R&S CMU200 and for measuring and testing (E)GPRS aspects of mobile phones in compliance with the GSM standard.

2 Introduction

This application note is not intended to explain the associated theory in full but rather simply provides a brief summary of the most important aspects.

The 'General Packet Data Service' (GPRS) and the 'Enhanced GPRS' (EGPRS) provide packet-oriented services for data communication in existing networks (e.g. Internet) in compliance with the GSM standard. GPRS offers increased data rates by bundling several timeslots (as with 'High Speed Circuit Switched Data' (HSCSD)), and EGPRS provides a further increase in data rate by means of 'Enhanced Data Rates for GSM Evolution' (EDGE; new modulation: 8PSK).

(E)GPRS is simply an extension of GSM and uses physical resources of GSM (phase 2+ or 2.5).

Packet-oriented data communication means that resources are only used if data is actually to be transmitted. In (E)GPRS, this is referred to as 'Temporary Block Flow' (TBF).

To allow better adaptation to the given channel characteristics, four channel codes (CS1 to CS4; CS1 provides optimum protection and the lowest data rate) have been defined in GPRS and nine modulation and channel-coding schemes (MCS1 to MCS9) defined in EGPRS (Figure 1). Here it is important to note that MCS1 to MCS4 are also GMSK-modulated in EGPRS.

Scheme	Code rate	Modulation	RLC blocks per Radio Block (20ms)	Raw Data within one Radio Block	Family	BCS	Punctured bits	Data rate kb/s
CS-1	0.5		1	456	225	40	0	9.05
CS-2	≈2/3		1	588	50 7 8	16	132	13.4
CS-3	≈3/4	GMSK	1	676	-	16	220	15.6
CS-4	1	1	1	456	1.5	16	20	21.4
Scheme	Code rate	Modulation	RLC blocks per Radio Block (20ms)	RawData within one Radio Block	Family	BCS	Punctured bits	Data rate kb/s
MCS-9	1.0		2	2x592	A	2x12	1224	59.2
MCS-8	0.92		2	2x544	А		1080	54.4
MCS-7	0.76	8PSK	2	2x448	В		792	44.8
MCS-6	0.49		1	592 544+48	A			29.6 27.2
						12	588	
MCS-5	0.37		1	448	В		156	22.4
MCS-4	1.0		1	352	С		576	17.6
MCS-3	0.80	GMSK	1	296 272+24	A		576	14.8 13.6
MCS-2	0.66]	1	224	В		360	11.2
MCS-1	0.53		1	176	С		216	8.8

Figure 1 - Channel coding schemes in (E)GPRS

3 Manual Operation of the the R&S CMU200

Call Setup and Release

Since the various mobile phones require different parameters in (E)GPRS, the settings necessary prior to the actual call setup are described here.

CMU200 signalling unit (B21)

The CMU200 can be equipped with two different link handlers. Information on this can be displayed under SETUP|OPTIONS (Figure 2).

GSM900	Receiver Quality		Circuit Switched Single Slot	Conner Contro
Setup				
-Setup			Hardware Options/	
 Hardware Options 				
CMU-B11/B12	OCXO		not installed	
CMU-B17	I/Q-IF Interface		not installed	
CMU-B21	Universal Signalling Unit		not installed	
CMU-B21v14	Universal Signalling Unit		available	
CMU-B21/2	Universal Signalling Unit		available	
CMU-B21/2v14	Universal Signalling Unit		not installed	
CMU-B41	Audio Measurement Unit		not installed	
CMU-B52	Speech Coder f. CMU-B21 Speech Coder f. CMU-B21v14		not installed	
CMU-B52v14			not installed	_
CMU-B52/2	Speech Coder f. CMU-	eech Coder f. CMU-B21/2		
CMU-B52/2v14	Speech Coder f. CMU-	B21/2v14	not installed	
CMU-B53	Signalling Module f.Bluet	tooth	not installed	
CMU-B53v14	Signaling Module f Bluet	tooth	not installed	
CMU-B53/2	Signalling Module f Bluet	tooth	available	
			1	_

Figure 2 - Hardware options

There are two different versions: B21 and B21V14. If the older B21 version is installed, a DSP must first be switched over to measure the BLER on several downlinks. To do so, the parameter 'B52 Mode' in the **Network** tab must be set to 'Multislot Support' in the 'Signal Off' state (Figure 3).

Gh.1 Ch.2 GSM900 Overview	W Pack Data L1 Test M.A E Connect Control
😑 GSM 900 Connection Control 🚦	Signal Off
_Setup	B52 Mode
Default Al Settings Network Support Main Service	GSM + GPRS Packet Data
B52 Mode Network Identity	Multislot Support
 Circuit Switched 	
 <u>Packet Data</u> Coding Scheme Directiving Scheme 	CS 1
Puncturing Scheme PC Meas Chan	вссн
USF Extend. Dyn. Alloc. Number of PDUs	0 L Auto 4095
Slot Offset Testmode with ACK	0 Off
Connection MS Signal	BS Signal Network AF/RF 🚱 Sync. 12

Figure 3 - DSP setting for MultiSlot Support

With the more recent version 14 (B21V14), no additional settings need to be made; the associated parameter is not available. Furthermore, B21V14 allows BLER measurements in EGPRS to be performed on 4 downlinks at the same time.

Auxiliary RF generator (AuxTX - B95)

In the standard GSM environment, a single generator in the CMU is still sufficient to test 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 (Figure 4).



Figure 4 - Downlink on 2 channels without B95

Figure 5 shows the required CMU settings in the **BS Signal** tab. The parameters 'BCCH Channel' and 'TCH Channel' are particularly important here. The level of the BCCH ('BCCH Level') and the **Main Timeslot** can also be set here. The **Mode** parameter is only relevant for the conventional GSM mode; here the BCCH can be disabled following call setup ('BCCH or TCH') to allow measurement on all timeslots.

GSM 900) Overview	Pack. Data ↓↑ Test M. A	Connect Control
😑 GSM 900 Connecti	on Control 🔒		Idle
Frequency Offset	TCH&BCCH +0 Hz	тсн	
Mode	7× BCCH and TCH	4 dB	P 0
BCCH Level -86	5.0 dBm	- 90.0 dBm TCH Ref Level	Slot Config.
BCCH Channel 32		62	TCH Channel
		Off	Hopping
		3	Main Timeslot
Connection	MS Signal BS Signal	Network AF/RF 🕀	Sync. 12

Figure 5 - CMU setup for BS Signal without B95

Since there is no continuous-time transmission in GPRS mode but data is instead only transmitted when required, the majority of 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 (Figure 6) cannot be performed.

If the auxiliary generator is available, a permanent BCCH is generated and channel change and dual-band handover are possible (Figure 7).

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



	TS 7	TS O	TS 1	TS 2	TS 3	TS 4	TS 5	TS 6	TS 7	TS 0	TS 1
H32						BCCH					
H64	TCH										

Figure 7 - Downlink with B95

Figure 8 shows the BS Signal tab when the B95 is used.

Ch. 1 Ch. 2 GSM900 Receiver Quality	Connect Control
😑 GSM 900 Connection Control 😭 👘 Sig	gnalOn
Frequency +0 Hz TCH&BCCH TCH Single Slot	Slot Mode
- 82.0 dBm - 20.0 dB used unused 1 935.2 MHz	TCH Level TCH Channel
Channel BCCH Aux TX Off	Hopping
BCCH - 75.0 dBm 36 3 Level Channel	Timeslot
Connection MS Signal BS Signal Network RF @* Sync.	1 2

Figure 8 - CMU setup for BS Signal with B95

A number of restrictions apply if the B95 is used:

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

The actual call setup takes place under 'Connection Control' in the **Connection** tab (Figure 9).

Ch. 1 Ch. 2 GSM90	0 Overview		Pack. Data ↓ † Test M. A	1	Connect Control
😑 GSM 900 Connec	tion Control 🚦				Idle
I					
Circuit Switched	Signal On				Signal
Packet Data	idie		Waiting for		Off
→MS Capabilities					VII I
MS Revision Level			obile synchroniza		.
SBands/PowClass		0	r call from the mo	obile.	Connect
P-GSM					Mobile
E-GSM					
R-GSM					Service
GSM 1800		Off	Test h	Aode A 🛃	
✓Multislot Class		Auto Sh	ot	for MTC	Selection
Circuit Switched		Config.			
			Booket	Dete	Main
GPRS	1000	100	Packet	Data 🛓	Service
EGPRS					
-Signaling Info					Network
IMSI			GSM + (GPRS 💵	
IME	<u></u>		6 - 03		Support
Dialled Number		GSM	only		
- +BS Signal		CSM	+ GPRS		Wideband
Frequency Offset	0 Hz				Power
- Control Channel		GSM	+ EGPRS	Ente	The second s
				chte	
· · · · · · · · · · · · · · · · · · ·					
Connection	MS Signal E	S Signal 🚽 Network	AF/RF 🞯	Sync.	1 2

Figure 9 - Overview of Call Setup

First of all, 'GPRS' or 'EGPRS' must be selected under **Network Support**. Additionally, **Main Service** must be set to 'Packet Data'.

Ch. 1 Ch. 2 GSM 90	00 Overvie	w		Pack:Data ↓ † Test M. A	7.	Connect Control
😑 GSM 900 Conner	ction Control					Idle
➡Signalling States						
Circuit Switched Packet Data -MS Capabilities	Signal On Idle		mol	Waiting for bile synchroniz	ation	Signal Off
MS Revision Level SBands/Pow/Class P-GSM F-GSM		13		all from the m		Connect Mobile
R-GSM GSM 1800 ↓Multislot Class		22 23	Off Auto Sid	Test	Mode A 🛓	Service Selection
Circuit Switched Packet Data GPRS EGPRS				Fest Mode B GPRS Loopb. 9	sym.	Main Service
→ Signaling Info IMSI IMEI				GPRS Loopb. : ted. Sig. Mode :	<u>،</u>	Network Support
Dialled Number →BS Signal Frequency Offset →Control Channel	0 Hz			 Peak		Wideband Power
Connection	MS Signal	BS Signal	Network	AF/RF ⊕+	Sync.	1 2



Under **Service Selection**, it is now possible to select a test mode (important: A, B, BLER) and to enable 'Automatic Slot Configuration' (see the section Automatic slot configuration).

In the **Network** tab, the various 'Coding Schemes' (GPRS: CS1 to CS4; EGPRS: MCS1 to MCS9) can be set and a number of settings specific to mobile phones can also be configured (Figure 11).

Ch. 1 Ch. 2 GSM900 Overview	W Pack Data
GSM 900 Connection Control	a idle
_ Setup	B52 Mode
B52 Mode	Speech Coder
Network Identity	
▶ Circuit Switched	
▼Packet Data	
Coding Scheme	CS1
Puncturing Scheme	
PC Meas Chan	BCCH
USF	0
Extend. Dyn. Alloc.	Auto
Number of PDUs	4095
Slot Offset	0
Testmode with ACK	Off
RLC Mode (Testmode B)	
PDP Context Activation	Accept
Bit Stream	2E9-1 PSR Bit Pattern
Connection MS Signal	BS Signal Network AF/RF 🕀 Sync. 💶 2

Figure 11 - CMU settings under Network – Packet Data

The MultiSlot settings can, of course, also be made under **MS Signal** (Figure 12). When doing so, the functional capabilities of the mobile phone must be taken into consideration (see also the section Automatic slot configuration). In the downlink, the CMU allows each timeslot to be enabled and disabled separately and different levels to be set. The levels are set relative to a reference level. The uplink timeslots and levels of the mobile phone can also be set individually.

Gh.1 GSM900 Overvie	w	Pack:Data ↓↑ Test M. A	Connect Control
GSM 900 Connection Control			Idle
Setup ———		Packet Data/MultiSlot/	<mark>0</mark>
Default All Settings PMAX Circuit Switched <u>Packet Data</u>	√ 5 (33.0 dBm)		
MultiSlot	Idle		
Main Timeslot	3		
 Slot Configuration 	Downlink/Level(BS)	Uplink/Gamma	(idle)
Slot 0	BCCH	Off Off	
Slot 1	Off	Off	
Slot 2	Bb 0.0 🔲	Off	
Slot 3 ← Main TS	Bb 0.0 🔽	🗹 3 (33.0 dBm)	
Slot 4	□ 0.0 dB	D Off	
Slot 5	0.0 dB	Off Off	
Slot 6	□ 0.0 dB	Off Off	
Slot 7	Off Off	D Off	
Connection MS Signal	BS Signal _ Network	AF/RF 🕀 Syne	



Automatic slot configuration

The CMU also allows automatic setup of the slot configuration. The associated parameter must first be set to 'ON' under **Service Selection**. Following the 'location update', the mobile phone also transmits its GPRS capability (MultiSlotClass) during the 'attach' procedure. The CMU uses the MultislotClass information, the selected test mode and the 'Coding Scheme' to set up an optimum configuration (Figure 13). This is done separately for GPRS and EGPRS as the MultiSlot classes may be different.



Figure 13 - Mechanism for automatic slot configuration

The mobile phone can be switched on once all relevant settings have been made. It performs a 'location update' (GSM) and must then perform an 'attach' ((E)GPRS).¹

GSM900 Conne	ction Contro				Attacked
GSIM900 COILLE	cuorreorrae	and the second se			Attached
-Signalling States	-		2		
Circuit Switched	Synchronized				Cianal
Packet Data	Attached		E P P P P P P P P P P P P P P P P P P P		Signal
-MS Capabilities			Make a ca	ll from the mobile	Off
MS Revision Level	Phase II		or	press the	and the second second
	and the second second		Conne	ct Mobile key.	Connect
P-GSM	supported	4 (max. 33 dBm)			Mobile
E-GSM	supported				
R-GSM	not supported				Service
GSM 1800	supported	1 (max. 30 dBm)	Off	Test Mode B	
→Multislot Class			Auto Slot	for MTC	Selection
Circuit Switched	6 (3 Dn/2 Up/4)	Sum)	Config.		
🚽 Packet Data			1.0	Packet Data	Main
GPRS	6 (3 Dn/2 Up/4)	Sum)	10	FackerData	Service
EGPRS	i en				
, Signaling Info					Network
IMSI	001.01.100000	100000		GSM+GPRS	
IMEI	350780.20.8297	81.01	104-0		Support
Dialled Number					
+BS Signal					— 📲 Wideband
Frequency Offset	0 Hz				Power
- Control Channel				Peak	

Figure 14 - 'Attached' state

A call to the mobile phone can now be set up by pressing **Connect Mobile**. The individual measurements can then be started.

¹ In some cases, the 'attach' is performed automatically, but in other cases it needs to be performed manually (via the mobile phone).

Figure 15 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.



Figure 15 - (E)GPRS states in CMU

Measurements

In (E)GPRS the same measurements can be performed as in GSM. For this reason, only special features and additional options are explained here.

Test Mode A

In Test Mode A, the mobile phone sends a defined PRBS; any number of TX measurements can be performed.

The measurements are the same as the standard measurements available in GSM (Power, Modulation, Spectrum). In the case of MultiSlot mode, the timeslot to be measured can be set for each individual measurement, i.e. measurements continue to be performed on just one timeslot.

It is, of course, the measurements in MultiSlot uplink mode which are most relevant for TX measurements. Here, the CMU allows up to 4 uplink slots to be taken into consideration in the power measurement (Figure 16).



Figure 16 - Power measurement with multislot

The CMU automatically detects whether GMSK or 8PSK is used for modulation, and displays the measurement accordingly (Figure 17). Furthermore, the CMU also automatically detects 'Access' and 'Normal Burst'.



Figure 17 - Power measurement with EDGE (8PSK)

A new spectrum measurement allows the measurements 'due to Modulation' and 'due to Switching' to be performed simultaneously (Figure 18).





Test Mode B

In Test Mode B, the mobile phone internally closes a loop and sends the data generated by the CMU (RLC blocks) back to the CMU. It is then possible to perform RX measurements in addition to the TX measurements described under Test Mode A (see the section Test Mode A) (Figure 19).

Ch. 1 Ch. 2	SM900 Recei	v <mark>er</mark> Quali	ty	Pack:Data ((* p*)) ↓ † Test M. B	Connect Control
0.0	00 % BER 00 % DBLER 00 % USF BLER False USF Det 0 CRC Err. 100 RLC Data Blocks 200	Time	Settings Signalling States MS Capabilities Signaling Info IMSI IMEI Dialed Number Coding Scheme Meas. Control Stop Condition Frames Test Setup Meas. Mode	001.01.100000095 350780 20.829781.0 - CS 1 1st Limit exceeded 100 Test 1 BER / DBL ER	L BER Appli- cation Analyzer Level MS Signal
Test Setup Meas. Mode OPRS CS Bit Stream USF D. Cycle Main Slot	Test 1 BER / DBLER CS 1 PRBS 2E9-1	C value RX Quality Sign. Var.	 Analyze Level → Analyze Level → BS Signal → Packet Data ✓ Ind. BER Levels Ref. Level Slot 0 Slot 1 Slot 2 Slot 3 Slot 4 	- 850 dBm BCOH Off 00 dB 00 dB 00 dB	BS Signal Network
Overview	Power Modulatio	on Spectru	m	eceiver Quality Audio	Menus

Figure 19 - BER measurement

In Test Mode B, the CMU sends blocks containing PRBS data and compares them with the data sent back from the mobile phone (bit error rate – BER)². If the CMU detects bit errors in the data field of the current block, this block is declared as invalid (data block error rate – DBLER). If a mobile phone decodes a USF incorrectly, it will not send the associated uplink block; this allows the USF-BLER to be measured. Conversely, if a mobile phone wrongly receives a USF, it wrongly sends an uplink block. This block is indicated as 'False USF Detection'. To allow this, 'USF Duty Cycle' must of course be set accordingly. The 'CRC Errors' are also displayed.

Here too, the CMU allows levels to be set individually for each downlink timeslot.

EGPRS Loopback Symmetric or Asymmetric (SRB)

In **EGPRS Loopback Symmetric** or **Asymmetric**, the mobile phone internally closes a loop and sends the data generated by the CMU (RLC blocks) back to the CMU, whereby no channel coding takes place (corresponds to Burst-By-Burst mode (BBB) in GSM). This mode is basically the same as Test Mode B, except that there is no channel coding. As a result, both TX and RX measurements can be performed. The CMU sends blocks containing PRBS data and compares them with the data sent back from the mobile phone (bit error rate – BER). If the CMU detects bit errors in the data field of the current block, this block is declared as invalid (data block error rate – DBLER). If a mobile phone decodes a USF incorrectly, it will not send the associated uplink block; this allows the USF-BLER to be measured. Conversely, if a mobile phone wrongly receives a USF, it wrongly sends an uplink block. This block is indicated as 'False USF Detection'. To allow this, 'USF Duty Cycle' must of course be set accordingly. The 'CRC Errors' are also displayed.

Here too, the CMU allows levels to be set individually for each downlink timeslot.

In *Symmetric* mode, both the uplink and downlink are modulated using the same modulation type (either GMSK *or* 8PSK); all data can thus be sent back 1:1.

In *Asymmetric* mode, only the downlink is 8PSK-modulated, while the uplink is GMSK-modulated; as a result, the downlink carries three times as much data as can be sent back in the uplink. To ensure that the data rate of the downlink corresponds to that of the uplink, the CMU only sends data to the mobile phone in every third RLC block.

BLER

In BLER mode, the CMU again sends data blocks; however, the mobile phone does not return complete data blocks but instead only informs the CMU whether it has received the blocks correctly or incorrectly. Incorrectly received blocks are sent again (block error rate – BLER).

² According to the original specification (which has since been updated), some mobile phones return a dummy burst if errors are detected in a block. In this case, no BER measurement can be performed.

BLER R	LC Blocks F	LC Data Rate			1	R
			Slot 0			BLER
			Slot 1			
			Slot 2 @ - 85.0 dBm			Appli-
0.00 %	888	7.05 kBit/s	Slot 3 @ - 85.0 dBm			cation
0.00 %	888	7.05 kBit/s	Slot 4 @ - 85.0 dBm			Analyze
0.00 %	887	7.05 kBit/s	Slot 5 @ - 85.0 dBm			Level
		<u></u>	Slot 6 @ - 85.0 dBm			
			Slot 7			MS Sign
0.00 %	2663	21.14 kBit/s	Over all			
21.30 kBit/	 s Long Term T	hroughput				BS Signa
7.10 kBit/						Networ
Main Slot 21	(-90 to -89 dBm	C value				
	(0.0 to 0.2 %)	RX Quality				
	(0.00 to 0.25 dB)	Sign. Var.	GPRS Coding S Bit Stream	cheme CS BL		

Figure 20 - BLER measurement

The CMU is able to perform measurements on up to four downlink slots simultaneously; this reduces the measurement time.

Here too, the levels of the downlink slots can be set individually.

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 for all standards available on the R&S CMU200 both via a GPIB bus (IEE488.2) and via the RS-232-C interface.

CMUgo includes a feature for outputting test reports. Moreover, a report of remote-control commands with the times of the individual items 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 memory
- Peripherals: National Instruments GPIB bus or RS-232-C interface, mouse

Software requirements

- Windows 98 / ME / 2000 / XP
- CMUgo V1.45 with GSM/GPRS modules V1.45 or newer

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. Individual sequences can then be created based on 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), it is sometimes possible to save time by making additional optimizations.

Note: All modules with the prefix 'GSM' can also be used in (E)GPRS. Single parameters or measurements are, however, of little use and are therefore not taken into consideration. Reference to these restrictions is made again in the descriptions of the individual (GSM) modules in this document.

GPRS Call Setup Module

The GPRS Call Setup module must always be at the beginning of a sequence for (E)GPRS (after Basic Initializing). All parameters relevant for setting up a GPRS connection to a mobile phone are set here.

GPRS Call Setup Configuration			<u>a</u>	×
	- Network	GSM 900	ОК	1
	BCCH BCCH BF Channel: RF Level:	95)	Cancel Slot Configuration	
	TCH after call set RF Channel:	up 62		÷
	GPRS Testmode	A	Configure	
	Coding Scheme Support	iguration CS1 CS1 CPRS		
	Testmode with			
	Attenuations Input: Output:	0		
	CMU Connector:	O RF1 © RF2		

Figure 21 - GPRS Call Setup module

First of all, the desired band (450, 850, 900, 1800, 1900 MHz) must be selected in the **Network** section.

The auxiliary RF generator ('use AuxTx (B95)') can be enabled and the channel and level of the BCCH can be set in the **BCCH** section. The traffic channel (TCH) can, of course, also be specified.

In the **GPRS** section, the desired 'Testmode' (A, B, EGPRS Loopb sym, EGPRS Loopb asym or BLER) can be selected and 'Auto Slot Configuration' enabled. The 'Coding Scheme' (CS1 to CS4, MCS1 to MCS9) can also be selected. Only GPRS and EGPRS can be selected under 'Support' (there is no sense in setting 'GSM only' here).

Note: If GSM and (E)GPRS functions are to be tested successively, the **GSM Call Setup** module (not described here) allows GPRS and/or EGPRS to be selected.

The parameters 'Testmode with ACK' and (in Test Mode B only) 'Acknowledge RLC Mode' can also be activated in this section.

The **Slot Configuration** button opens a window in which slots can be set up individually (Figure 22).





The 'Main Timeslot' can be set here first of all. The 'Main Timeslot' is activated automatically in the graphical **MultiSlot** section. The slot with the blue marking indicates the BCCH, the grey markings indicate deactivated slots without level, the dark green markings indicate non-activated slots with a defined level, and the light green markings 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, slots are activated and the gamma value to be used by the mobile phone can be specified.

Note: These settings are overwritten if 'Auto Slot Config' is activated.

Clicking the **Configure** button opens another window (Figure 23). Additional parameters can be set in this window.

and the second second	Mobile Network Code (MNC):		1
	Mobile Country Code (MCC):		1
	Bit Stream:	PR 9	•
	Ext. Dynamic Allocation:	Auto	-
	PC Meas Chan:	ВССН	-
escription			
		Enter your de	scription here



Figure 24 shows a typical entry in the test report. If 'Auto Slot Config' is activated, the respective settings are only overwritten after the call has been set up.

Figure 24 - Call Setup report

Once the sequence has been started, the user is prompted to switch the mobile phone off and then on again.

Message	<u>a</u>
Please switch your mobile o	off and on again !
ОК	

Figure 25 - Location update

Note:

The GPRS Call Setup module uses the RF analyzer setting 'PCL/Gamma' and automatically configures the DSP on the 'Signalling Unit B21' so that four timeslots can be observed at the same time in the BLER measurement (see the section CMU200 signalling unit (B21)).

GPRS Call Release Module

In the Call Release module, the active call to the mobile phone is released; the R&S CMU200 enters the 'Attached' and 'Synchronized' state (Figure 26). If 'Free all CMU resources' is activated, the instrument changes to the 'SOFF' state.

Call Release Configuration		8	×
	Type Release from Testset CMU		
	<u>ОК</u>	Cancel	

Figure 26 - Call Release module

1

If the call is not set up or released, the following window will be displayed (Figure 27). This query is also performed by all other modules (except for Call Setup).

CMUgo		×
This testItem does	not support the current in	strument state!
	ОК	



Figure 28 shows the Call Release entry in the test report.

GPRS Call Release Test:	E.	E	passed	1

Figure 28 - Call Release report

GPRS Call Change Module

A number of parameters can also be changed during an active call; the GPRS Call Change module is used for this purpose (Figure 29).



Figure 29 - GPRS Call Change module

The various GSM bands can again be selected in the **Network** section. If this setting differs from the current setting, a *dual-band handover* is performed.

The channel ('Traffic Channel'), timeslot ('Main Timeslot') and channel code ('Coding Scheme') can also be changed in this module.

The multislot structure can be changed in the **MultiSlot** section; once again, the grey markings indicate deactivated timeslots without level, dark green markings indicate non-activated slots with a defined level, and the light green markings indicate activated timeslots. In the **Downlink** section, slots can be activated and a level relative to the 'Reference Level' can be set. In the **Uplink** section, slots are activated and the gamma value to be used by the mobile phone can be specified.

Figure 30 shows the corresponding entry in the test report.

Figure 30 - Call Change report

GPRS BER/BLER Test Module

The receiver measurements (RX Quality) in (E)GPRS are performed in this module (Figure 31).

GPRS BER Configuration		e	3	×
	Slot 1 (dB): 0 Slot 2 (dB): 0 Slot 3 (dB): 0 Slot 4 (dB): 0 Slot 5 (dB): 0 Slot 7 (dB): 0 Attenuations 0 Input: 0 Output: 0 BLER 2: Bad DUT: 1: Result Window: 0FF min. Test Time (s): 1: BLER 2: BLER 2: Description 0	100 0.2 1 10 V 1.5 2000 10		
	Enter your description		1	
	OKC	ancel		

Figure 31 - GPRS BER/BLER test

In the **BS Signal** section, a level ('Slot 0' to 'Slot 7') relative to the reference level ('RF Level (Reference)') must be set for each timeslot. The level settings are only valid during the associated measurement; the previously set levels are used again after the measurement has been completed. It is again possible to specify the attenuation ('Attenuations').

In the **BER** section, it is possible to choose between a **BER/DBLER** measurement for 'Test Mode B' and a **BLER** measurement for the 'BLER' mode. The number of 'Frames' and the individual limits can be set in the subsection BER/BLER; the number of blocks ('RLC Block Count') and a limit can be specified under BLER. The BER/DBLER measurement can be performed as a confidence BER. To allow this, 'Enable Confidence BER' must be activated in the **Confidence** section and the appropriate parameters must be set.

CRC: 100 Frames		0	~
DBLER: 100 Frames	10.00 %	0.00 %	-
USFBLER: 100 Frames	1.00 %	0.00 %	~
BER: 100 Frames	0.20 %	0.00 %	~
BS Reference Level (dBm): -85.0, Slots (07, dB)	0.0/0.0/0.0/0.0/0.0/0.0/0.0/0.0, Attenuation In/Out (a	B): 0.0/0.0	17 a

Figure 32 - BER/DBLER test report

Confidence: for limit 0.20 : Early		passed	1
CRC: 100 Frames		0	1
DBLER: 100 Frames	10.00 %	0.00 %	-
USFBLER: 100 Frames	1.00 %	0.00 %	-
BER: 100 Frames	0.20 %	0.00 %	-
BS Reference Level (dBm): -85.0, Slats (07, dB) 0.0	V0.0/0.0/0.0/0.0/0.0/0.0/0.0, Attenuation In/Out (-	#B): 0.0/0.0	TP.

Figure 33 - BER/DBLER test report with confidence interval

BS Reference Level (dBm): -85.0, Slots (07, dB) 0.0/0.0/0.0/0.0/0.0/0.0/).0/0.0/0.0, Attenuation In/Out (dE	1): 0.0/0.0	24
BLER: 200 Blocks	10.00 %	0.00 %	~

Figure 34 - BLER report

GSM Testset Module

All TX measurements in GPRS with GMSK modulation are performed using the **GSM Testset** module (Figure 35); the 'Power versus Time' measurement for multislot is performed in the **GSM Multislot** module (see GSM Multislot Test Module). It is important to note that parameters in GPRS should be changed under GPRS Call Change. The settings which can be made in the top left-hand section (**Network, TCH, BS Signal**) are ignored in GPRS mode; only the **Attenuations** and the measurementspecific settings are valid (**Meas Slot**). The measurements selected in the right-hand section are all valid, except for **RXQual**, **RXLev** and **Receiver Quality**. RXLev and RXQual are of no use in the case of a GPRS connection; a dedicated module (GPRS BER/BLER Test) is provided for measuring receiver quality.

	- Network	Measurements
and the second	GSM 900	
	Jasm au	Average Burst Power
	TCH	Peak Burst Power
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	RF Channel:	62 Femplate Matching
		Timing Error
	PCL:	5 Burst Graphic
	Timeslot:	3 Modulation
		Phase Error Peak
	- BS Signal	Phase Error BMS
	RFLevel:	-85 V Origin Offset
		-ao IV IQ Imbalance
		Frequency Error
	Attenuations	Phase Error Graphic
	Input:	
	Output:	Reports RXQual
		BXLev
	Meas Slot:	3 Spectrum
		Spectrum due to Modulation
	A	Graphics Spectrum Modulation
		Spectrum due to Switching
		Graphics Spectrum Switching
		RX Quality
		C No RX Test
		• Rx Test (BER)
		C RX Test (RFER)
		C RX Test (BBB/Fast BER)
	- Description	
	Description	
		Enter your description he
		imits OK Cancel

Figure 35 - GSM Testset

The timeslot to be measured is set using 'Meas Slot'.

The individual measurements can be selected in the respective 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; 'Origin Offset' and/or 'IQ Imbalance' under Modulation should, however, not be selected. 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, a graphical display can be activated in each case.

Clicking the Limits button opens the dialog shown in Figure 36.

TXA	veraging (Bursts):	īī	RX Averaging (Frames):	88
			Bit stream synch time (s):	0.2
Powe	r Upper Limit (dBm):	35		0.2
	r Lower Limit (dBm):	31	Class II Error (max. %):	0.2
		51	Class Ib Errors (max. %);	0.2
Max.	Timing Error (Bits):	2	Erased Frames (max. %):	0
			Confidence	
max.	Frequency Error (Hz):	90	Enable Confidence BE	R
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 Imbalance (dB):	-20	Result Window:	OFF 🔻
ΓD	ecoding with guard and tail bit	s	min. Test Time (s):	0
ΦA	verage			2
C M	aximum		RXLev (max.):	27
			RXLev (Min.):	23
			RXQual (Max.):	1
⊢ Spec	1			
Spec	Slot Co	unt	1	
E V	ar. Meas Point 1 (MHz):		Var. Meas Point 2 (MHz)	
	ar. Meas Point 3 (MHz):	0.8	Var. Meas Point 2 (MHz)	
1. 4	ai. Meas Foiric 5 (MH2).	1.4) val. meas Foint 4 (mm2)	1.6
Spe	ectrum due to Modulation		No of Bursts:	-
			NO OF DUISIS.	10
Offs				
10		600 80	0 1000 1200 140	0 1600 1800
Sh	ectrum due to Switching: ——		No of Bursts:	10
Offs				
40	0 600 1200 1800	10.0		

Figure 36 - GSM Testset – Limits

The parameters for the TX measurements are set in the top left-hand section. First of all, the desired number of TX bursts must be set under 'TX Averaging (Bursts)'. The limits for power ('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, it is possible to activate 'Decoding with Guard and Tail Bits' and to choose between 'Average' and 'Maximum'.

The top right-hand section is reserved for the RX measurements and is not required in GPRS mode.

The bottom section **Spectrum** is reserved for the two spectrum measurements. The 'Offsets', depending on the specification, and the number of bursts ('No. of Bursts') can be set underneath the two measurements. It is also possible to activate and enter four variable offsets ('Var. Meas Point 1' to 'Var. Meas Point 4'). The parameter 'Slot Count' refers to the measurement 'due to Switching' for multislot measurements.

Figure 37, Figure 38 and Figure 39 show the entries in the test report.

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

Decoding for modulation. Standard, DER Synch unle. 0.2	vs .	24 - 194 194		20
Average Power: 10 Bursts	31.00 dBm	35.00 dBm	31.01 dBm	~
Peak Burst Power: 10 Bursts	31.00 dBm	35.00 dBm	34.09 dBm	-
Power Time Template: 10 Bursts			passed	1
Timing Error: 10 Bursts	-2.00 Bit	2.00 Bit	0.66 Bit	~
Phase Error Peak: 10 Bursts	-20.00 °	20.00 °	-8.08 °	-
Phase Error RMS: 10 Bursts		5.00 °	4.26 °	~
Origin Offset: 10 Bursts		-20.00 dB	-9.72 dB	1
IQ Imbalance: 10 Bursts		-20.00 dB	-19.74 dB	1
Frequency Error: 10 Bursts	-90.00 Hz	90.00 Hz	15.32 Hz	1
Spectrum due to Switching:			passed	1
Spectrum Switching: @-0.6 MHz			-47.74 dBm	1
Spectrum Switching: @ - 0.4 MHz			-86.34 dBm	-
Spectrum Switching: @ 0.4 MHz			-73.31 dBm	-
Spectrum Switching: @ 0.6 MHz			-19.33 dBm	1
Spectrum due to Modulation:			passed	1
Spectrum Modulation: @-0.6 MHz			-36.65 dBc	1
Spectrum Modulation: @ - 0.4 MHz			-74.44 dBc	1
Spectrum Reference Power: @ 0 MHz			20.00 dBm	-
Spectrum Modulation: @ 0.4 MHz			-22.99 dBc	1
Spectrum Modulation: @ 0.6 MHz			-61.55 dBc	1

Figure 37 - Testset report



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



Figure 38 - Spectrum due to modulation (graph)

Annex: Spectrum due to Switching

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



Figure 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 here the measurements are performed with 8PSK modulation (Figure 40). All TX measurements in GPRS with 8PSK modulation are performed using the **GSM Call Edge** module; the 'Power versus Time' measurement for multislot is performed in the **GSM Multislot** module (see GSM Multislot Test Module). It is important to note that parameters in GPRS should be changed under 'GPRS Call Change'. The settings which can be made in the left-hand section (**TCH, BS Signal**) are ignored in GPRS mode; only **Attenuations** and the measurement-specific settings are valid (**Meas Slot**). The measurements are selected in the right-hand section (**Measurements**).

GSM Call Edge (8PSK)		<u>a</u> 2
	TCH RF Channel: PCL: 5 Timeslot: 3	Measurements Power Peak Burst Power Peak Burst Power Template Matching Timing Error Burst Graphic Modulation 9 95th Percentile Error Vector Magnitude 9 95th Percentile Magnitude Error
	RF Level: .85 Attenuations	 95th Percentile Phase Error Error Vector Magnitude Peak Error Vector Magnitude RMS Magnitude Error Peak Magnitude Error RMS Phase Error RMS Phase Error RMS Origin Offset Frequency Error
		Spectrum Spectrum due to Modulation Graphics Spectrum Modulation Spectrum due to Switching Graphics Spectrum Switching
	Description	Enter your description here

Figure 40 - GSM Call Edge

The timeslot to be measured is set using 'Meas Slot'.

The individual measurements can be selected in the respective 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, a graphical display can be activated in each case.

Clicking the **Limits** button opens the dialog shown in Figure 41 - GSM Call Edge Limits.

Edge Limits				8
	Power / Modulation			
	Number of Bursts:	100	 Average Maximum 	
	Power		Modulation	
	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
	1		max. Phase Error Peak (*):	20
			max. Magn. Error RMS (%):	12.5
			max. Magn. Error Peak (%):	17.7
			max. EVM RMS (*):	9
			max. EVM Peak (*):	30
			max. 95th perc. Phase Err (*):	5
			max. 95th perc. Magn Err (%):	5
			max. 95th perc. EVM (%):	100
			Inda. Sour pole. E vin (va).	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
	Spectrum due to Modulation		1	1
			No of Bursts:	200
	Offsets: 100 200 250 400 0	500 _8	00 1000 1200 1400	1600 1800
	- Spectrum due to Switching:		No of Bursts:	10
	Offsets: 400 600 1200 1800			
				ОК

Figure 41 - GSM Call Edge Limits

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

The bottom section **Spectrum** is reserved for the two spectrum measurements. The 'Offsets', depending on the specification, and the number of bursts ('No. of Bursts') can be set underneath the two measurements. It is also possible to activate and enter four variable offsets ('Var. Meas Point 1' to 'Var. Meas Point 4'). The parameter 'Slot Count' refers to the measurement 'due to Switching' for multislot measurements.

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

Average Power (8PSK): 100 Bursts Peak Burst Power (8PSK): 100 Bursts	31.00 dBm 31.00 dBm	33.00 dBm 33.00 dBm	31.00 dBm 32.34 dBm	1
Power Time Template (8PSK): 100 Bursts			passed	1
Timing Error (8PSK): 100 Bursts	-2.00 Bit	2.00 Bit	-0.89 Bit	~
95th percentile EVM (8PSK): 100 Bursts	-15.00 %	15.00 %	-6.35 %	1
95th percentile Magitude Error (8PSK): 100 Bursts	-5.00 %	5.00 %	1.26 %	
95th percentile Phase Error (8PSK): 100 Bursts	-5.00 °	5.00 °	4.91 °	1
EVM Peak (8PSK): 100 Bursts	-30.00 %	30.00 %	3.80 %	~
EVM RMS (8PSK): 100 Bursts	-9.00 %	9.00 %	-6.54 %	
Magnitude Error Peak (8PSK): 100 Bursts	-17.70 %	17.70 %	8.25 %	1
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	0.00	-30.00 dB	-79.90 dB	-
Frequency Errort (8PSK): 100 Bursts	-90.00 Hz	90.00 Hz	53.33 Hz	1
Spectrum due to Switching (8PSK):	Ē	[]	passed	~
Spectrum due to Modulation (8PSK):	E	C]	passed	~

Figure 42 - Call Edge report

GSM Multislot Test Module

The (multislot) power can be measured in MultiSlot Test (Figure 43).

MultiSlot test				
	Settings No. of Slots: Bursts: Guard Level (dB):	E 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 Input: Output:	0
	Max. Timing Error (Bits):	2	Meas. Slot:	3
	Description		Enter your desc	ription here Cancel
				Cancel

Figure 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 **Multi Slot Power** section.

Figure 44 shows a typical entry in the report. If the 'Burst Graphic' tick box is activated, a graph is generated (Figure 45).

Average Power: Slot 0 , 100 Bursts	31.00 dBm	35.00 dBm	18.49 dBm	-
Average Power: Slot-1 , 100 Bursts	31.00 dBm	35.00 dBm	-41.25 dBm	-
Average Power: Slot +1 , 100 Bursts	31.00 dBm	35.00 dBm	-41.06 dBm	-
Average Power: Slot +2 , 100 Bursts	31.00 dBm	35.00 dBm	-40.86 dBm	-
Peak Burst Power: Slot 0 , 100 Bursts	31.00 dBm	35.00 dBm	21.51 dBm	-
Peak Burst Power: Slot - 1 , 100 Bursts	31.00 dBm	35.00 dBm	-31.68 dBm	-
Peak Burst Power: Slot +1 , 100 Bursts	31.00 dBm	35.00 dBm	-32.01 dBm	-
Peak Burst Power: Slot +2 , 100 Bursts	31.00 dBm	35.00 dBm	-33.45 dBm	-
Power Time Template: Slot 0 , 100 Bursts			passed	
Power Time Template: Slot-1 , 100 Bursts	1	1	passed	1
Power Time Template: Slot +1 , 100 Bursts			passed	4
Power Time Template: Slot +2 , 100 Bursts			passed	4
Timing Error: Slot 0 , 100 Bursts	-2.00 Bit	2.00 Bit	0.00 Bit	1
Timing Error: Slot -1 , 100 Bursts	-2.00 Bit	2.00 Bit	0.50 Bit	4
Timing Error: Slot +1 , 100 Bursts	-2.00 Bit	2.00 Bit	0.50 Bit	1
Timing Error: Slot +2 , 100 Bursts	-2.00 Bit	2.00 Bit	0.50 Bit	

Figure 44 - Multislot report (table)

Annex: Power Graphic

Guard Level (dB): 3.0, Number of Slots: 4



Figure 45 - Multislot report (graph)

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Remote Sequences

GPRS Call Setup

First of all, the RF analyzer is set to PCL/Gamma mode, the RF connector (RF2) is selected and the attenuation (0 dB) is set.

LEV:MODE PCL

SIGN:STAT?

INP:STAT RF2

OUTP:STAT RF2

SENS:CORR:LOSS:INP2 0.0

SENS:CORR:LOSS:OUTP2 0.0

Setting of Network Support (GSM+GPRS), DSP B52 of B21V02 (Multislot Support) and parameter P-Zero (0). Also channel of the BCCH (32) and level (-85 dBm) as well as the traffic channel (62) and the main timeslot (3).

CONF:NETW:NSUP GGPR

CONF:NETW:B52M MSUP

CONF:BSS:PDAT:MSL:PZER 0

CONF:BSS:CCH:CHAN 32

CONF:BSS:CCH:LEV -85.0

CONF:BSS:PDAT:TCH:MSL:CHAN 62

CONF:BSS:PDAT:TCH:MSL:MTIM 3

CONF:SIGN:PDAT:ASC:ENAB OFF

Setting of multislot uplink (slot 3 ON, gamma all 3) and downlink (slot 3, all 0 dB relative), coding scheme (CS1)

CONF:BSS:PDAT:TCH:MSL:SCON

CONF:NETW:PDAT:GPRS:CSCH CS1

Acknowledge mode (Off), controchannel mode (BCCH and TCH)

CONF:NETW:PDAT:TWAC OFF

CONF:BSS:CCH:MODE BATC

CONF:NETW:PDAT:RLCM UNAC

Bit stream (pseudo-random 9)

CONF:NETW:PDAT:BITS PR9

CONF:RXQ:PDAT:BITS PR9

MCC (1) and MNC (1)

CONF:NETW:IDEN:MCC 1

CONF:NETW:IDEN:MNC 1

Meas channel (BCCH) and dynamic allocation (Auto)

CONF:NETW:PDAT:PCMC BCCH

CONF:NETW:PDAT:EDAL AUTO

Starting of the generator (GSM and GPRS)

PROC:SIGN:ACT SON

PROC:SIGN:PDAT:ACT SON;*OPC?

Waiting for location update (SYNC) and attach (ATT) (must be repeated in loops)

SIGN:STAT?

SIGN:PDAT:STAT?

Call to mobile (here Test Mode A), waiting for 'TEST' (must be repeated in loops)

PROC:SIGN:PDAT:ACT CTMA

SIGN:PDAT:STAT?

Querying of information

CONF:MSS:PDAT:MSL:SCON? CONF:BSS:PDAT:MSL:SCON?

MSS:IMSI:MCC?

MSS:IMSI:MNC?

MSS:IMSI:MSIN?

MSS:IMEI:FAC?

MSS:IMEI:TAC?

MSS:IMEI:SNR?

MSS:IMEI:SVN?

MSS:REV?

MSS:POW:CLAS?

MSS:MSCL:PDAT?

GPRSCall Release

Querying of the status, execution of Call Release (DISC), waiting for 'ATT'. If all resources are to be released, the SOFF command is given.

SIGN:PDAT:STAT? PROC:SIGN:PDAT:ACT DISC SIGN:PDAT:STAT? PROC:SIGN:ACT SOFF

GPRS Call Change

Status query

SENS:SIGN:PDAT:STAT?

CONF:BSS:CCH:MODE?

Changing of uplink and downlink parameters (main timeslot 3; downlink: all 0 dB relative; uplink: all gamma 3)

PROC:SIGN:PDAT:MSL:SCON

Changing of channel (62) and coding scheme (CS1)

PROC:SIGN:PDAT:MSL:CHAN 62;*OPC?

PROC:NETW:PDAT:CSCH CS1;*OPC?

GPRS BER/BLER Test

Status query and attenuation (0 dB)

SENS:SIGN:PDAT:STAT?

INP:STAT?

SENS:CORR:LOSS:INP2 0.0

SENS:CORR:LOSS:OUTP2 0.0

Configuration of BER/DBLER without confidence (singleshot, 100 frames BER/DBLER, reference level -85 dBm)

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

CONF:RXQ:BER1:CONT BDBL,100

CONF:RXQ:BER1:CONT:PDAT:TCH:MSL:RLEV -85.0

CONF:RXQ:BER:TSET T1

Alternatively: Configuration of BER/DBLER with confidence (stop on confidence, , ,fail and pass 99.8%,)

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

CONF:RXQ:CONT:CONF:MTT 0.0

CONF:RXQ:BER1:LIM:CLII 0.2

CONF:RXQ:CONT:CONF:FAIL C980

CONF:RXQ:CONT:CONF:PASS C980

CONF:RXQ:CONT:CONF:RWIN OFF

CONF:RXQ:BER1:CONT BDBL,100

CONF:RXQ:BER1:CONT:PDAT:TCH:MSL:RLEV -85.0

CONF:RXQ:BER:TSET T1

Execution of BER/DBLER (start and waiting for results)

INIT:RXQ:BER

FETC:RXQ:BER?

Alternative BLER measurement (singleshot, 2000 blocks, level -85 dB) CONF:RXQ:BLER:CONT:REP SING,NONE,NONE

GSM Testset

Status query, attenuation (0 dB) and unimportant 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:MP05:ENAB ON

CONF:SPEC:MOD:CONT:MP06:ENAB OFF CONF:SPEC:MOD:CONT:MP07: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, modulation ANY, 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?

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 Windows Application CMUgo (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-*)

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 GSM	1115.6907.02

 $^{(1)}\mbox{CMU-B21}$ or CMU-B21v14 with CMU-B54v14 is required.



ROHDE & SCHWARZ GmbH & Co. KG Mühldorfstraße 15 D-81671 München Postfach 80 14 69 D-81614 München Tel (089) 4129 - 0 Fax (089) 4129 - 13777 Internet: http://www.rohde-schwarz.com

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