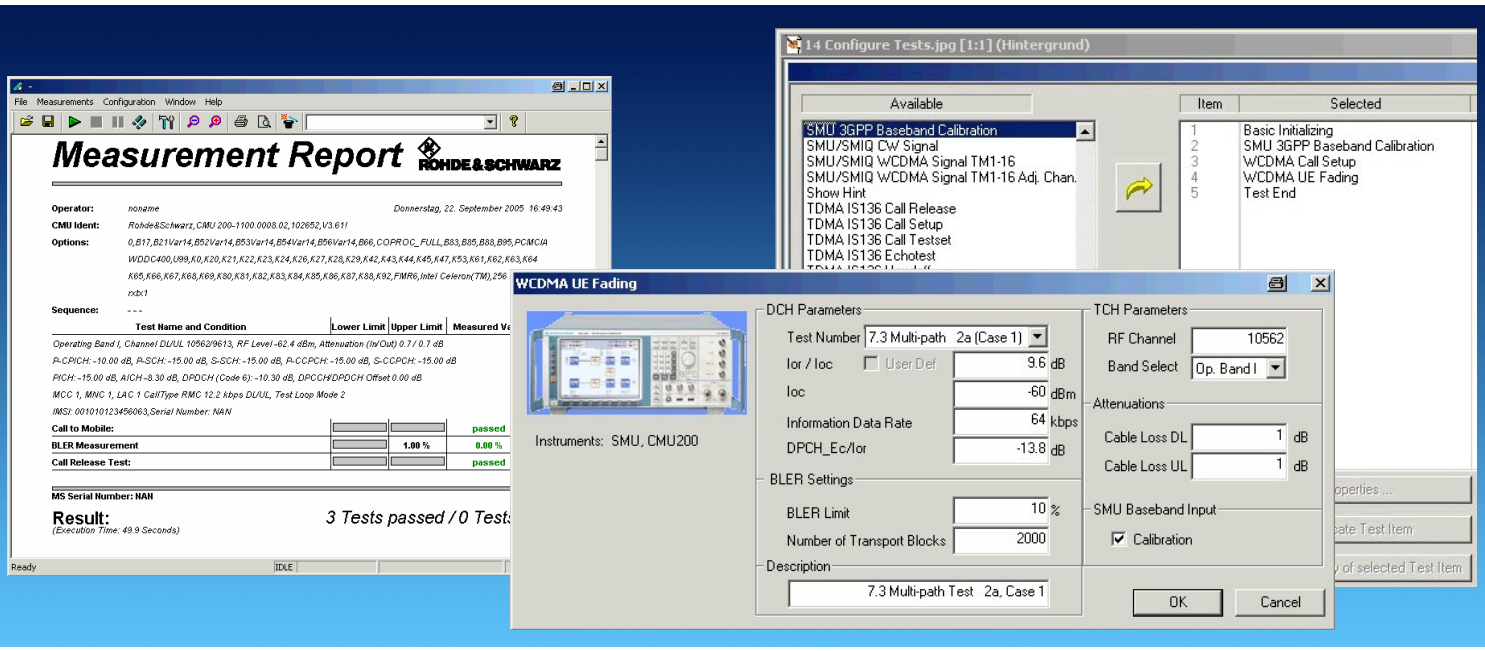

Products: RS®CMU200 (B17),RS®SMU (B14, B15), RS®CMU-Z11, RS®NRP-Z21, RS® NRP-Z22, RS® NRP-Z23, RS® NRP-Z24, RS®NRP, RS®NRVD, RS®NRVS

3GPP User Equipment Tests Under Fading Conditions with CMUGo! and R&S®CMU200 / R&S®SMU / R&S®AMU

Application Note

This application note describes how to perform 3GPP (UTRA-FDD) user equipment (UE) performance tests under fading conditions according to TS 34.121 with the automated R&S testsoftware CMUGo!. The test setup requires a Universal Radio Communication Tester R&S®CMU200 with IQ-IF interface option R&S®CMU-B17 and a Vector Signal Generator R&S®SMU or Fading Simulator R&S®AMU.

ROHDE&SCHWARZ

Contents

1 Overview

The signal strength and quality of signals received by 3GPP User Equipment (UE) is influenced by effects resulting from the movement of the UE, and the overlay of numerous delayed signals caused by reflections. The phenomenon is called fading and is classified in profiles such as Fine Delay, Moving Propagation and Birth-Death Propagation Fading. This application note describes how to connect an R&S®CMU200 Radio Communication Tester with IQ-IF interface option R&S®CMU-B17 to an R&S®SMU Signal Generator for generating 3GPP signals suitable for tests under fading conditions according to the test specification TS 34.121 for performance tests. It also describes the according CMUGo! function WCDMA_Fading_SMU for automatic baseband calibration and BLER measurement.

CMUGo! can be downloaded free of charge from the R&S website.

The following abbreviations are used in the text for R&S® test equipment:

CMU200	R&S®CMU200 Universal Radio Communication Tester
SMU	R&S®SMU200A Vector Signal Generator
AMU	R&S®AMU200A Fading Simulator
NRP-Z11, NRP-Z21, etc.	R&S®NRP-Z11, R&S®NRP-Z21, etc. Power Sensors
NRP	R&S®NRP Power Meter
NRVD	R&S®NRVD Power Meter
NRVS	R&S®NRVS Power Meter
R&S	Rohde & Schwarz GmbH und Co. KG

2 Introduction to 3GPP Fading

There are basicly two factors that affect the quality of a received 3GPP signal. A signal from the base station (Node B) usually makes its way to the UE via multiple paths. For test purposes, a variety of profiles simulate real-world fading:

- Pure Doppler which simulates direct transmission paths for which Doppler shift is occuring due to movement of the UE.
- Rayleigh Fading simulates a radio hop which arises as a result of scatter caused by obstacles in the signal path (buildings, etc.).

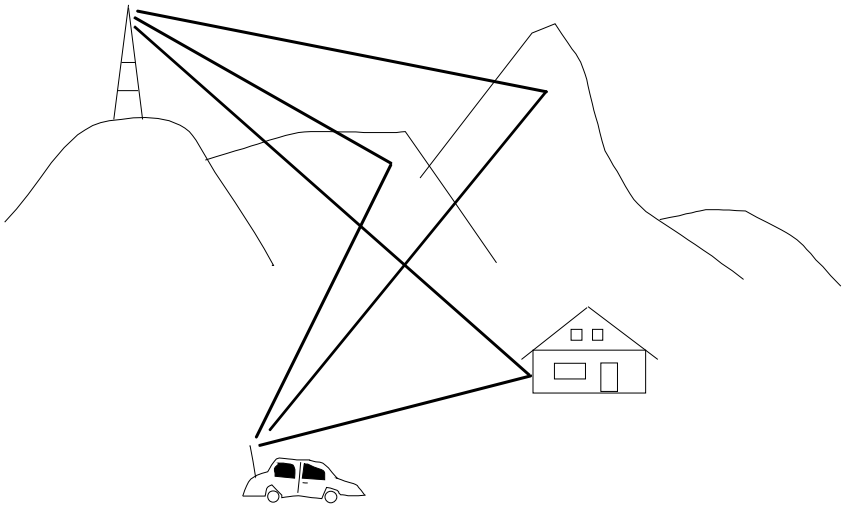

Fig. 1 Multi-path Fading

Delay variations (whether sudden or slow) become important with fast modulation standards such as 3GPP. Therefore two further propagation conditions were introduced in order to simulate the full range of influences affecting the receiver.

- Moving Propagation
- Birth Death Propagation

Since a UE only can decode the signal on one specific RF frequency at a time, the modulated signals on other frequencies simply appear as noise. The quality of the received signal is affected by the ratio of the signal power to the surrounding traffic noise level (Signal/Noise Ratio). This effect is simulated by including some Additive White Gaussian Noise (AWGN) to the signal.

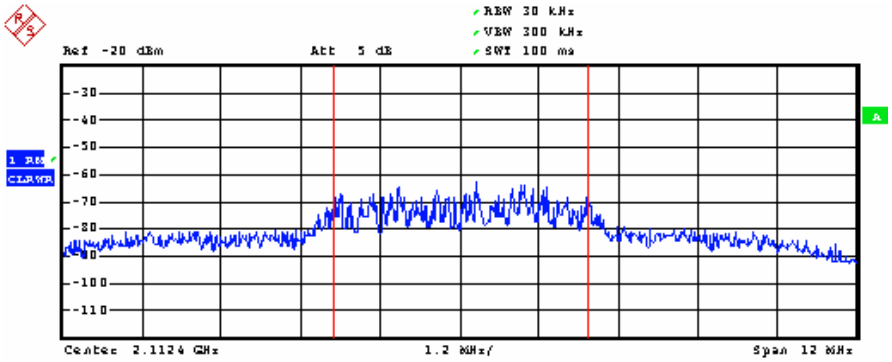

Fig. 2 Faded 3GPP signal + AWGN (Ior/Ioc = 12dB)

The test specification for 3GPP User Equipment (TS 34.121) contains numerous test cases in order to guarantee wide ranging functionality. The fading or propagation conditions are classified as:

- STATIC PROPAGATION – For a UE located at a fixed point the received signal is merely overlayed by surrounding traffic noise (AWGN).
- MULTI-PATH FADING PROPAGATION (Fine Delay) – This simulates the effect that occurs when a UE is moving with a certain speed. The test specification 3GPP TS 34.121 defines 6 different cases that cover typical situations, e.g. pedestrian (3 km/h), cars (50 km/h) and trains (250 km/h). The signal is additionally overlayed by surrounding traffic noise.
- MOVING PROPAGATION (Moving Delay) – Simulates the gradual change of one moving path to a reference path which occurs while driving on a flat countryside with no other dramatic landscape changes such as entering a forest. The signal is additionally overlayed by surrounding traffic noise.
- BIRTH-DEATH PROPAGATION – Is the sudden cancellation of the direct path leaving only one reflected path left. This situation may occur when turning around a corner and leaving the basestation's line of sight. The signal is additionally overlayed by surrounding traffic noise.

The SMU requires both fading options SMU-B14 and SMU-B15 to simulate these effects according to the test specification 3GPP TS 34.121.

3 3GPP Fading with CMU200 and SMU

Test Setup

The specification TS 34.121 prescribes the following test setup variations for performance tests under fading conditions. For the static propagation test AWGN is added to the signal.

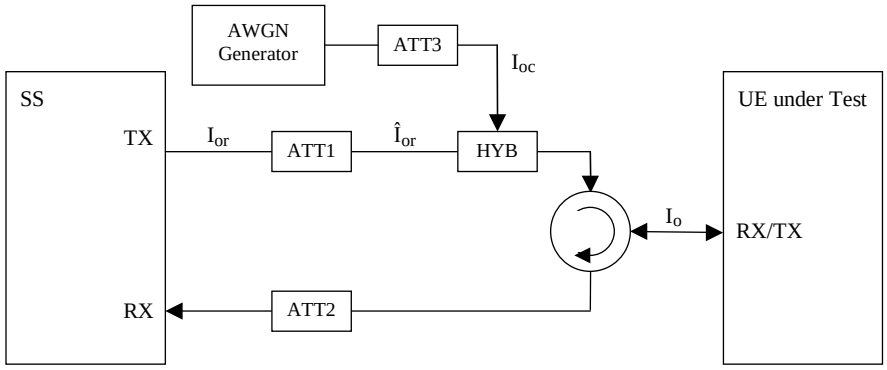

Fig. 3 Connection for Static Propagation Test

In the multi-path fading propagation test the signal is faded first, then AWGN is added to the faded signal.

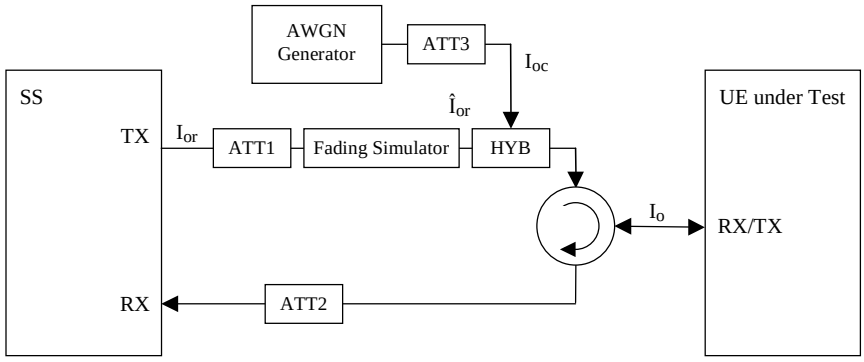

Fig. 4 Connection for Multi-path Fading Propagation Test

The same effect is achieved by simulating fading and AWGN in the base-band layer inside the SMU.

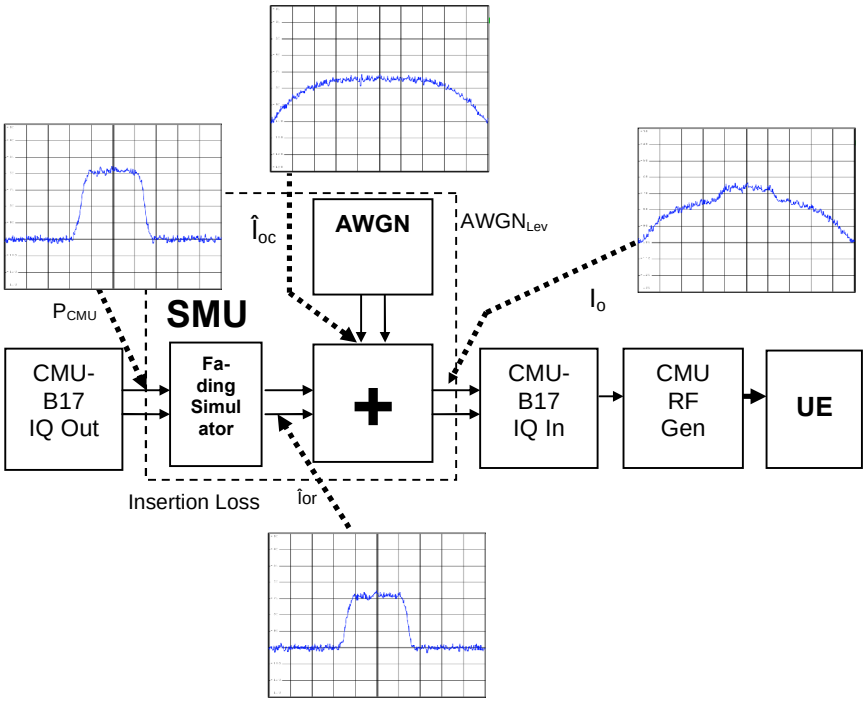

Fig. 5 Baseband Fading

The 3GPP baseband signal generated by the CMU200 is fed to the SMU IQ baseband input via the CMU-B17 IQ/IF option. The manipulated BB signal is returned to the CMU which modulates it to RF.

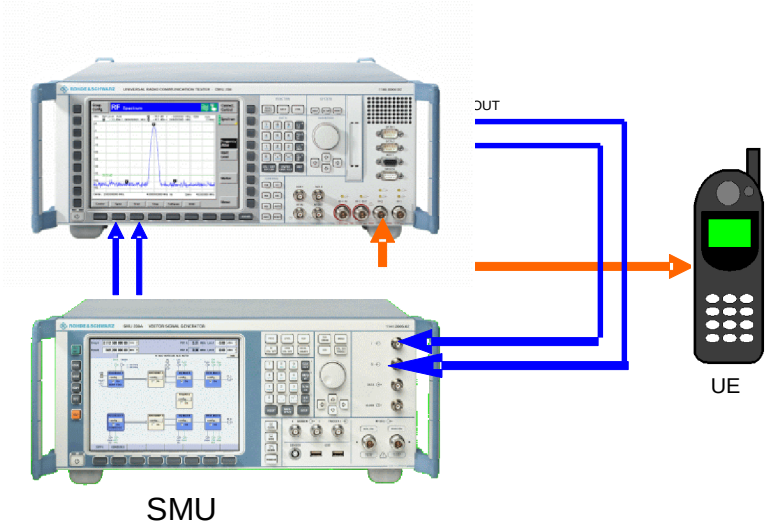

Fig. 6 Test setup

The CMU IQ out signal exceeds the SMU 0 dBfs (= 0.5Vp) limit und must therefore be attenuated accordingly with the I/Q-IF-Levelrms control. This control allows an attenuation range of 0…20 dB.

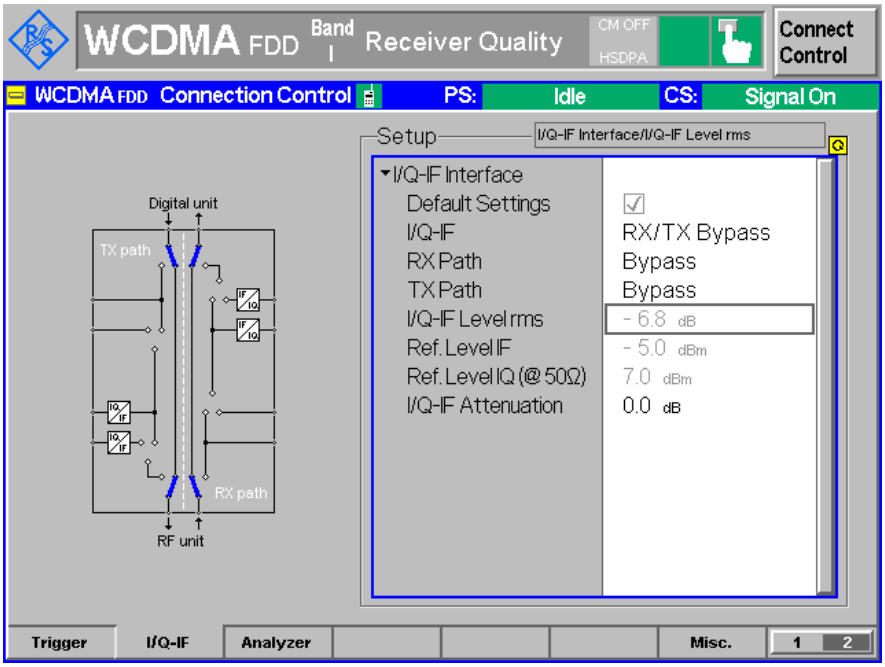

Fig. 7 I/Q-IF Level rms

The SMU can determine the level of the baseband input and automatically adjust it to Up = 0,5V which corresponds to AWGN level. This enables a very precise Îor/Ioc setting. The attenuation caused by the external 3 dB attenuators, the SMU baseband insertion loss and the RF cable loss must be compensated with the CMU RF level. The following section explains the steps necessary to perform this manually.

BLER Measurement Preparation

In order to obtain precise BLER results two calibration steps must be performed prior to the actual measurement.

- Manual measurement of the RF cable loss between the CMU RF2 output and the UE at various relevant frequencies.
- Manual or automatic calibration of the SMU Baseband Insertion Loss which is necessary to adjust the signal level (Ior) to the AWGN level (Ioc). The automatic calibration is performed in the the CMUGo! function WCDMA_Fading_SMU.

When the cable and insertion losses are known it is possible to calculate the CMU output level compensation (EXTernal ATTenuation OUTPut) in order to obtain the prescribed UE input power.

RF Cable Loss

The loss of the RF cable between the CMU to the UE can be determined with an R&S power meter NRP, NRP-zx, NRVS or NRVD.

1. Connect the power meter (e.g. NRP-Z11) instead of the UE to the cable.

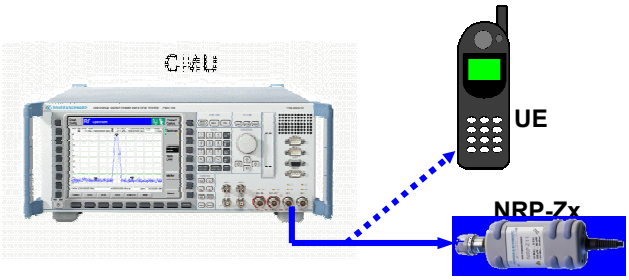

Fig. 8 Measure Cable Loss

2. Reset CMU with **RESET** → **ALL**.
3. Press **MENU SELECT** → **BASIC FUNCTIONS** → **RF** → **ANALYZER / GENERATOR** on CMU. [BILD]
4. Press **CONNECT. CONTROL** on CMU.

5. Generate a CW signal on the CMU with **RF LEVEL** = **-10.0 dBm** (Pnom) and **FREQUENCY** → e.g. **2112.4 MHz**.

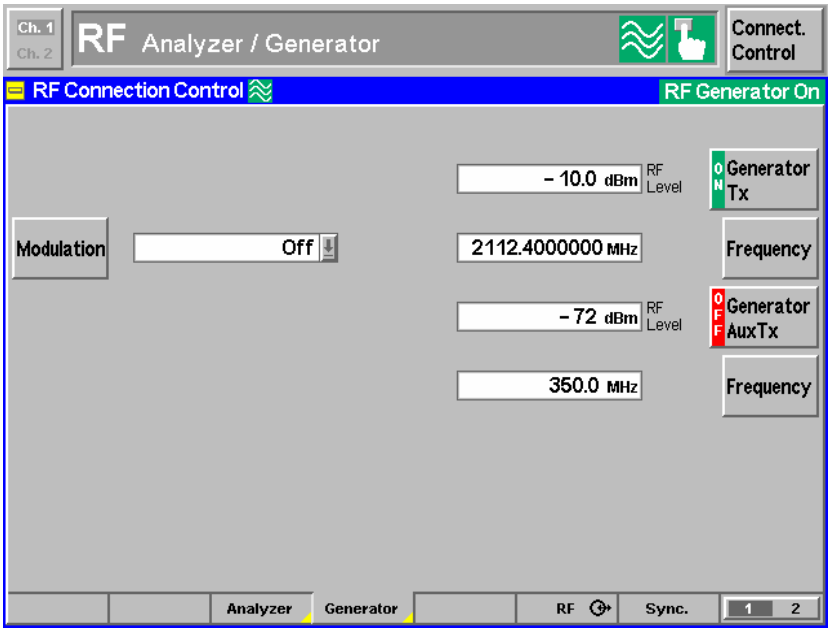

Fig. 9 CMU Configuration for Cable Loss Measurement

6. Zero the power meter.

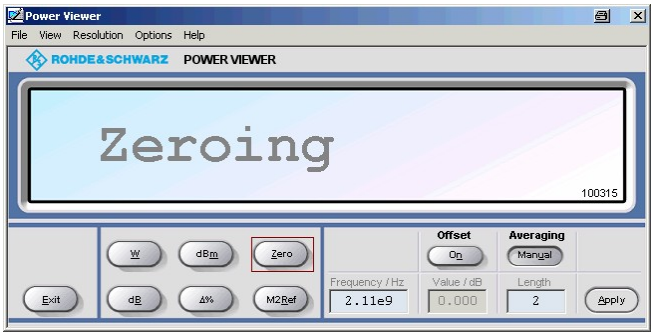

Fig. 10 Zero power sensor

7. Enter NRP-Zx correction frequency (e.g. 2.11e9 Hz).

8. Perform measurement (Pmeas).

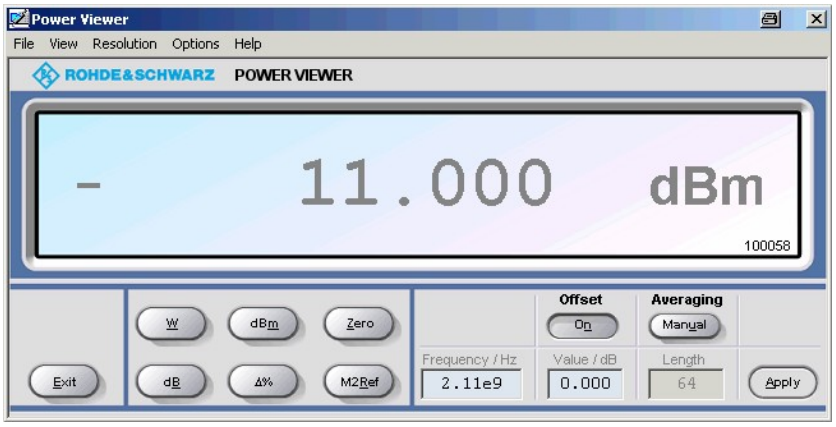

Fig. 11 Power Measurement

9. The resulting cable loss is the difference between the measured power (Pmeas = -11.0 dBm) and the CMU nominal level (Pnom = -10.0 dBm).

$$Cable\ Loss = P_{nom} - P_{meas} = -10.0\,dBm + 11.0\,dBm = 1.0\,dB$$

The Cable Loss must be memorized for later use.

SMU Baseband Insertion Loss

This section shows how to calibrate the SMU baseband input (BB Input) manually. The same steps are performed automatically in the CMUGo! function **WCDMA_FADING_SMU** descibed in chapter 4.

1. Select the 3GPP signalling mode on the CMU with **MENU SELECT → 3G UMTS USER EQUIPMENT → WCDMA FDD → SIGNALLING → RECEIVER QUALITY → BER**.

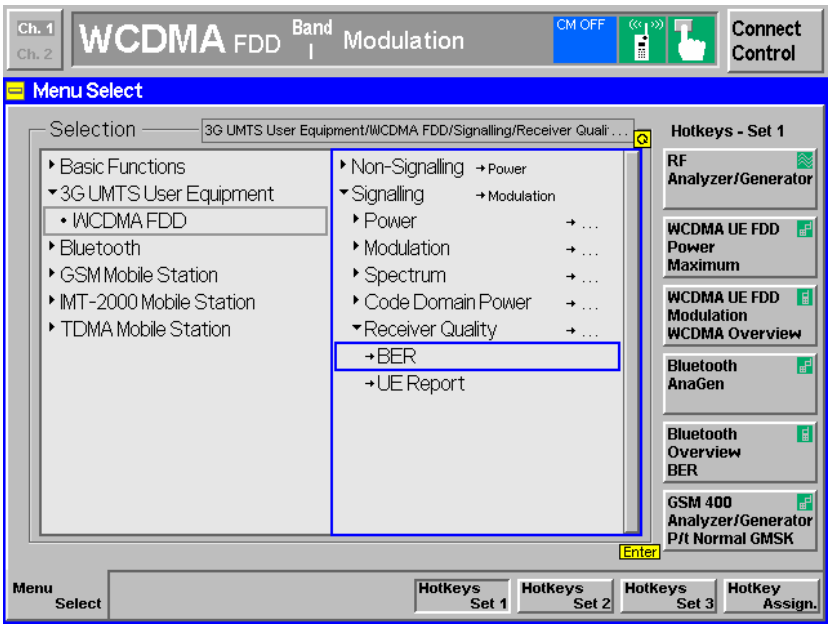

Fig. 12 Select 3G BER Mode

2. Set the RF parameters to realistic values, e.g.

   - RF Chn. Downlink → 10562 (= 2112.4 MHz)
   - Downlink Power → -60.0 dBm
   - Dedicated Channel → RMC
   - Band Select → Operating Band I

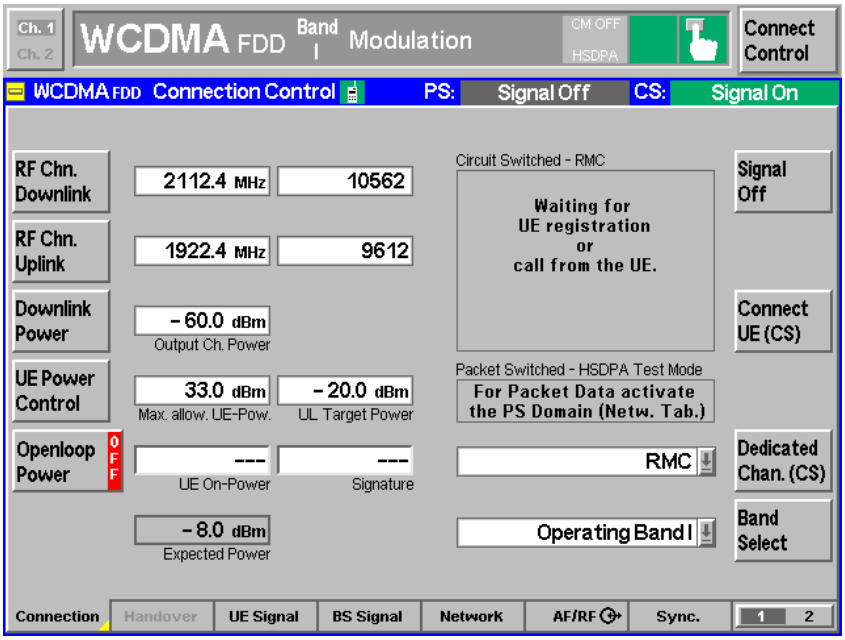

Fig. 13 CMU RF Parameters

3. Route the CMU I/Q signal to the baseband output with **CONNECT CONTROL → 2 → I/Q-IF INTERFACE → I/Q-IF → FADING**.

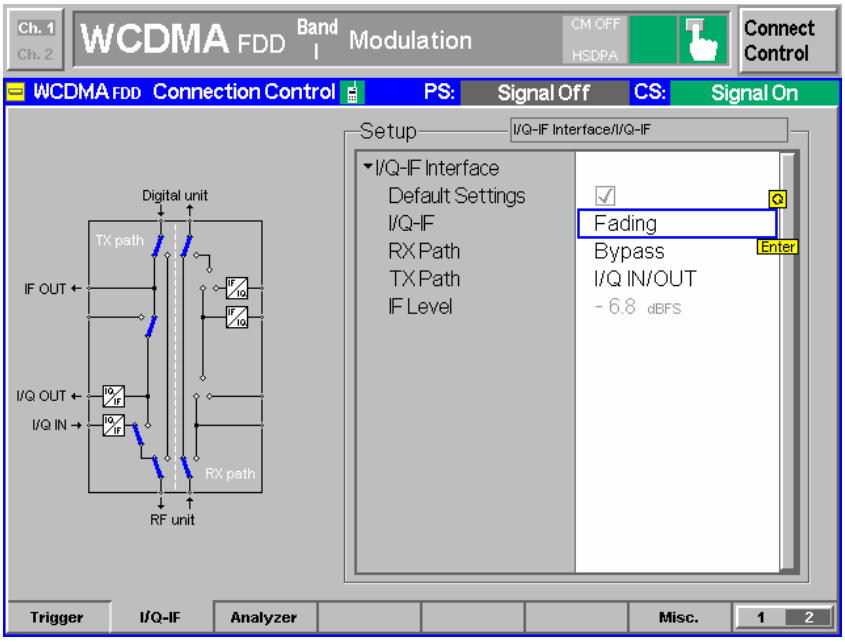

Fig. 14 I/Q-IF Setting

4. Turn SMU **BB INPUT → ON**.

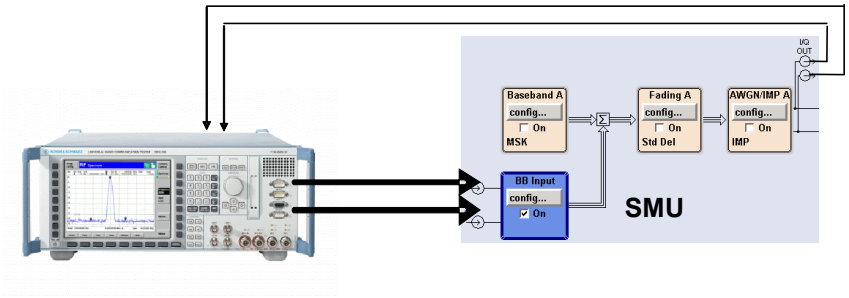

Fig. 15 Correction configuration

5. Perform **BB INPUT → CONFIG… → BASEBAND INPUT SETTINGS → AUTO LEVEL SET** in SMU to determine CMU IQ output level.

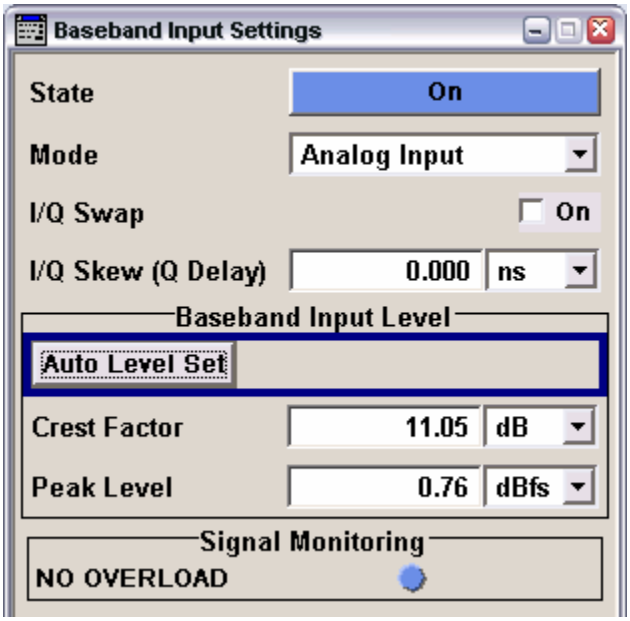

Fig. 16 BB Auto Level Set

The BB input level is calculated as

$$BBrms = PeakLevel - CrestFacto\ r = 0{,}76\,dBfs - 11{,}05\,dB = -10{,}29\,dBfs$$

This value must be stored for later use. This procedure can also be performed automatically in the CMUGo! function **WCDMA_Fading_SMU** by checking the **BB INPUT CALIBRATION** button (see section 4 – 3G Fading Test with CMUGo!).

Note: *The OVERLOAD LED (red) may eventually appear but does not affect the measurement results.*

6. Enter the **FADING A → CONFIG…** Fading Settings menu and select:
   - **STATE → ON**
   - **STANDARD → 3GPP CASE 1 (UE/BS)**
   - **Signal dedicated to → BASEBAND OUTPUT**
   - **VIRTUAL RF → 2.1124 GHz**

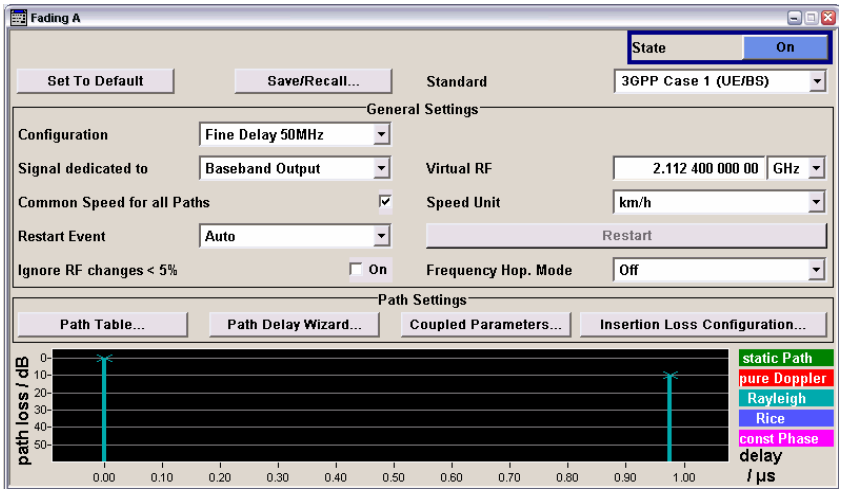

Fig. 17 Fading Menu

7. Enter the **AWGN/IMP A → CONFIG… → I/Q IMPAIRMENTS (DIGITAL BASEBAND)…** menu and determine the Signal Level (RMS).

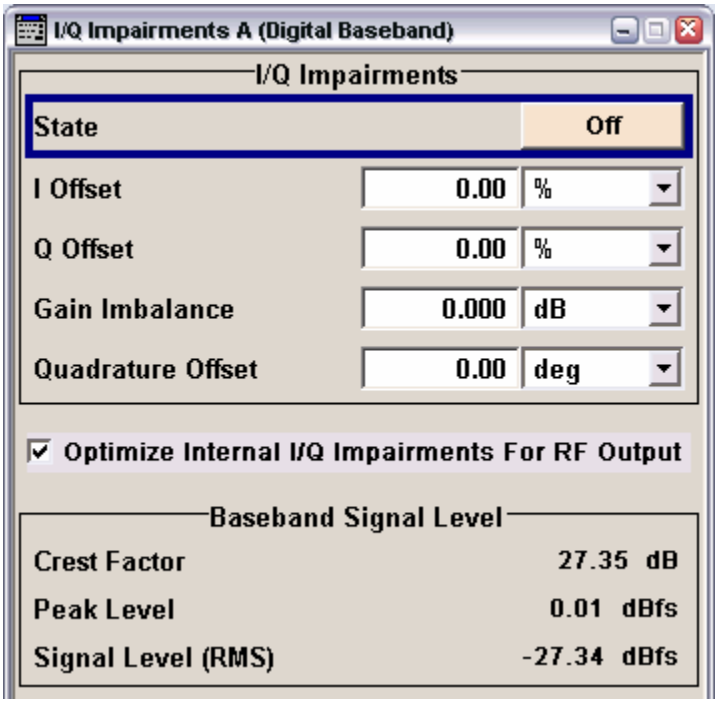

Fig. 18 I/Q Impairments Menu

The difference between **BB$_{RMS}$** (see formula on page 13) and the **SIGNAL LEVEL (RMS)** is the baseband insertion loss of the SMU. The

sum of the **RF CABLE LOSS**, **SMU BASEBAND INSERTION LOSS** and 3 dB external input attenuators must be compensated with the CMU **EXT**ernal **ATT**enuation **OUTPUT** control.

$$Ext.Outp.Att = BbRms - SignalLevelRms + 3\,\text{dB} + CableLoss$$
$$= -10{,}29\,\text{dBfs} + 27.34\,\text{dBfs} + 3\,\text{dB} + 1{,}0\,\text{dB}$$
$$= 21{,}05\,\text{dB}$$

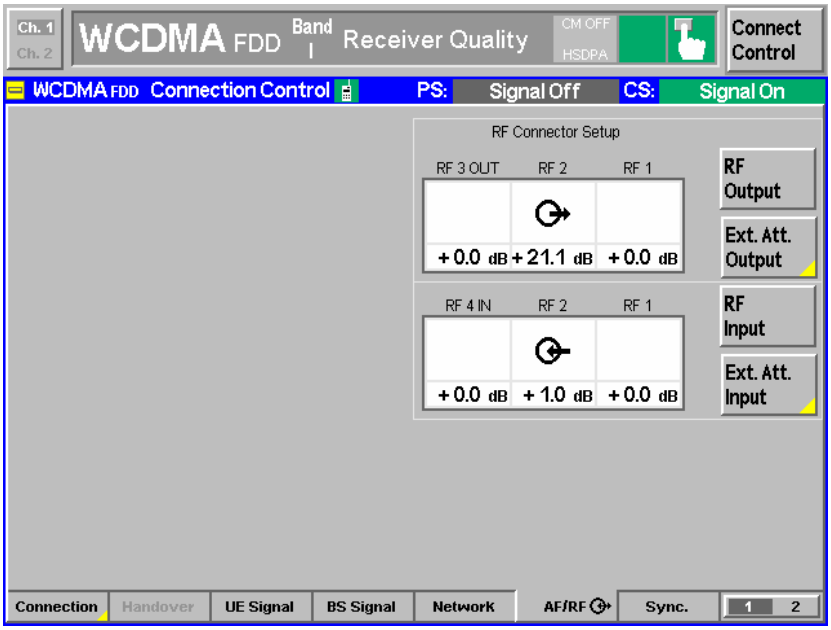

Fig. 19 CMU External Attenuation Output

8. Enter the **AWGN/IMP A → CONFIG… → AWGN…** menu and select (differing from default):

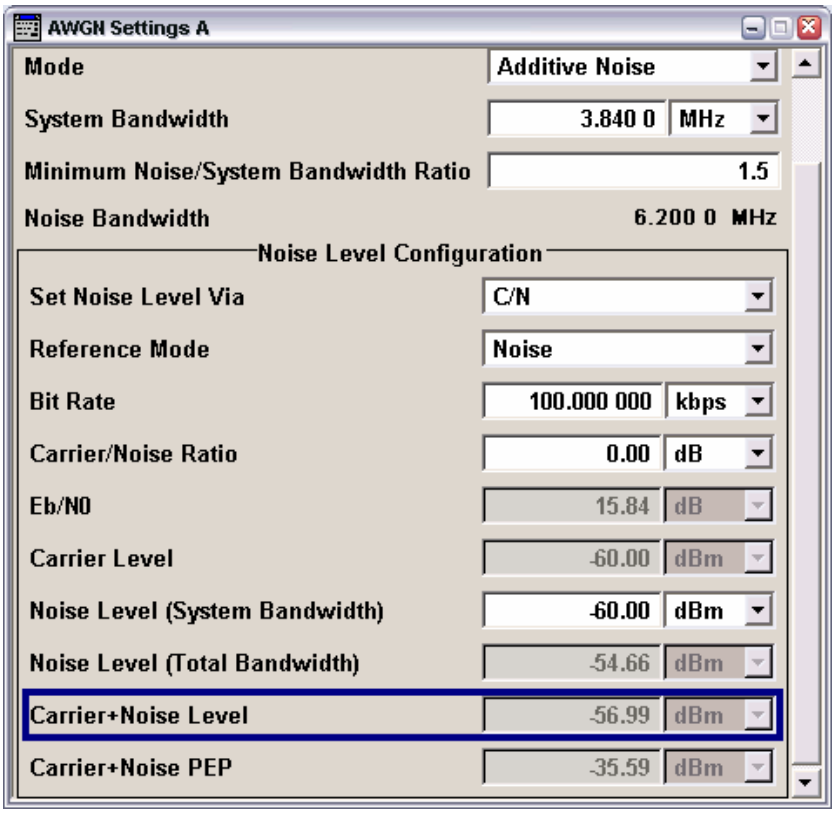

Fig. 20 AWGN Menu

- **STATE → ON**
- **MINIMUM NOISE/SYSTEM BANDWIDTH RATIO → 1.5**
- **REFERENCE MODE → NOISE** (as defined in TS 34.121)
- **CARRIER/NOISE RATIO → 0.00 dB**. This allows easy comparison since Ior = Ioc = Ior + Ioc - 3.01 dB.
- **NOISE LEVEL (SYSTEM BANDWIDTH) → -60 dBm**

When entering a realistic value for Ioc (e.g. **NOISE LEVEL → -60.00 dBm**) the total output power Io (**CARRIER + NOISE LEVEL**) will display the correct value. Io is calculated with following formula:

$$Io = 10 * \log\left(10^{\frac{\hat{I}or/\mathrm{dB}}{10}} + 10^{\frac{Ioc/\mathrm{dB}}{10}}\right)$$

After all compensation measures have been taken Io is the expected power fed to the UE.

9. The resulting CMU RF channel power may optionally be checked with a spectrum analyser, e.g. FSQ8 in Fast ACP mode.

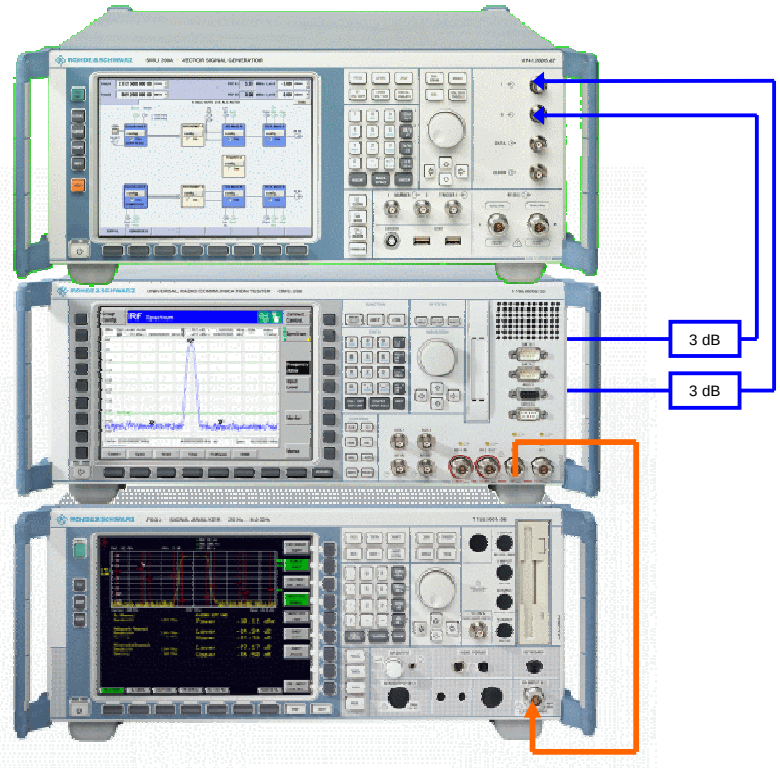

Fig. 21 Io Measurement with FSQ

Note: *For a steady FSQ power readout the* ***SPEED*** *parameter in the SMU Fading Path Table may be set to the maximum value (817.5 km/h). Be sure to reset it for BLER measurements.*

Fading A: Path Table Standard/Fine Delay

	1 1	1 2	2 1	2 2	3 1	3 2
State	Off	Off	On	Off	On	Off
Profile	Rayleigh	Rayleigh	Rayleigh	Rayleigh	Rayleigh	Rayleigh
Path Loss /dB	0.00	0.00	0.00	0.00	10.00	0.00
Basic Delay /us	0.00	0.00	0.00	0.00	0.00	0.00
Additional Delay/us	0.000 00	0.000 00	0.000 00	0.000 00	0.976 00	0.000 00
Resulting Delay /us	0.000 00	0.000 00	0.000 00	0.000 00	0.976 00	0.000 00
Power Ratio /dB						
const Phase /deg	0.0	0.0	0.0	0.0	0.0	0.0
Speed /km/h	817.5	817.5	817.5	817.5	817.5	817.5
Freq. Ratio	0.00	0.00	0.00	0.00	0.00	0.00

FAST

Fig. 22 Fading Path Table

The noise level Ioc may be easily measured by disconnecting the baseband input cables from the SMU.

Use following settings on the analyzer:

- **FREQUENCY → 2112.4 MHz**
- Press **MEAS → CHAN PWR ACP → CP / ACP STANDARD → WCDMA 3GPP FWD**
- Enter **SWEEP → SWEEP TIME → 5S**
- Press **MEAS → CHAN PWR ACP → CP / ACP CONFIG → NO. OF ADJ. CHAN** → 0
- Press **MEAS → CHAN PWR ACP → CP / ACP CONFIG → FAST ACP → ON**

With the CMU **OUTPUT CHANNEL POWER** set to -60 dBm the expected total output power **IO** is **-56,99 dBm** (see figure below).

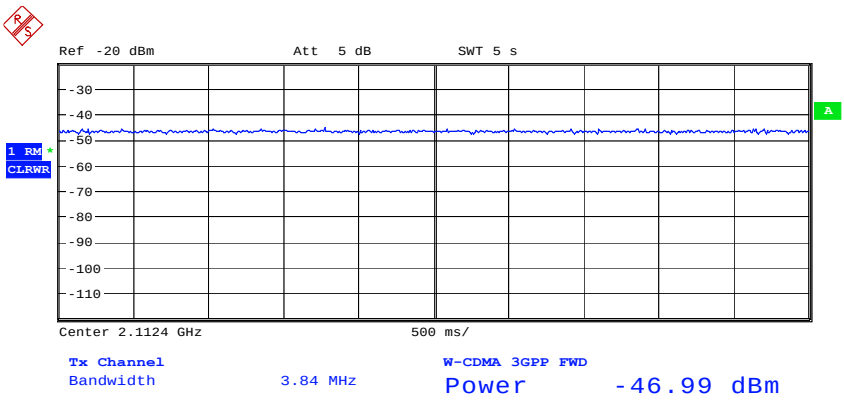

Fig. 23 FSx ACP Measurement

4 CMUGo! Multi-path Fading Propagation Example Test 2a, Case 1

CMUGo! is a software platform for easily creating automated test routines with a CMU and various R&S test equipment required for GSM, CDMA200 or 3GPP tests. This section shows the steps necessary to perform a BLER measurement according to **7.3 MULTI-PATH FADING PROPAGATION TEST 2A, CASE1**.

A detailed description of the **WCDMA CALL SETUP** and **WCDMA FADING SMU** functions is given in chapter 5. The demo sequence **3GUEFADTST.SEQ** included in CMUGo! note contains all performance tests listed in the test specification TS 34.121.

Defining SMU GPIB Address

In order to use the SMU in CMUGo! click on the menu item **CONFIGURATION → AUXILIARY GPIB PORT 1:**. Set the **DEVICE NAME** to SMU, make sure you have the correct **PRIMARY ADDRESS** and check **ENABLE PORT**.

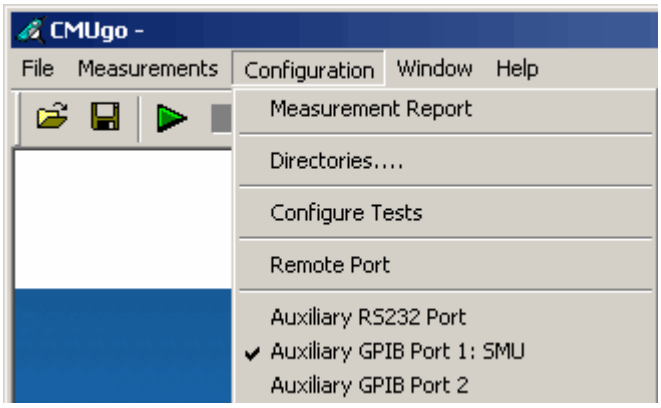

Fig. 24 AUX GPIB Port 1

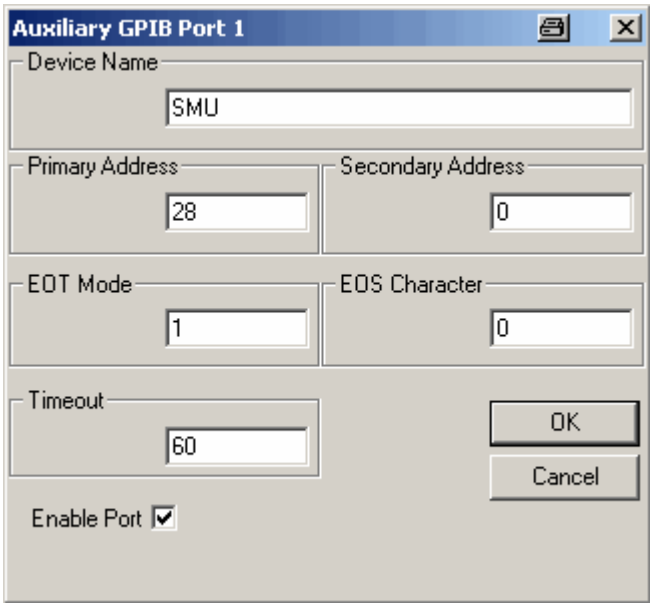

Fig. 25 SMU GPIB Address

Configuring a BLER Test Sequence

A test sequence can be generated in CMUGo! by using a mouse to drag and drop a function from the **AVAILABLE** to the **SELECTED** list. A BLER measurement (e.g. 7.3 Multi-path Test 2a, Case 1) requires at least following steps.

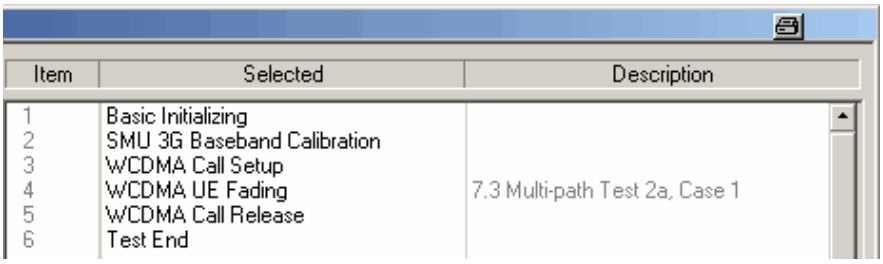

Fig. 26 BLER Test Sequence

- **BASIC INITIALIZING** – Selects the required function group, e.g. **WCDMA 1900 FDD** and initializes the CMU accordingly. The **RF** function group must also be switched ON.

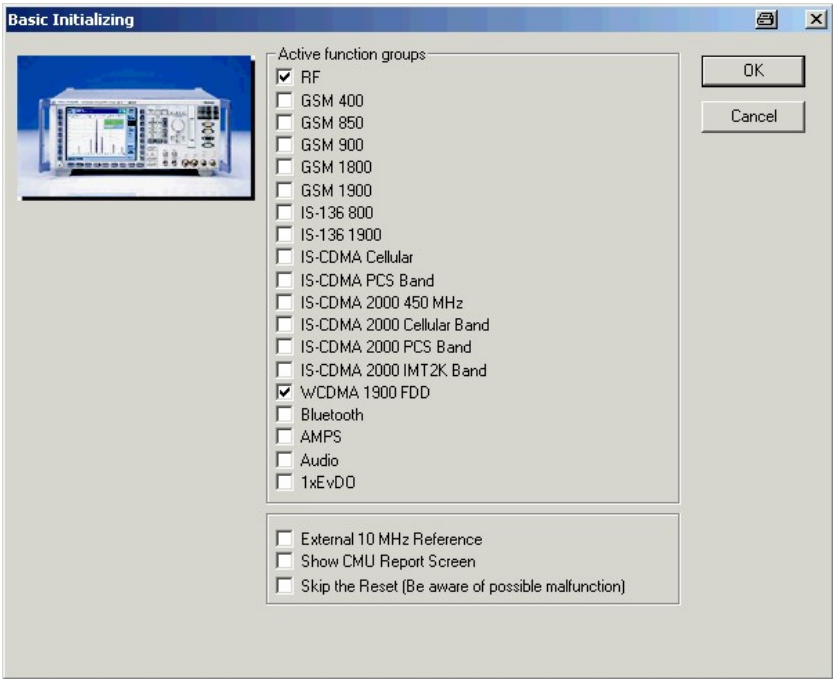

Fig. 27 Basic Initializing

- **WCDMA CALL SETUP** – Performs the call. The yellow marked **CHANNEL CONFIGURATION** parameters P-CPICH, P-SCH, S-SCH, P-CCPCH, PICH and Data Information Rate are configured in this menu (see Chapter 5). The other test specific parameters are set in the succeeding **WCDMA UE FADING** functions.

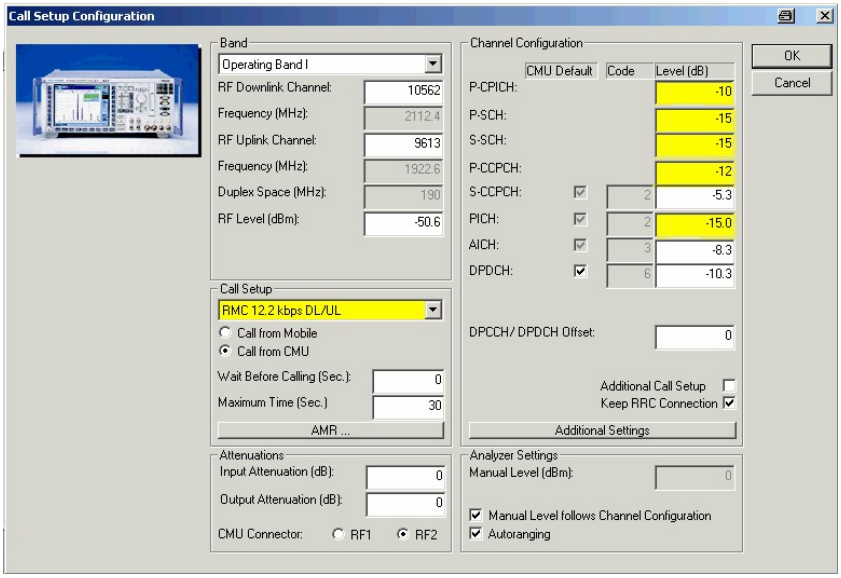

Fig. 28 WCDMA Call Setup

- **WCDMA FADING SMU** – This function allows to enter a test case as specified in TS 34.121 (performance tests 7.2 static propagation, 7.3 multi-path fading propagation, 7.4 moving propagation and 7.5 birth-death propagation). By selecting a **TEST NUMBER** the parameters **IOR/IOC**, **IOC**, **DPCH_EC/IOR** and **BLER LIMIT** are preset with the appropriate value. When the **SMU BASEBAND INPUT CALIBRATION** checkbox is ON the SMU determines the baseband input RMS level. This function needs to be turned ON only in the first test after the **WCDMA CALL SETUP**. Select RF Channel and enter the cable loss.

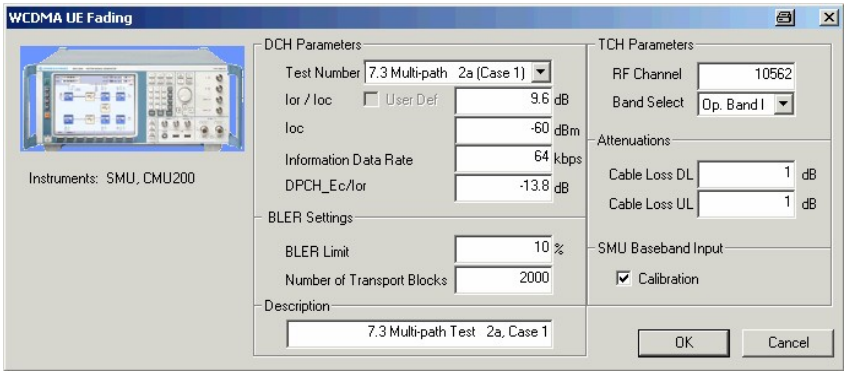

Fig. 29 WCDMA Fading SMU

- **WCDMA CALL RELEASE** – This command releases the call.

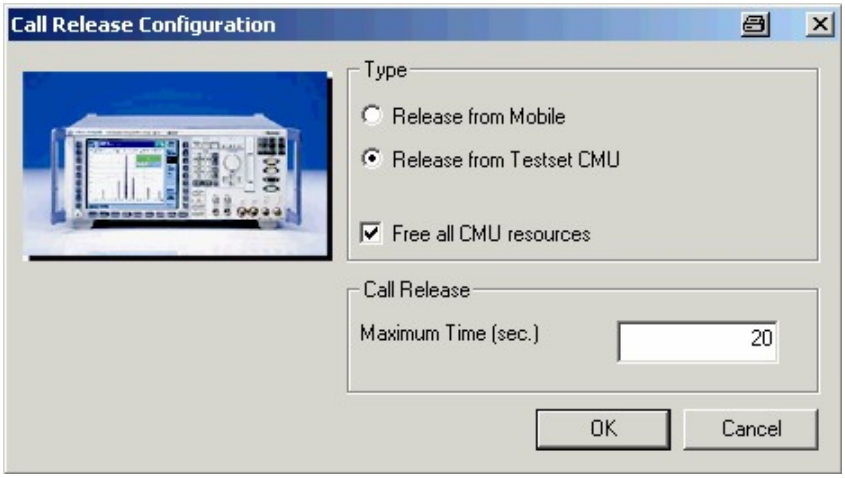

Fig. 30 WCDMA Call Release

- **TEST END** – Is necessary for all test sequences and closes unused handles and frees unused memory.

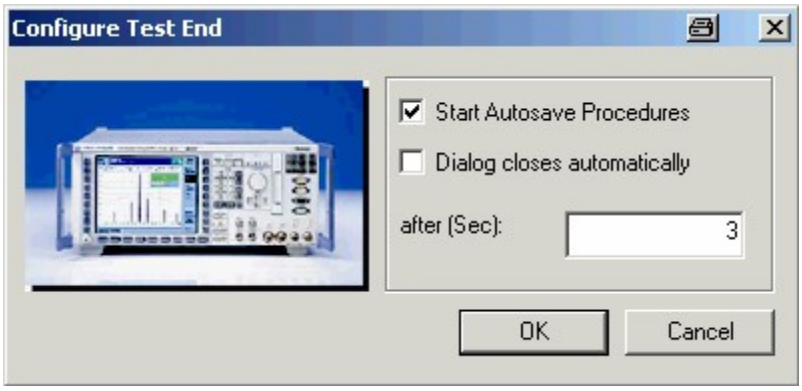

Fig. 31 Test End

Running the Test Sequence

- Load the example Test 2a, Case 1 with **CONFIGURATION → CONFIGURE TESTS → LOAD SEQUENCE… → T2AC1.SEQ**.
- Start the sequence by selecting **MEASUREMENTS → START** from the menu, pressing **CTRL-F5** or clicking on the green arrow.

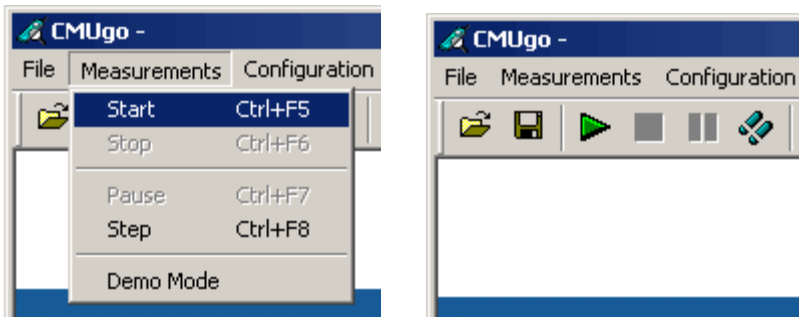

Fig. 32 Start Test Sequence

- After approx. 30s you will be prompted to switch ON the mobile for registration.

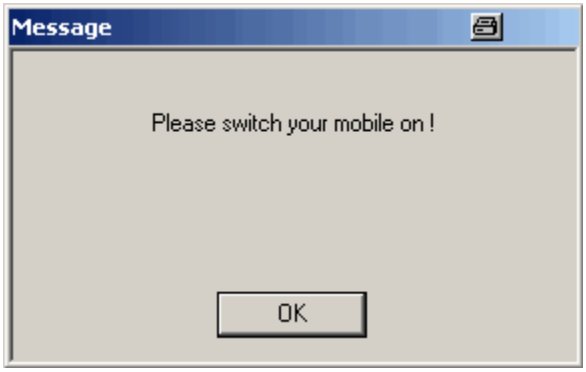

Fig. 33 Switch Mobile On

After turning the mobile ON the message will disappear as soon as the mobile has been registered.

- After approx. 80 seconds the test is completed and a measurement report window appears.

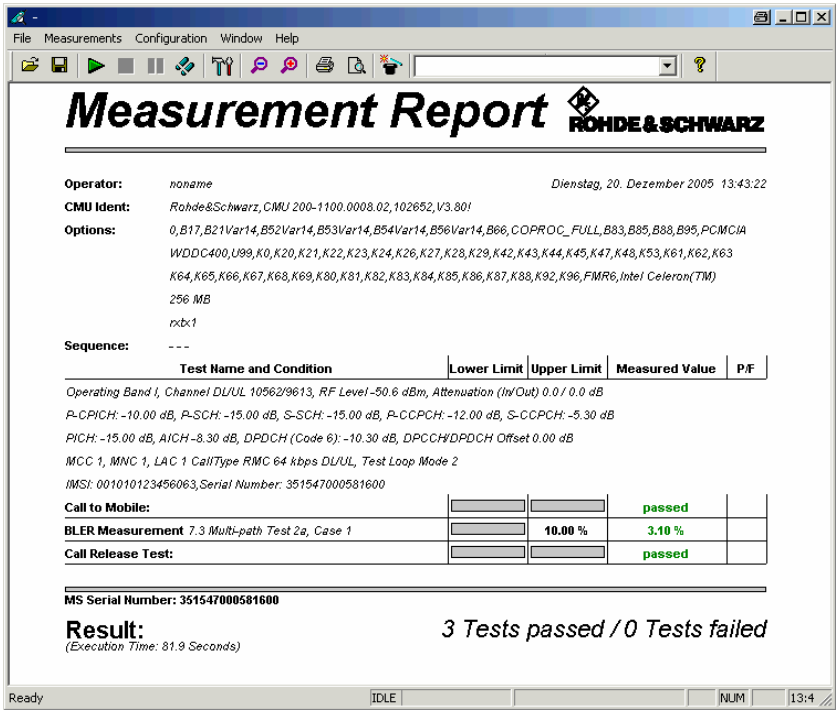

Fig. 34 Measurement Report

CMUGo! considers the **CALL TO MOBILE**, **BLER MEASUREMENT** and **CALL RELEASE** as tests and includes them accordingly in the result line.

BLER vs. Îor/Ioc Characteristic

An easy method for comparing different UEs with each other is a BLER characteristic with variable Îor/Ioc. The following test sequence **T2AC1 CHAR.SEQ** based on 7.3 Multi-path fading, Test 2a, Case 1, was performed with decreasing Îor/Ioc (12 dB to 0 dB) and constant Ioc = -60dBm.

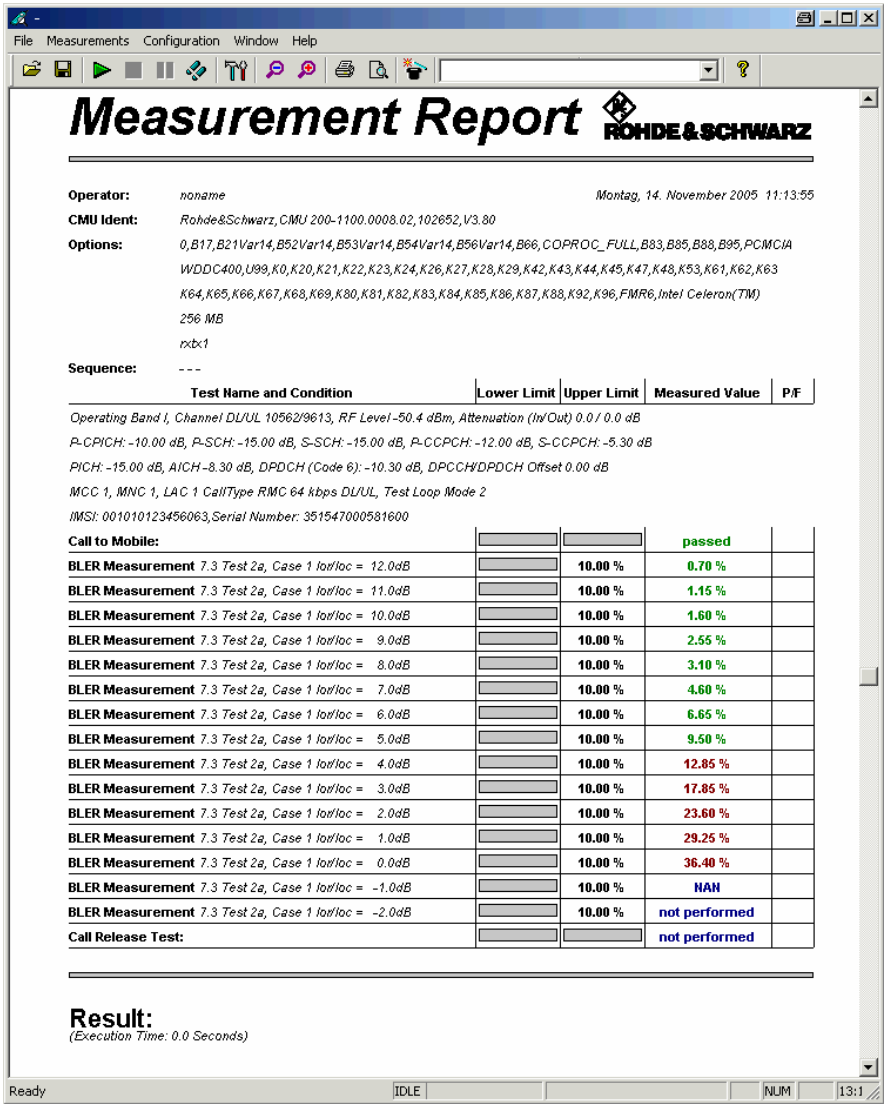

Fig. 35 BLER vs. Ior/Ioc

The curve has a non-linear chararacteristic and becomes rather steep with increasing Ior / Ioc. This region suites best for curve comparison.

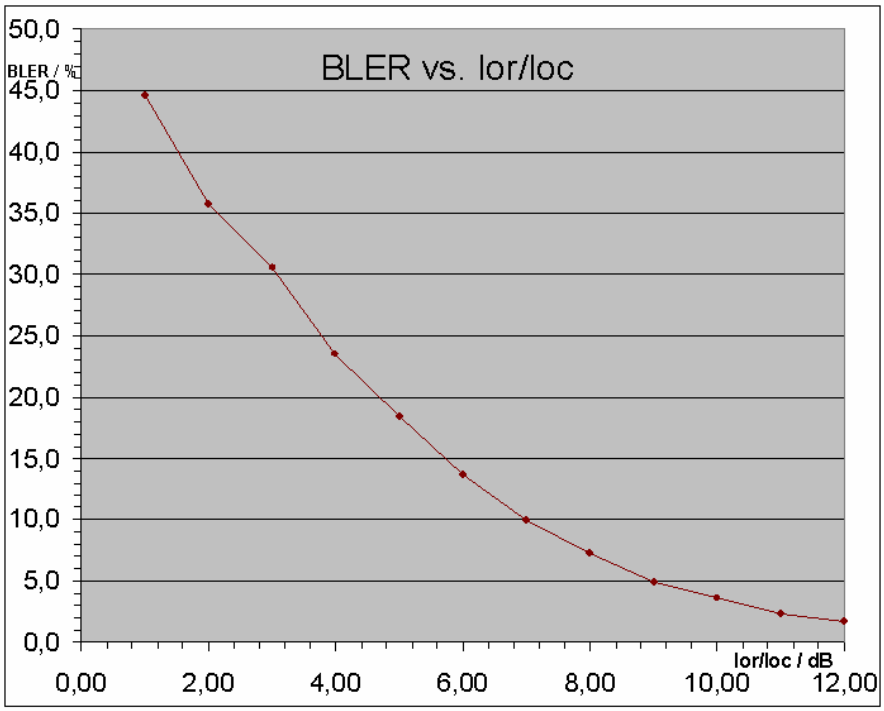

Fig. 36 BLER vs. Îor/Ioc

5 Using TS 34.121 Parameters in CMUGo!

The receiver characteristics of the Dedicated Channel (DCH) in different multi-path fading environments are determined by the **BL**ock **E**rror **R**atio (BLER) values. This section is also based on **7.3 MULTI-PATH TEST 2A, CASE 1** and shows which parameters from the test specification TS 34.121 are relevant and how they are used in the CMUGo! functions **WCDMA CALL SETUP** and **WCDMA FADING SMU**.

WCDMA Call Setup

The **DOWNLINK PHYSICAL CHANNEL** levels and the test dependant **INFORMATION DATA RATE** are configured in the CMUGo! function **WCDMA CALL SETUP** and marked yellow. The non-marked parameters may be left in default state since they are test dependant and will be overriden in the succeeding **WCDMA UE FADING** command(s).

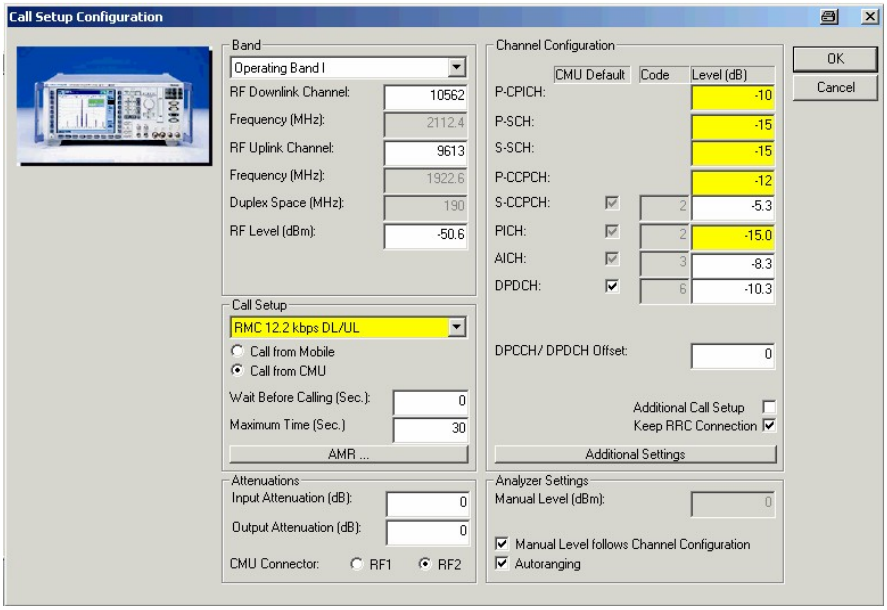

Fig. 37 WCDMA Call Setup

In the following list taken from TS 34.121 the according levels are marked and apply for performance tests 7.1 Static Propagation, 7.2 Multi-path Fading Propagation, 7.3 Moving Propagation and 7.4 Birth-Death propagation .

Table E.3.3: Downlink Physical Channels transmitted during a connection

Physical Channel	Power	Note
P-CPICH	P-CPICH_Ec/Ior = –10 dB	Use of P-CPICH or S-CPICH as phase reference is specified for each requirement and is also set by higher layer signalling.
S-CPICH	S-CPICH_Ec/Ior = –10 dB	When S-CPICH is the phase reference in a test condition, the phase of S-CPICH shall be 180 degrees offset from the phase of P-CPICH. When S-CPICH is not the phase reference, it is not transmitted.
P-CCPCH	P-CCPCH_Ec/Ior = –12 dB	
SCH	SCH_Ec/Ior = –12 dB	This power shall be divided equally between Primary and Secondary Synchronous channels
PICH	PICH_Ec/Ior = –15 dB	
DPCH	Test dependent power	When S-CPICH is the phase reference in a test condition, the phase of DPCH shall be 180 degrees offset from the phase of P-CPICH.
OCNS	Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	OCNS interference consists of 16 dedicated data channels as specified in table E.3.6.
NOTE: For dynamic power correction required to compensate for the presence of transient channels, e.g. control channels, a subset of the DPCH channels may be used.		

Table 7.3.1.11: DCH parameters in multi-path fading propagation conditions (Case 1)

Parameter	Test 1	Test 2	Test 3	Test 4	Unit
Phase reference	P-CPICH				
$\hat{I}_{or}/I_{oc}$	9,6				dB
I_{oc}	–60				dBm / 3,84 MHz
Information Data Rate	12,2	64	144	384	kbps

INFORMATION DATA RATE is the data rate of the signal (e.g. 64 kbps for Test 2a, Case 1). It is test dependedant, but must be configured before establishing a call. This means that a call must be released and re-established before performing a test case with a different Information Data Rate.

WCDMA Fading SMU

The test dependant DCH parameters for the test **7.3 DEMODULATION OF DCH IN MULTI-PATH FADING PROPAGATION CONDITIONS TEST 2A , CASE 1** are configured in the function **WCDMA FADING SMU**.

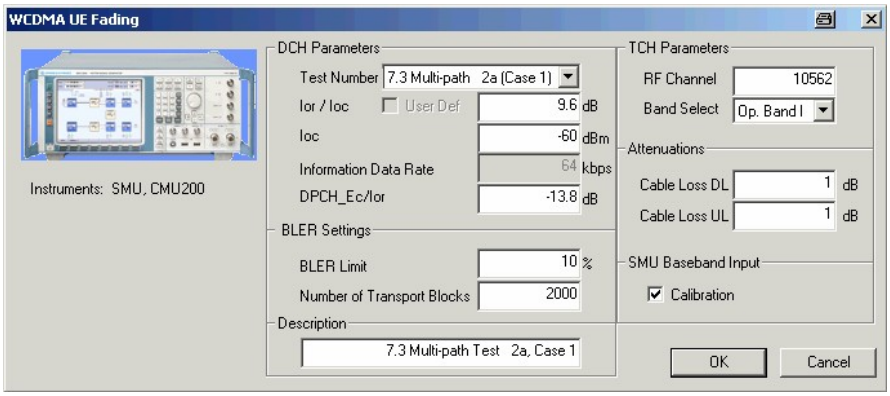

Fig. 38 WCDMA Fading SMU (Test 2a, Case 1)

The DCH parameters are taken from following TS 34.121 table.

Table 7.3.1.11: DCH parameters in multi-path fading propagation conditions (Case 1)

Parameter	Test 1	Test 2	Test 3	Test 4	Unit
Phase reference	P-CPICH				
$\hat{I}_{or}/I_{oc}$	9,6				dB
I_{oc}	–60				dBm / 3,84 MHz
Information Data Rate	12,2	64	144	384	kbps

PHASE REFERENCE – The CMU200 currently supports only P-CPICH and therefore cannot perform tests involving S-CPICH (e.g. 7.3.1.17 / 7.3.1.18).

ÎOR/IOC is the Signal to Noise Ratio (SNR) between the WCDMA Output Channel Power **ÎOR** and the AWGN signal level **IOC**. (e.g. 9.6 dB for Test 2a, Case 1). The CMU Output Channel Power is equivalent to Îor and is calculated as:

$$\hat{I}_{or} = I_{oc} + \frac{\hat{I}_{or}}{I_{oc}} = -60{,}0\,\text{dBm} + 9{,}6\,\text{dB} = -50{,}4\,\text{dBm}$$

IOC is the absolute level of the AWGN interferer (e.g. -60dBm for Test 2a, Case 1) at 3.84 MHz system bandwidth.

Table 7.3.1.12: DCH requirements in multi-path fading propagation conditions (Case 1)

Test Number	$\frac{DPCH\_E_c}{I_{or}}$	BLER
1	–14,9 dB	10^{-2}
2	–13,8 dB	10^{-1}
	–9,9 dB	10^{-2}
3	–10,5 dB	10^{-1}
	–6,7 dB	10^{-2}
4	–6,2 dB	10^{-1}
	–2,1 dB	10^{-2}

DPCH_EC/IOR – is the ratio of the **D**edicated **P**hysical **Ch**annel to the signal level **ÎOR** (e.g. -13.8dB for Test 2a, Case 1).

BLER LIMIT – is the specified maximum measured Block Error Rate (e.g 10^{-1} = 10% for Test 2a, Case 1).

TEST NUMBER – Selects the test according to TS 34.121, e.g. 7.3 Multi-path Test 5, Case 2 and sets the parameters **IOR/IOC** (S/N ratio), **IOC** (AWGN level), **DPCH_EC/IOR** and also the **BLER LIMIT**. The fading path parameters are also automatically confgured according to the table below.

Table D.2.2.1: Propagation conditions for multi-path fading environments

Case 1, speed 3km/h		**Case 2, speed 3 km/h**		**Case 3, speed 120 km/h**	
Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]	Relative Delay [ns]	Average Power [dB]
0	0	0	0	0	0
976	-10	976	0	260	-3
		20000	0	521	-6
				781	-9

USER DEF – Indicator that becomes checked as soon as one of the parameters **IOR/IOC**, **IOC**, **DPCH_EC/IOR** or **BLER LIMIT** is changed. This indicates that the test is no longer specified by TS34.121 but user defined.

INFORMATION DATA RATE – Indicator that shows the INFORMATION DATA RATE of the selected Test Number e.g. 64 kbps. It must match the Information Data Rate of the preceeding **WCDMA CALL SETUP**. And cannot be changed during an established call.

NUMBER OF TRANSPORT BLOCKS – Number of blocks that are taken into account for BLER measurement. A higher number results in better averaging. Range 1…50000.

CABLE LOSS DL – Cable loss of the **D**own**L**ink channel. It is calculated as CABLE LOSS DL = Pnom - Pmeas = -10,0 Bm + 11,0 dBm = 1,0 dBm

CABLE LOSS UL – Cable loss of the **U**p**L**ink channel. It is equal to **CABLE LOSS DL** in case the same cable for DL and UL is used.

6 Additional Information

Please contact TM-Applications@rsd.rohde-schwarz.com for comments and further suggestions.

7 Ordering information

Communication Tester		
CMU 200		1100.0008.02
CMU-B17	IQ-IF Interface	1100.6906.02
CMU-U65	Measurement DSP for WCDMA / CDMA200 - upgrade kit	1100.7402.02
CMU-B68	Layer-1 Board (3GPP/FDD,DL+UL)	1149.9809.02
CMU-B56	3GPP Signalling Unit	1150.1850.14
CMU-B21	Univ.Signalling Unit (3GPP Hardw.)	1100.5200.14
CMU-PK60	Softw.Package–3GPP/FDD/UE,TX-Test Gen. Band 1+2+3+4+5+6	1159.3355.02
CMU-Z10	Antenna Coupler	1150.0801.02
CMU-Z11	Shielded Chamber for Mobile Stations	1150.1008.02
Vector Signal Generator		
SMU200A	(300 kHz to 2.2 GHz)	1125.5555.02
SMU-B14	Fading simulator 6 path, mandatory	1085.4002.02
SMU-B15	2nd Fading simulator, mandatory	1085.4402.02
SMU-B17	Baseband Inputs	1142.2880.02
SMU-K62	AWGN	1159.8511.02
Power Meter		
NRP	Power Meter	1143.8500.02
NRP-Z11	Power Sensor	1138.3004.02
NRP-Z21	Power Sensor	1137.6000.02
NRP-Z22	Power Sensor	1137.7506.02
NRP-Z23	Power Sensor	1137.8002.02
NRP-Z24	Power Sensor	1137.8502.02
Signal Analyzer		
FSQ3	(20 Hz to 3.6 GHz)	1155.5001.03

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