

Rohde & Schwarz products: Universal Radio Communication Tester R&S®CMU200, Signal Analyzer R&S®FSQ, Spectrum Analyzers R&S®FSU, R&S®FSP and R&S®FSL, Signal Generators R&S®SMU200A, R&S®AMU200A, R&S®SMJ100A, R&S®SML and R&S®SMR

## Tests on CDMA2000® 1xEV-DO Access Terminals in Accordance to IS-866-A

Tests with combined instruments

### Application Note 1MA123

The Universal Radio Communication Tester R&S®CMU200 can perform most of the CDMA2000® 1xEV-DO access terminal (AT) tests specified in the standard IS-866-A on its own. Some tests require additional instruments. This application note shows how to perform these tests easily with the remote-control software CMUgo, using the R&S®CMU200 in combination with R&S®SMU, R&S®AMU, R&S®SMJ or R&S®SML signal generators, and R&S®FSQ, R&S®FSU, R&S®FSP, R&S®FSL or R&S®FSMR spectrum analyzers.



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The following abbreviations are used in this application note for Rohde & Schwarz test equipment:

- The Universal Radio Communication Tester R&S®CMU200 is referred to as the CMU.
- The Vector Signal Generator R&S®SMU200A is referred to as the SMU.
- The Baseband Signal Generator R&S®AMU200A is referred to as the AMU.
- The Vector Signal Generator R&S®SMJ100A is referred to as the SMJ.
- The Signal Generator R&S®SML is referred to as the SML.
- The Signal Generator R&S®SMR is referred to as the SMR.
- The Signal Generator R&S®FSL is referred to as the FSL.
- The Spectrum Analyzer R&S®FSP is referred to as the FSP.
- The Spectrum Analyzer R&S®FSU is referred to as the FSU.
- The Signal Analyzer R&S®FSQ is referred to as the FSQ.
- The Signal Analyzer R&S®FSMR is referred to as the FSMR.

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## **1 Overview**

Most of the tests specified in the standard IS-866-A that a CDMA2000® 1xEV-DO access terminal (AT) has to fulfill can be performed by the Universal Radio Communication Tester R&S®CMU200 without further assistance. Other tests, however, require additional instruments, for instance for generating interfering signals. Some tests of the standard IS-866-A need features that a tester optimized for production cannot offer, for example high dynamic spectrum analysis up to 12.75 GHz. This Application Note shows how to perform these tests easily with the remote-control software CMUgo, using the R&S®CMU200 in combination with Vector Signal Generators R&S®SMU, R&S®SMJ or Signal Generator R&S®SML, Baseband Signal Generator R&S®AMU200A and Spectrum Analyzers R&S®FSQ, R&S®FSU, R&S®FSP, R&S®FSL or R&S®FSMR. New test items and sequences have therefore been added in the CMUgo software to control the R&S®CMU200 as well as the signal generators and spectrum analyzers remotely. These predefined settings are an integral part of CMUgo from version 1.9.8 on. This expands the list of the CDMA2000® 1xEV-DO AT measurements already implemented in the R&S®CMU200 firmware by the following tests (the leading number is the corresponding section number of the test in the standard IS-866-A):

### **3 Physical Layer Receiver Minimum Standards**

#### **3.2 Demodulation Requirements**

##### **3.2.2 Demodulation of Forward Traffic Channel in Multipath Fading Channel**

#### **Receiver tests under static conditions:**

##### **3.3 Receiver Performance**

###### **3.3.2 Single-Tone Desensitization**

###### **3.3.3 Intermodulation Spurious Response Attenuation**

###### **3.3.4 Adjacent Channel Selectivity**

###### **3.3.5 Receiver Blocking Characteristics**

##### **3.4.1 Conducted Spurious Emissions**

#### **Transmitter tests:**

##### **4.4 Limitations on Emissions**

###### **4.4.1 Conducted Spurious Emissions**

###### **4.4.3 Occupied Bandwidth**

For each of the tests mentioned above, this application note gives you a short overview of the test itself, a recommended hardware setup, predefined test sequences, and step-by-step instructions on how to perform this test using the CMUgo software. Measurement results obtained with these predefined sequences complete the presentation of each test.

## **2 CMUgo: Operating Principles**

CMUgo is a software tool for running remote-control tests using the CMU200 and additional instruments. CMUgo provides a large number of essential test items of a measurement, such as **1xEV-DO SINGLE-TONE DESENSITIZATION**, **1xEV-DO ADJACENT CHANNEL SELECTIVITY**, **1xEV-DO BLOCKING TEST**, **1xEV-DO RX SPURIOUS EMISSIONS**, **1xEV-DO TX SPURIOUS EMISSIONS** and **1xEV-DO OCCUPIED BANDWIDTH**. To set up a complete test, you need – in addition – some more general test items: **BASIC INITIALIZING**, **1xEV-DO CALL SETUP**, **1xEV-DO CALL RELEASE**, and **TEST END** (to display a summary result). Use these test items as building blocks to create your own test sequences. For the seven tests mentioned above, there are predefined test sequences included in CMUgo from version 1.98. The examples refer to band class 0 (BC 0), but can be easily switched to other band classes as well.

With this support, your operating procedure will always be as follows:

- Load a predefined test sequence.
- Adapt the parameters to your application and enter the path losses of your test setup (see section below).
- Save your test sequence for later use.
- Run the test.

All predefined sequences include in their name the section number of the test in the standard IS-866-A. For example, load sequence **1xEV-DO\_3.2.2.SEQ** for the **DEMODULATION OF FORWARD TRAFFIC CHANNEL IN MULTIPATH FADING CHANNEL** test described in section 3.2.2 of IS-866-A. It is presumed that you are already familiar with the CMU200 and CMUgo. Otherwise first read the manual **CMUGO.PDF**, which is extracted to a custom folder during installation. It describes the menus, the entries and the controls, and provides examples. We encourage you to learn as you go.

- Familiarize yourself with the CMUgo software.

**Note:** Read section **3.2.2 DEMODULATION OF FORWARD TRAFFIC CHANNEL IN MULTIPATH FADING CHANNEL** first, since details on the complete measurement are given there and not repeated in the description of the other tests.

## **System Requirements**

To ensure proper operation of CMUgo, your computer shall fulfill the following minimum requirements:

Platform: Windows XP / Vista

Processor: Pentium V

RAM: 256 MBytes

Display: SVGA 800x600 pixels

Hard-disk storage: 50 Mbytes

Peripherals: Mouse

National Instruments GPIB controller

CMU200 firmware version  $\geq 4.5.2$ .

## **Installation of CMUgo**

Application Note 1MA123 consists of two parts:

- The CMUgo software (file CMUgo.zip)
- This document (1MA123\_xe.pdf)

Download it from <http://www.rohde-schwarz.com/appnote/1MA123>

Unzip **CMUgo.zip**, run **SETUP.EXE** and follow the instructions in the installer dialog.

## **Configuring the GPIB settings**

CMUgo is used here as a tool to remote-control the CMU200 and other instruments via the GPIB bus. All devices should be set to different IEEE addresses, and have to be connected via the GPIB bus to your controller where CMUgo is running.

(To keep the setup figures simple, GPIB interfacing has been omitted in those figures on the following pages.)

- Run CMUgo.
- Click **CONFIGURATION**

The port for remote control of the CMU200 can be configured at **REMOTE PORT**. In addition, CMUgo can control up to ten additional **AUXILIARY GPIB PORTS**:

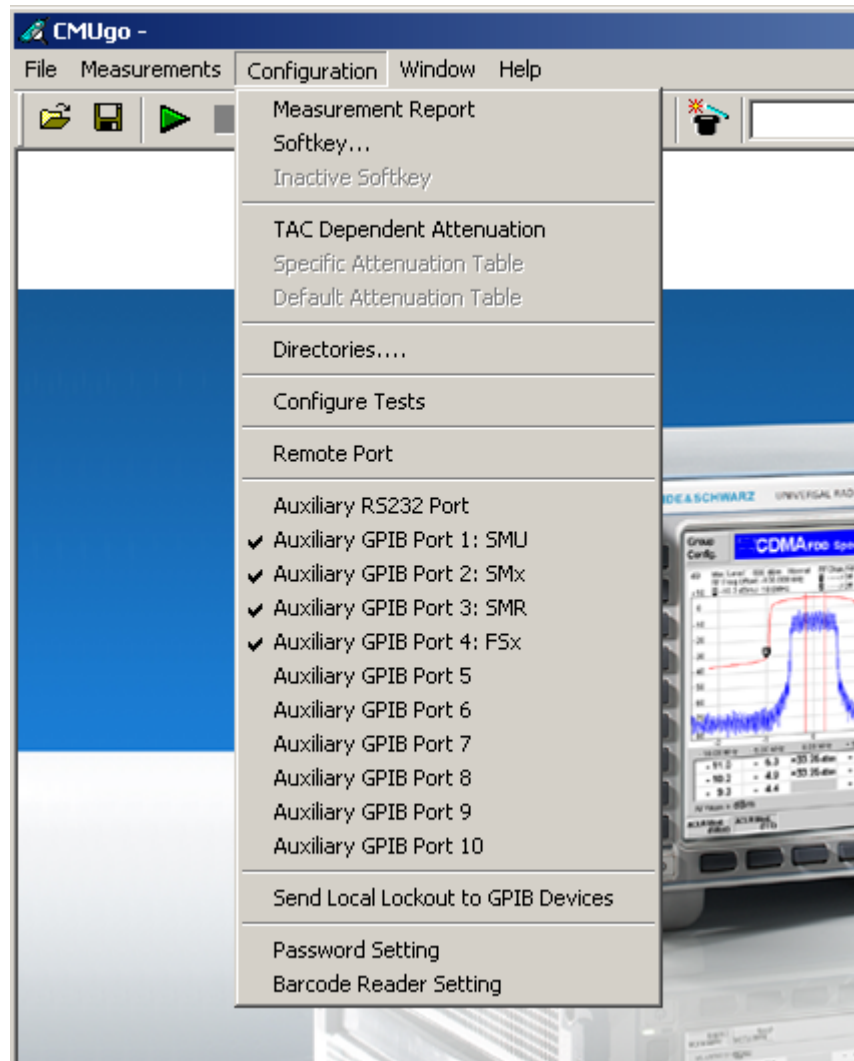
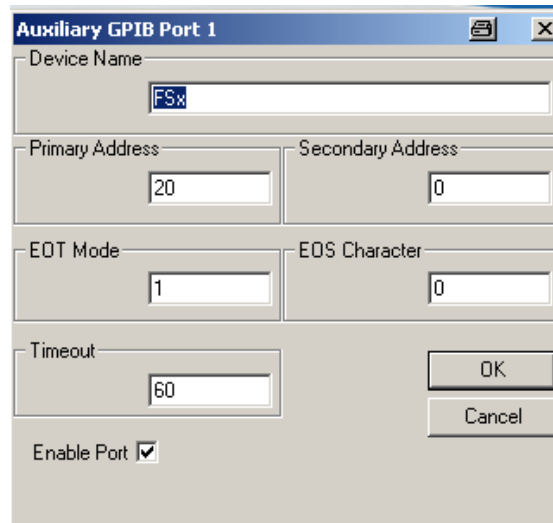


Fig. 2\_1 GPIB Configuration for up to ten additional instruments

- Double-click one of the auxiliary GPIB ports to make a device known to CMUgo.

The configuration window for this port opens (see Fig. 2\_2).

- Enter a device name you wish to use.  
Always use the same device names and spellings that you use later in the test items. We recommend '**FSx**' for any analyzer (FSQ, FSU, FSP, FSL or FSMR), '**SMx**' for any CW generator (SMU, SMJ, SMR or SML), '**SMR**' for SMR, and '**SMU**' for SMU exclusively.
- Enter the GPIB address.
- Enable port (do not omit this step!).
- Repeat this procedure for the other devices.



Auxiliary GPIB Port 1

Device Name: FSx

Primary Address: 20

Secondary Address: 0

EOT Mode: 1

EOS Character: 0

Timeout: 60

OK

Cancel

Enable Port ☒

Fig. 2\_2 Configuration of Auxiliary GPIB Port, Enable Port checkbox

## Measuring the Path Losses

For each test you will find a recommended hardware setup in this application note. Even if you work with the same components, your setup will have its own characteristic that depends, for example, on the lengths and types of your cables.

Before running any test, measure the actual path losses of your hardware setup. Use the same frequencies that are used later in the test. Enter the measured values as **INPUT** or **OUTPUT ATTENUATION** when you edit a test sequence. The losses will thus automatically be compensated by the software.

We recommend the Rohde & Schwarz application program FreRes as a helpful tool for measuring frequency response. FreRes is part of Application Note 1MA09, which you can download free of charge at

<http://www.rohde-schwarz.com/appnote/1MA09>

**Note:** For measurements below 10 MHz, set the analyzer to input DC.



## **3 Receiver Tests**

The tests in this chapter are performance related and simulate real world influences such as moving access terminals (AT) with multipath fading models or disturbances by neighboring access networks (AN) by adding AWGN (Additive White Gaussian Noise). The following section numbers correspond to the numbers used in IS-866-A

### **3.2 Demodulation Requirements**

The receiver tests in multipath fading channel show how well the mobile station demodulates a CDMA2000® 1xEV-DO traffic channel under realistic propagation conditions. Unlike other tests using static signals, the RF input at the mobile antenna changes over time as if the access terminal were moving and received the forward signal simultaneously via different reflections.

Fig. 3.2\_1 shows a car with a mobile radio installed, driving in a typical urban situation. You see some (of many) routes a Node B transmitter signal takes at this point to reach the antenna on the car. Since the car is moving, the routes may be completely different an instant later.

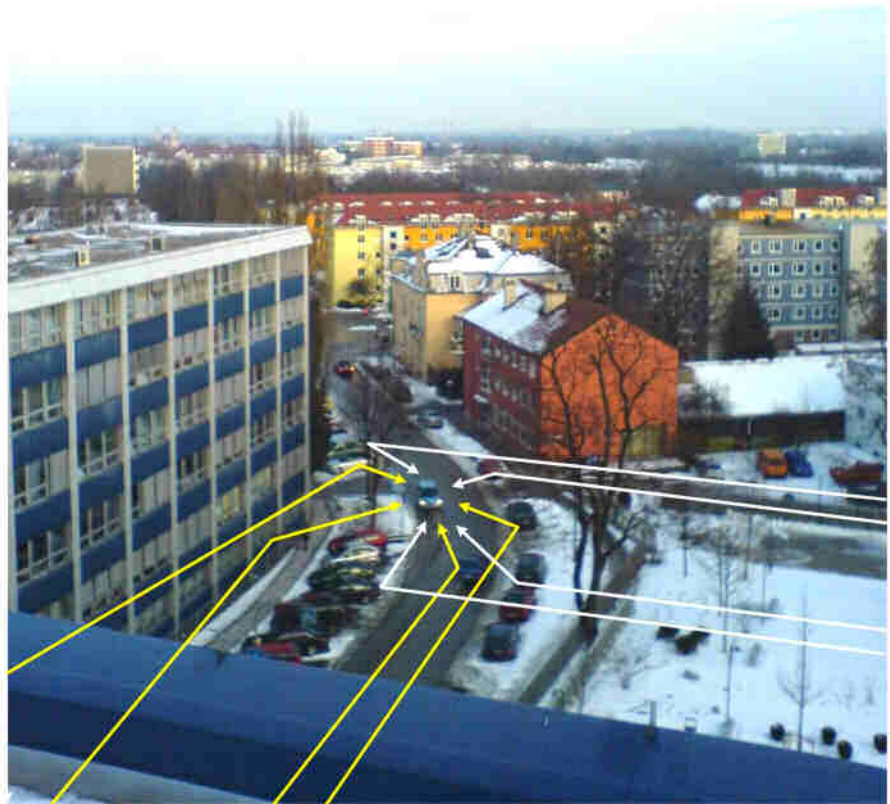


Fig. 3.2\_1 Typical multipath condition in the city for a mobile radio installed in a car.



Reflected signals differ in attenuation and length (delay). We will call a set of routes with nearly the same delay one "path". The yellow lines in Fig. 3 belong to one path, the white lines to another. If there is no direct line of sight between Node B and the mobile station, the sum of the reflected signals of one path represents a "Rayleigh" fading profile. Each mobile standard defines its own characteristic fading profiles. During a test, the stipulated profile is calculated inside a channel simulator in realtime. Measurements can thus be repeated at any time, providing the same results. The standard IS-866-A stipulates the following five CDMA2000® 1xEV-DO fading profiles (channel simulator configurations):

**Table 8.4.1.1-1. Standard Channel Simulator Configurations**

Parameters		Channel Simulator Configuration				
		1	2	3	4	5
Vehicle Speed [km/h]	Band Classes 0, 2, 3, 7, 9, 10, and 12	8	3	30	100	0
	Band Classes 1, 4, 6, and 8	8	3	30	100	0
	Band Class 5 and 11	15	6	58	192	0
Number of Paths		2	1	1	3	2
Path 2 Power (Relative to Path 1) [dB]		0	N/A	N/A	0	0
Path 3 Power (Relative to Path 1) [dB]		N/A	N/A	N/A	-3	N/A
Delay from Path 1 to Input [μs]		0	0	0	0	0
Delay from Path 2 to Input [μs]		2	N/A	N/A	2	2
Delay from Path 3 to Input [μs]		N/A	N/A	N/A	14.5	N/A

Measure the performance of the mobile station in multipath fading in the same way as in non-fading receiver tests. Apply a forward signal with pre-defined channel configuration and RF level, and check the Frame Error Rate (FER) or the Bit Error Rate (BER) for each frame category (data rate) supported by the mobile station.

### 3.2.2 Demodulation of Forward Traffic Channel in Multipath Fading Channel

The section 3.2.2 of standard IS-866-A is about "demodulation of the forward traffic channel in multipath fading" conditions. Since all of these tests use the same hardware configuration and only differ in their parameters, they are discussed together in this section. Fig. 4 shows the functional hardware setup for the fading tests as outlined in the standard, using an RF fading channel simulator.

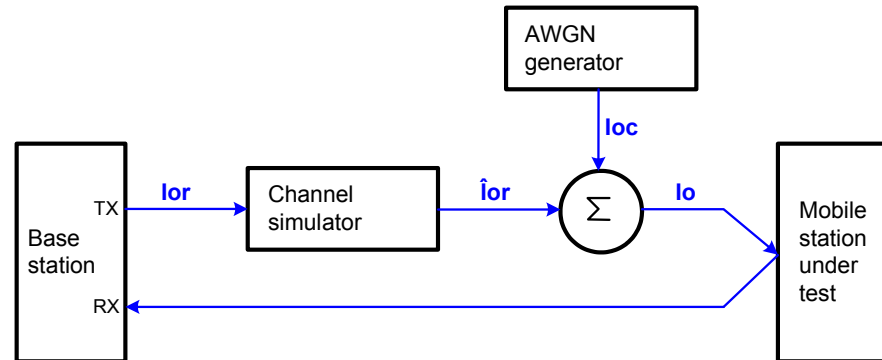


Fig. 3.2.2\_1 Setup for fading tests in the standard IS-866-A.

The RF channel simulator transforms the static level TX signal  $I_{or}$  into the fading signal  $\hat{I}_{or}$ . An AWGN generator adds white noise  $I_{oc}$  to simulate other non-1xEV-DO channels.  $I_o$  is the signal summary at the antenna of the mobile station under test. In this application note, the fading profiles and AWGN are generated in the baseband.

### Recommended test setup:

Fig. 5 shows the hardware setup for CDMA2000® 1xEV-DO fading tests with an SMU. The CMU200 generates the CDMA2000® 1xEV-DO forward channel in the baseband and provides it at the IQ outputs of the option CMU-B17. This signal is fed to the baseband inputs of the SMU generator. Inside the SMU, fading profiles are applied and AWGN is added. Then the signal is returned from the SMU baseband outputs to the IQ inputs of the option CMU-B17, and up-converted into the RF band. For connecting the instruments, the option CMU-B17 includes a dedicated cable with a DSUB connector to the CMU200 and BNC connectors to the SMU. The CMUgo software also supports RX Diversity. If you are not sure if the AT has a 50Ω terminated RX diversity input, use a 20 dB attenuator to avoid damage of the SMU output by reflected power.

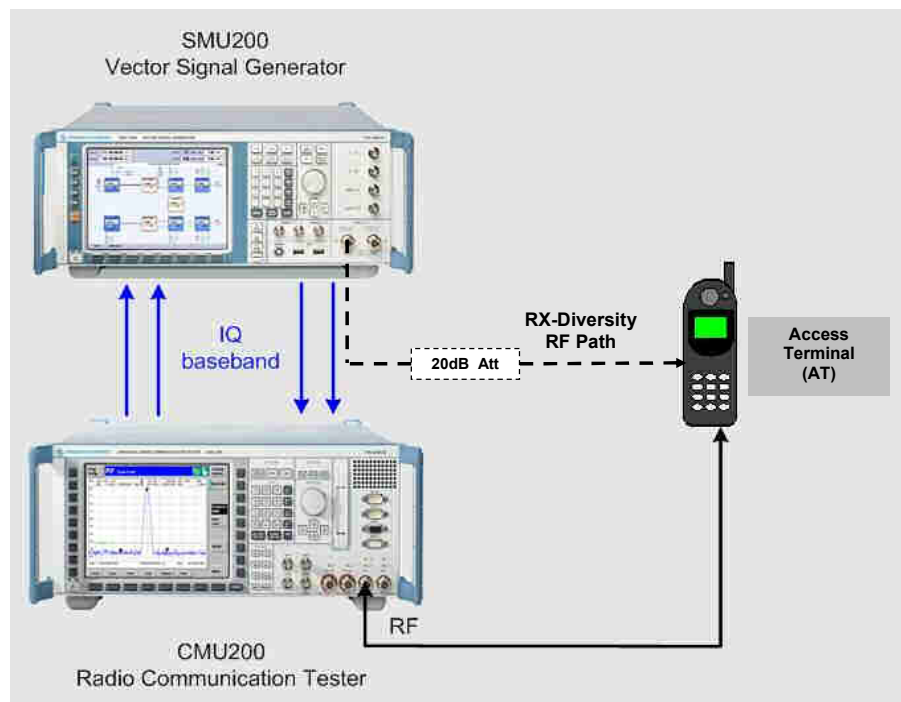


Fig. 3.2.2\_2 Hardware setup for 1xEV-DO® fading tests.

### Instruments and accessories:

- CMU200 including CMU-B17 I/Q-IF interface
- SMU incl. options
  - SMU-B13 Baseband main module
  - SMU-B14, B15 Fading Simulator
  - SMU-B17 Baseband Input
  - SMU-K62 AWGN

### Path loss compensation:

Measure the RF cable loss between the access terminal (AT) and the CMU200 and the AT and SMU. Then proceed as described in the following section **Configure test item 1xEV-DO FADING**.

## Fading path:

Fig. 3.2.2\_3 illustrates the signal processing in the baseband, displayed on the SMU generator screen. Inside the SMU, only the blue blocks are active. The IQ input signals are fed into the baseband block Fading A and B, where the requested profiles are generated. Afterwards they are sent to the AWGN / Impairment block, which adds the white noise.

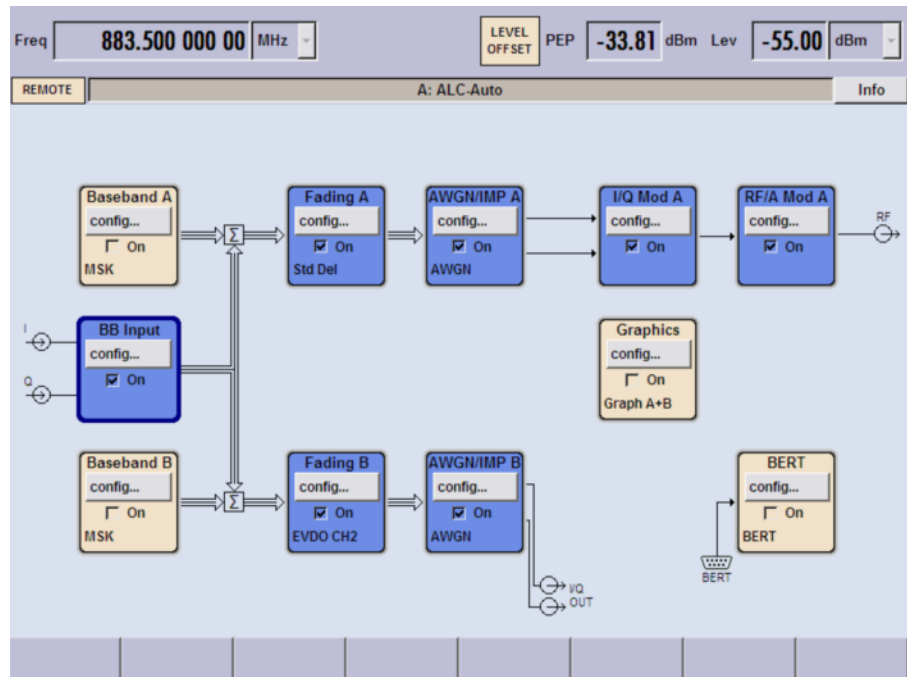


Fig. 3.2.2\_3 Functional signal processing inside the SMU.

In the baseband path, the levels vary several times; see Fig. 3.2.2\_4:

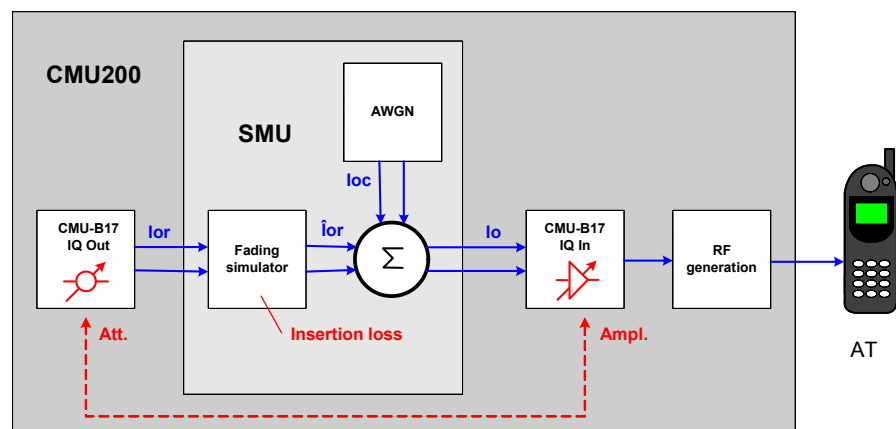


Fig. 3.2.2\_4 Level variation in the fading path.

Due to the high crest factor of CDMA2000® 1xEV-DO signals, the average level at the CMU baseband outputs is already reduced in the CMU-B17 before reaching the SMU inputs. If the checkbox **SMU BASEBAND INPUT CALIBRATION** in the multipath test item is enabled (see Fig. 3.2.2\_3), the SMU measures the level at its IQ inputs. The attenuation **ATT.** in Fig. 3.2.2\_4 is the difference between full scale and the measured level. To

avoid clipping, the fading simulator further reduces the baseband level. This attenuation is called **INSERTION LOSS** in Fig. 3.2.2\_4.

- The SMU knows both attenuations, and adjusts the actual internal AWGN level automatically to maintain the required ratio  $\hat{I}_{or} / I_{oc}$ .

Whereas the level attenuation **ATT** in the CMU-B17 output block is compensated by an amplifier inside the CMU-B17 input block, the **INSERTION LOSS** in Fig. 3.2.2\_4 is not yet taken into account. If no measures are taken, the RF output of the CMU200 would be too low. The test item **1xEVDO FADING** copes with this by simulating a higher output attenuation for the CMU200. The **INSERTION LOSS** is added to the **RF CABLE LOSS**, and the CMU raises its level accordingly.

### Generic Test Item, Subtests, Sequences

The tests for section 3.2.2 of the IS-866-A standard all use the same hardware setup and one common generic test item **1xEVDO FADING**. To set up the channel configuration use the test item **1xEVDO CALL SETUP**. Furthermore, the tests differ in their power control configuration; set this up in the test item **1xEVDO FADING**. Perform the measurements for each band class the mobile station supports. Each of the four sections contains a number of subtests (single measurements) with a specific combination of parameters for the level ratios, the data rates, and the fading simulator configurations. For each subtest, a parameter set is preprogrammed in the test item **1xEVDO FADING**. In addition, CMUgo provides a predefined test sequence for 3.2.2. From the CMUgo user's point of view, the multipath tests are handled in the same way as tests with static RF level:

- Load a predefined test sequence.
- Adapt the parameters to your application and enter the path losses of your test setup (see section below).
- Save your test sequence for later use.
- Run the test.

For tests of section 3.2.2 use the following sequence:

**1xEVDO 3.2.2.SEQ** runs the tests 2, 5, 7 and 8 of section 3.2.2. Use this sequence as an example, and modify the parameters as required by your application.

## Test Procedure

- 1) Connect instruments and mobile station as shown in Fig. 3.2.2\_2.
- 2) Run CMUgo, and then click **CONFIGURATION** → **CONFIGURE TESTS**.

The **CONFIGURE TEST** window opens.

- 3) Click **LOAD SEQUENCE**, and select **1xEVDO 3.2.2 T1-T3 C1.SEQ**.

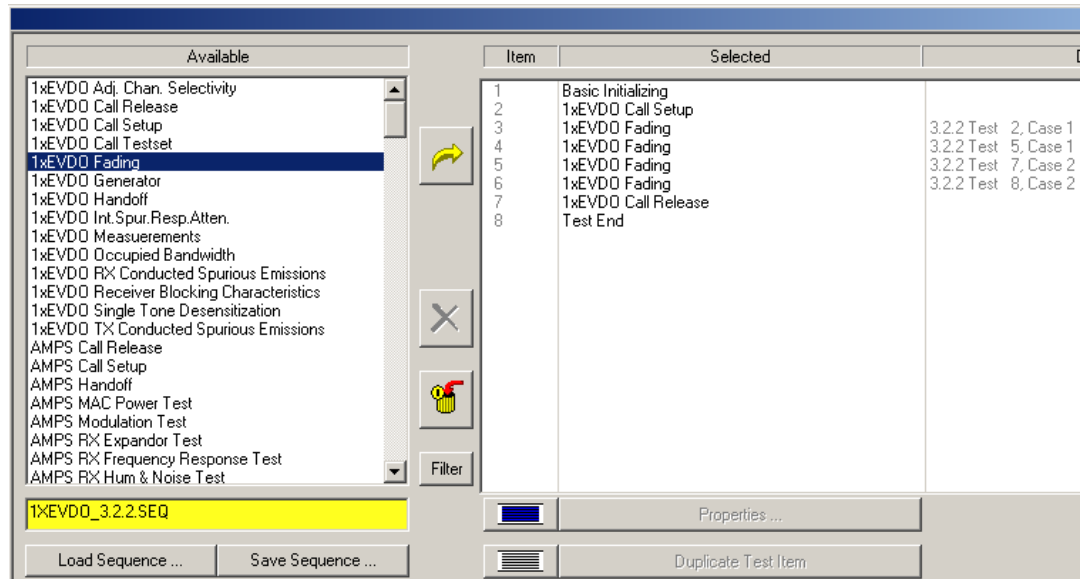


Fig. 3.2.2\_5 Available and selected test items (test sequence) for the demodulation of forward traffic channel in multipath fading channel test

## Configure test item BASIC INITIALIZING:

- 1) Double-click the test item **BASIC INITIALIZING**. The configuration window opens (see Fig. 3.2.2\_6). It shows which function groups could be available inside the CMU200.
- 2) Always enable the function groups **RF** and **1xEVDO**.

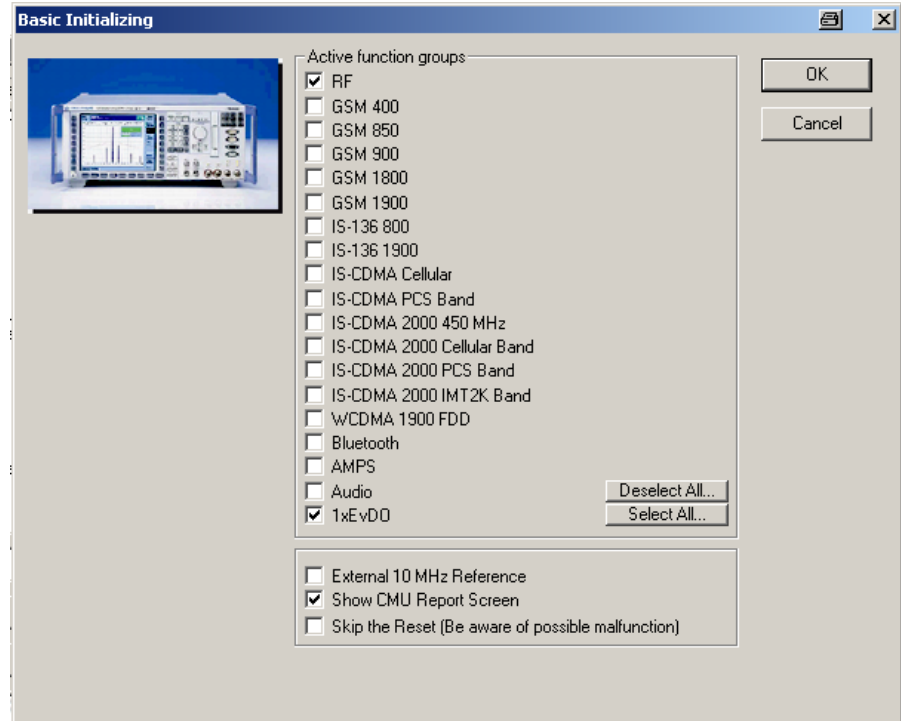


Fig. 3.2.2\_6: Available function groups inside CMU200

Table 3.2.2\_1 shows which CMU200 option is necessary for each band class:

BC0, BC2, BC3, BC7, BC9, BC10	1xEV-DO Cellular Band	CMU-K849 option
BC1, BC4, BC8	1xEV-DO PCS Band	CMU-K859 option
BC5	1xEV-DO 450 MHz	CMU-K839 option
BC6	1xEV-DO IMT2K Band	CMU-K869 option

Table 3.2.2\_1: Band classes and CMU function groups.

- 3) Select the correct function group for your application.

**Note:** If you enable **SHOW CMU REPORT SCREEN**, the CMU monitors all GPIB commands from and to your remote controller. Otherwise the CMU screen will be blank.

- 4) Click **OK**.



### Configure test item 1xEV-DO CALL SETUP:

- 5) After double-clicking **1xEVDO CALL SETUP** in the list of the selected test items the window **1xEVDO CALL SETUP CONFIGURATION** opens.

Fig. 3.2.2\_7 Call setup configuration for *demodulation of forward traffic channel in multipath fading channel* tests.

- 6) Select the **NETWORK** corresponding to the band class (BC) of your mobile station.
- 7) Select the according physical layer **SUBTYPE 0** or **SUBTYPE 2**.
- 8) Enter a channel number for the call setup at **PHYSICAL RF CHANNEL**.
- 9) Enter the path loss you measured between the AT and the CMU200 as **ATTENUATION IN** and **ATTENUATION OUT**.

You may modify the other parameters if necessary.

- 10) After clicking OK you return to the **CONFIGURE TEST** window (Fig. 3.2.2\_5):

### Configure test item 1xEVDO FADING:

- 1) Double-click **1xEVDO FADING** in the list of the selected test items. The **1xEV-DO FADING** window appears (see Fig. 3.2.2\_8).

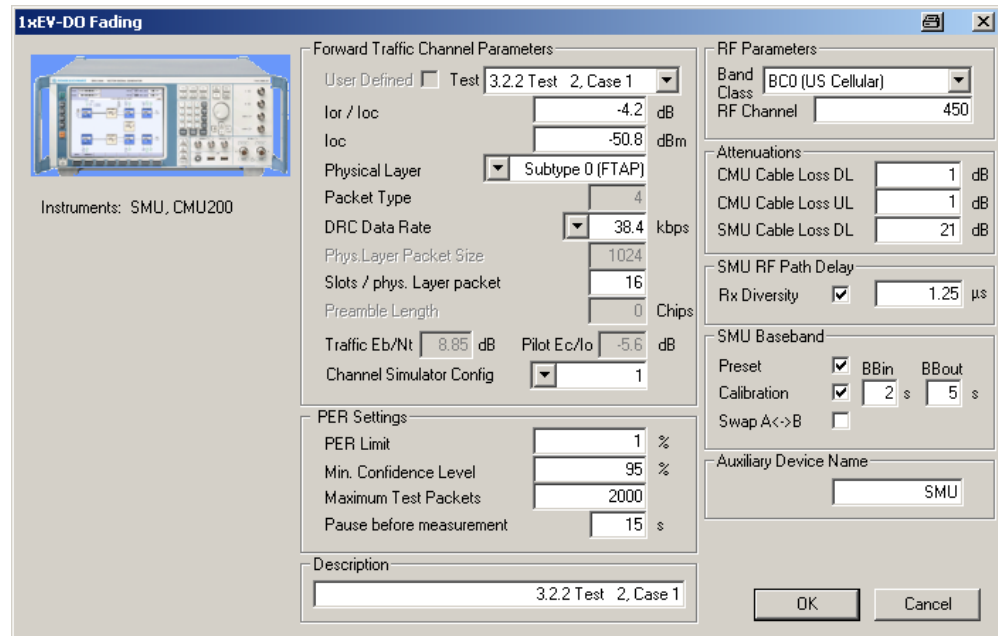


Fig. 3.2.2\_8 The generic 1xEV-DO Fading window for demodulation in multipath fading.

- 2) Select your **BAND CLASS** (NETWORK).
- 3) Select a **TEST**.

Once the bandclass and a test are selected most of the parameter entries in the window above are preset with predefined values from standard IS-866-A such as the signal parameters  $I_{or}/I_{oc}$ , **DATA RATE**, **CHANNEL SIMULATOR CONFIGURATION**, and the **PER LIMIT** (Packet Error Rate). If you modify one or more of these parameters, **USER DEFINED** will be checked.

## Listed below are some remaining parameters:

- 4) Enter the **MIN.CONFIDENCE LEVEL** and the **MAXIMUM TEST PACKETS**.
- 5) Optionally enter Pause before measurement (time span between configuration and measurement). Default 0 seconds.
- 6) Enter the **RF CHANNEL**.
- 7) Enter the path loss you measured between the AT and the CMU200 as **CABLE LOSS DL** and **UL**.
- 8) Enter the path loss you measured between the AT and the SMU200 as **SMU CABLE LOSS DL**.
- 9) Enable **RX DIVERSITY** if desired. The **SMU PATH DELAY** is set to 1.25 μs by default and compensates the delay between the CMU and SMU RF output.
- 10) Enable the **SMU BASEBAND INPUT CALIBRATION** checkbox in the item **1xEV-DO FADING** which follows immediately after **1xEV-DO CALL SETUP** in your test sequence. The SMU will then measure the incoming baseband signal and adjust the AWGN correctly. This calibration must be performed each time when **IOR / IOC** or the **CHANNEL SIMULATOR CONFIG** is changed. The SMU may optionally perform a **PRESET**.
- 11) Optionally add a comment in the **DESCRIPTION** field.

12) After clicking **OK** you return to the **CONFIGURE TEST** window (Fig. 3.2.2\_5).

13) Configure another item and create your own sequence, if necessary.

You may want to store your sequence. Use the **SAVE SEQUENCE** button in the **CONFIGURE TEST** window (see Fig. 3.2.2\_5).

14) Click **OK** in the **CONFIGURE TEST** window to complete the measurement setup.

### To start the measurement:

Click the start icon in the menu bar of CMUgo:

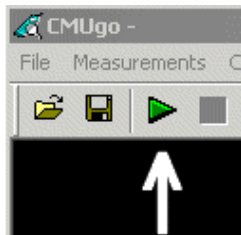


Fig. 3.2.2\_9 Start icon in the menu bar of CMUgo

### To stop a running measurement:

➤ Click the stop icon in the menu bar of CMUgo:

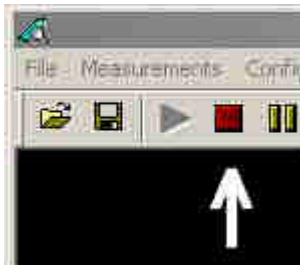


Fig. 3.2.2\_10 Stop icon in the menu bar of CMUgo

### Test description and measurement report:

When the basic initialization is completed, a pop-up menu instructs you to **SWITCH ON THE MOBILE**. Ignore this message if it is already powered up. After the individual response time of the mobile station, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established. The sequence **1xEVDO\_3.2.2\_T2-T8.SEQ** sets up the channel simulator configuration 3. This simulates one path, and a velocity of 30 km/h. The CMU200 starts the frame error measurement. The minimum measurement time for the requested confidence level of 95 % for Case 1 tests is 30 seconds according to the standard IS-866-A. The resulting minimum number of frames is 9000. For a first orientation, fewer frames could be taken. (In the test sequences, the number of frames is set to 2000). Once the test has been completed, you get a display similar to Fig. 3.2.2\_11.

```

Operator:          meunier
Date:              München, 1. April 2009 17:44:57
Cell Inlet:        Rohde&Schwarz, CMU 200-1100.000A.02, 102852, V5.03
Options:           0, A17, A21Var14, B52Var14, B53Var14, B54Var14, B56Var14, B66, C03210C, F411, B83, B85, B89, B95, 14CMCM,
                  W00C0400, I09, K14, K20, K21, K22, K23, K42, K43, K45, K47, K53, K54, K56, K60, K61, K62, K63, K64, K65, K66, K67,
                  K68, K69, K83, K84, K85, K86, K88, K96, K839, K849, K859, K869, J7M45, Intel Celeron, 256 MB
                  rx6c1
Sequences:         1X6W00, J12.2, J2-J3
SimulReult:

```

Test Name and Condition	Lower Limit	Upper Limit	Measured Value	Pass
<i>Network: US Cellular, RF Channel Level: -50/-70.0 dBm, Forward Packet Activity 100 %</i>				
<i>Connector: R12, Attenuation (In/Out): 1.0/1.0 dB</i>				
<i>Forward DUT: Enabled, DRG Rate Index: 1, Loopback: Enabled</i>				
<i>Reverse DUT: Disabled, Min Rate Index: 1, Max Rate Index: 1</i>				
<i>Data (dB): Offset Norm: 0.00, 9.6 kbps: 0.00, 19.2 kbps: 0.00, 38.4 kbps: 0.00, 76.8 kbps: 0.00, 153.6 kbps: 0.00</i>				
<i>MS Identification (SSN): "082-AA42"</i>				
1s87000 Call to Mobile:			100000000	Pass
<i>Ins.Loss: -19.65dB InLine: -4.20dB In: -50.80dBm Pack. Type ktx: 4 Data Rate: 38.4kbps Slots: 16</i>				
<i>Chan.Sim.Conf: AV001G1H Trans.Frames: 2247</i>		1.00 %	0.36 %	Pass
1s87000 Finding 3.2.2 Test 2, Case 1	95.00 %		99.99 %	Pass
<i>Ins.Loss: -18.13dB InLine: -0.90dB In: -54.90dBm Pack. Type ktx: 8 Data Rate: 19.2kbps Slots: 8</i>				
<i>Chan.Sim.Conf: AV001G1H Trans.Frames: 2259</i>		1.00 %	0.00 %	Pass
1s87000 Finding 3.2.2 Test 5, Case 1	95.00 %		100.00 %	Pass
<i>Ins.Loss: -17.30dB InLine: -0.90dB In: -55.90dBm Pack. Type ktx: 4 Data Rate: 38.4kbps Slots: 16</i>				
<i>Chan.Sim.Conf: AV001G1H Trans.Frames: 2173</i>		1.00 %	0.05 %	Pass
1s87000 Finding 3.2.2 Test 7, Case 2	95.00 %		100.00 %	Pass
<i>Ins.Loss: -16.90dB InLine: -2.30dB In: -57.30dBm Pack. Type ktx: 4 Data Rate: 38.4kbps Slots: 16</i>				
<i>Chan.Sim.Conf: AV001G1H Trans.Frames: 2331</i>		1.00 %	0.17 %	Pass
1s87000 Finding 3.2.2 Test 8, Case 2	95.00 %		100.00 %	Pass
1s87000 Call Release: Test:			100000000	Pass

WIS Special Number: "00269/92"

**Result:** *6 Tests passed / 0 Tests failed*  
(Execution Time: 199.7 Seconds)

Fig. 3.2.2\_11 Result for demodulation of forward traffic channel in multipath fading channel test.

Measurement values that are inside the limits are displayed in green; those outside the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. You see the number of frames, and the actual confidence level that was reached for this measurement.

**Note:** A test result which seems to be inside the limits (e.g. BER = 0%) could be displayed in red colour as failed, if the confidence level specified in the test item could not be reached. This could happen if the number of frames you entered was too low.

If your sequence contains more than one test item, each one provides a single test result. The total number of passed and failed tests are counted inside CMUgo and presented by the item **TEST END**. To repeat a test sequence, click the start button again (Fig. 3.2.2\_9). If your mobile station supports more than one band class, change the configurations accordingly and start the test sequence again.

## **3.3 Receiver Performance**

### **3.3.2 Single Tone Desensitization**

The single-tone desensitization is a measure of a receiver's ability to receive a 1xEV-DO signal at its assigned frequency in the presence of a single tone spaced at given frequency offsets from the center frequency of the assigned 1xEV-DO channel. A receiver's single-tone desensitization performance is measured by the packet error rate (PER). The purpose of test 3.3.2 is to verify that the PER of the mobile station does not exceed 1 % with 95 % confidence level under these conditions. This test shall be performed for each band class (BC) the mobile station supports, except band class 6.

#### **Recommended test setup:**

Fig. 3.3.2\_1 shows the test setup for single-tone desensitization tests. The RF ports of CMU200 Radio Communication Tester and the mobile station under test are connected by means of a 6 dB resistive combiner. During the test, a call is set up to the access terminal (AT) and a connection is established by CMU using this path. In addition, a signal generator is coupled in to provide the single-tone interferer. The resistive combiner ensures a flat frequency response. The 10 dB attenuator in the generator path decouples the instrument and reduces the 1xEV-DO signals at the generator input to a harmless level. Both CMU and signal generator are remote-controlled by CMUgo to run the test automatically.

#### **Instruments and accessories:**

- CMU200, SMU or SMJ or SML
- Resistive combiner, frequency response depending on the band class (recommended: Weinschel 1515-1, DC to 12.75 GHz)

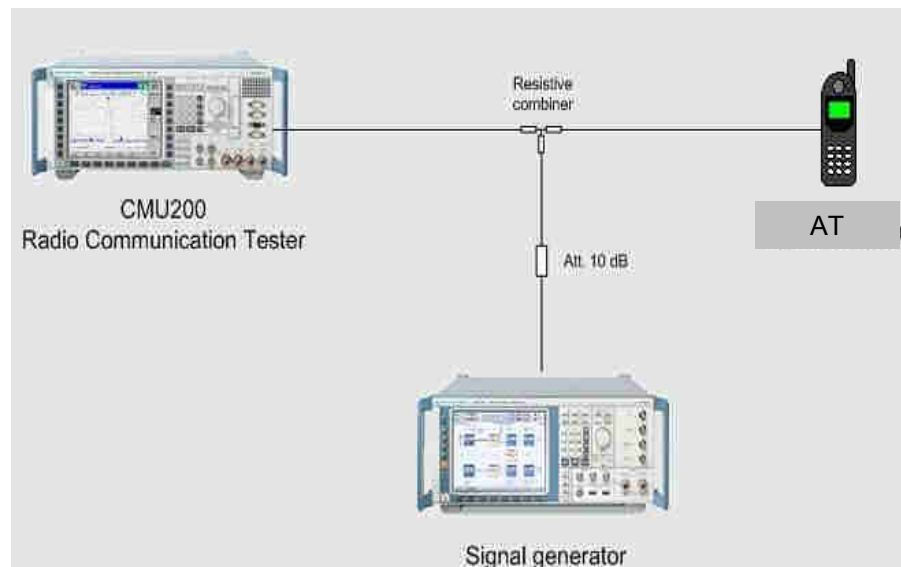


Fig. 3.3.2\_1 Test setup for single tone desensitization test

### Path loss compensation:

Measure the RF cable loss between the AT and CMU200 and between the signal generator and AT. Then proceed as described in chapter **CONFIGURE TEST ITEMS → 1xEVDO SINGLE TONE DESENSITIZATION**.

### Test procedure:

Click **LOAD SEQUENCE**, and select **1xEVDO 3.3.2 T1-T4.SEQ**. The **CONFIGURE TEST** window looks like Fig. 3.3.2\_2: The left-hand column contains all available test items, and the right column shows which test items have been selected to build the sequence for test 3.3.2. In general every CMUgo test sequence starts with a **BASIC INITIALIZING** of the CMU. It always ends with the item **TEST END**, which provides a summary result. Each 1xEV-DO AT test needs a call connection, which is established by the test item **1xEV-DO CALL SETUP** and released by item **1xEV-DO CALL RELEASE**. The essential items for test 3.3.2 are therefore the test items between **CALL SETUP** and **CALL RELEASE**. With sequence **1xEV-DO\_3.3.2 T1-T4.SEQ**, four tests are provided as listed in the standard IS-866-A.

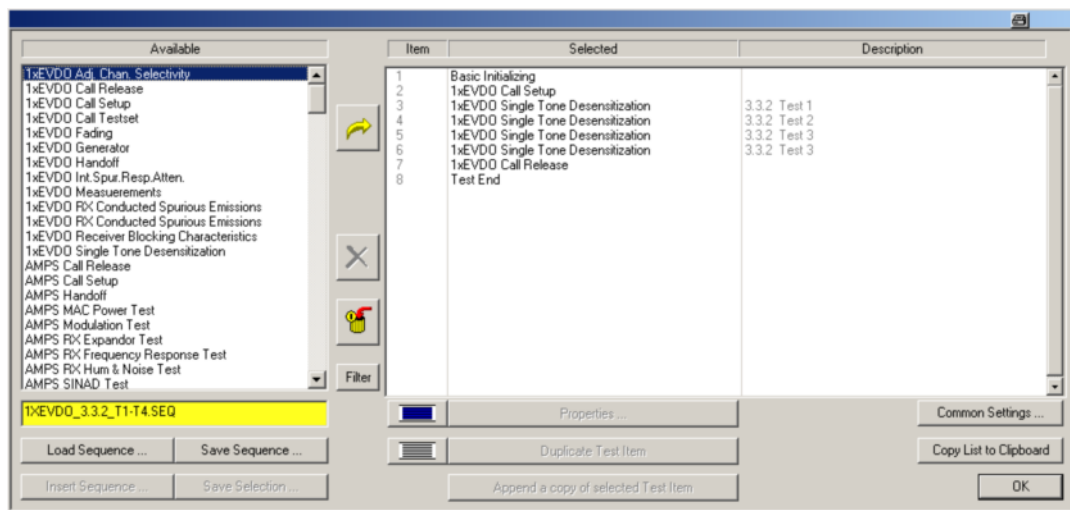


Fig. 3.3.2\_2 CONFIGURE TEST window. Available and selected test items (test sequence) for single-tone desensitization test.

Test items have to be configured before a test runs. Double-click a test item to open its configuration window.

### Configure test item **BASIC INITIALIZING**:

See section 3.2.2.

### Configure test item **1xEVDO CALL SETUP**:

See section 3.2.2.

### Configure test items **1xEVDO SINGLE TONE DESENSITIZATION:**

Double-click **1xEVDO SINGLE TONE DESENSITIZATION** (e.g. Item 1) in the list of the selected test items (see Fig. 3.3.2\_3). It provides parameter entry fields for one interfering generator (**SMx Signal**).

Fig. 3.3.2\_3 Setup for 1xEV-DO Single Tone Desensitization (Test 1)

The pull-down list **IS-866-A PREDEFINED TESTS** offers 4 test items. Depending on the **NETWORK** (bandclass) and Access Terminal **CLASS** selection the parameters **TONE OFFSET**, **TONE POWER**, **PER UPPER LIMIT** and **MINIMUM CONFIDENCE LEVEL** are set according to standard IS-866-A..

- 1) Select your **PREDEFINED TEST** in accordance with the band class of your AT.

If you modify one of the parameters mentioned above, the **USER DEFINED** indicator is checked.

- 2) Modify these parameters if necessary.

#### Listed below are some of the remaining parameters:

- 3) Enter a channel number at **RF CHANNEL**.
- 4) Enter the path loss measured between the AT and the CMU200 as **CABLE LOSS DL** and **UL**.
- 5) Enter the previously measured path loss between the AT and the signal generator as **CABLE LOSS** in the **SMx** field.
- 6) Enter as **AUXILIARY DEVICE NAME** the name you specified for the generator's GPIB configuration (see section *Configuring the GPIB settings* on page 6).
- 7) Optionally add a comment.
- 8) Click OK to return to the **CONFIGURE TEST** window (Fig. 3.3.2\_2).



- 9) Configure another item and create your own sequence, if necessary.

You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 3.5.2\_2).

- 10) Complete the measurement setup by clicking **OK** in the **CONFIGURE TEST** window.

- 11) Click on the **START** icon in the CMUgo menu bar to start the measurement (see Fig. 3.2.2\_9).

### Test description and measurement report:

Once you have clicked the **START** icon,

- the hardware setup is displayed as wallpaper if the item **SHOW HINT** is present
- otherwise a temporary **MEASUREMENT REPORT** window is displayed.

To optimize the speed, these windows are not updated before the last measurement of the last test item has been finished. The temporary **MEASUREMENT REPORT** window already shows the names of the tests and the test conditions. However, as long as the tests are running, all test items are indicated as *not performed*. When the basic initialization is completed, a pop-up menu instructs you to **SWITCH ON THE MOBILE**. Ignore this message if it is already powered up. After the individual response time of the MS, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established. With the predefined sequence **1xEVDO\_3.3.2\_T1-T4.SEQ**, the following measurements are subsequently run:

Test 1: The total power of the CMU is set to -102.4 dBm. The tone power (interferer level) is set to -30 dBm. The path losses you entered are compensated automatically. A first PER measurement is performed with an interferer tone offset of +2500 kHz. The result is stored inside CMUgo.

Test 2: The test is repeated with the same levels but with a tone offset of -2500 kHz. The result is stored inside CMUgo.

Test 3: The test is repeated with a tone power of -40 dBm and a tone offset of +2500 kHz. The result is stored inside CMUgo.

Test 4: The test is repeated with a tone power of -40 dBm and a tone offset of -2500 kHz. The result is stored inside CMUgo.

During the test, the currently executed test item and test step are indicated on the bottom bar of the **MEASUREMENT REPORT** window. (The test step is an internal count within each test item.)

Once all test steps have been completed, the hardware setup display is replaced by the **MEASUREMENT REPORT**, or the temporary *Measurement Report* window is updated. For **SINGLE-TONE DESENSITIZATION**, a display similar to Fig. 3.3.2\_4 appears.

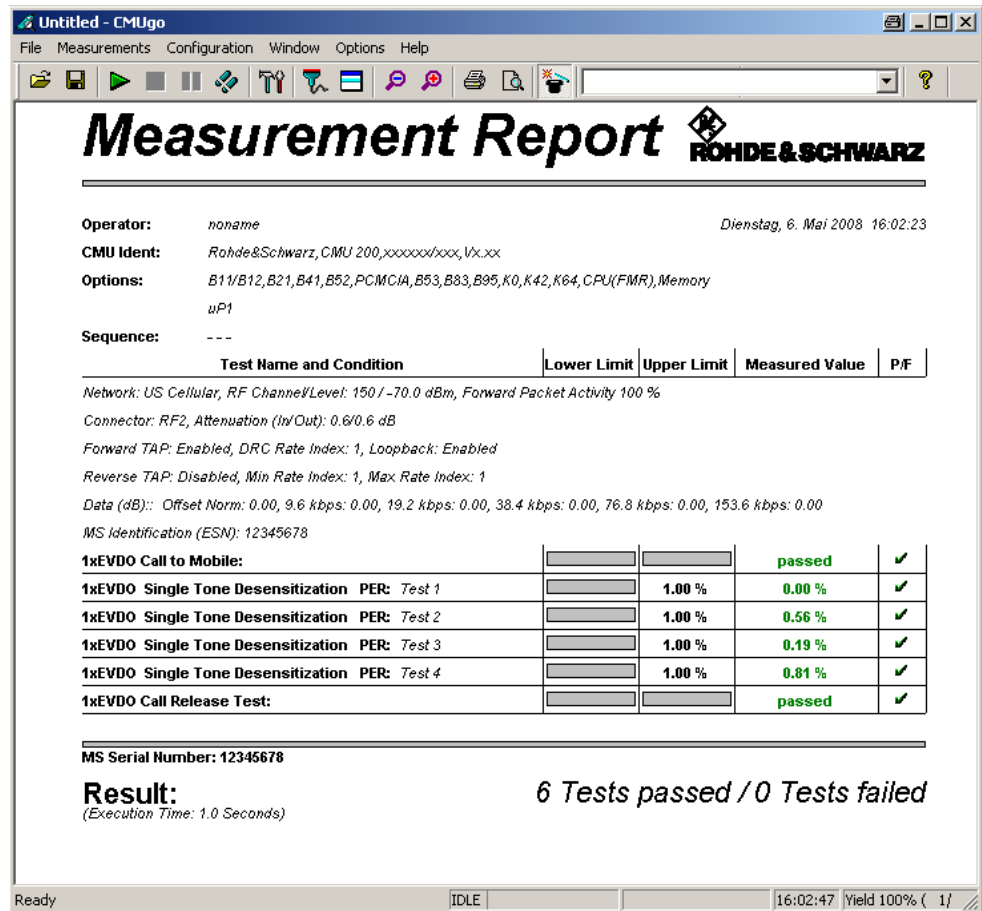


Fig. 3.3.2\_4 Test result for single tone desensitization (BC0)

Measurement values below the limits are displayed green; those exceeding the limits red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed.

**Note:** **CALL TO MOBILE** and **CALL RELEASE** are treated like the other test items. They increase the number of tests by two as tests without limits.

To repeat a test sequence, click the **START** button again (Fig. 3.2.2\_9). If your mobile station supports more than one band class, change the configurations accordingly and start the test sequence again.

### **3.3.3 Intermodulation Spurious Response Attenuation**

The intermodulation spurious response attenuation is a measure of a receiver's ability to receive a 1xEV-DO signal at its assigned channel frequency in the presence of two interfering CW tones. These tones are separated from the assigned channel frequency and from each other such that the third order mixing of the two interfering CW tones can produce an interfering signal in the band of the desired 1xEV-DO signal. The receiver performance is measured by the packet error rate (PER). The purpose of test 3.3.3 is to verify that the PER of the mobile station does not exceed 1 % with 95 % confidence level under these conditions. This test shall be performed for each band class the mobile station supports.

#### **Recommended test setup:**

Fig. 3.3.3\_1 shows the test setup for intermodulation spurious response attenuation. The RF ports of the Radio Communication Tester CMU200 and the AT under test are connected by means of a hybrid combiner. During the test, a call is set up to the mobile station and a connection is established by the CMU using this path. In addition two interfering signals are fed in from two generators. Hybrid combiners are used for this test because of their isolation is better than that of resistive combiners. The hybrids decouple the instruments and make sure that the interferer signals at the CMU RF port are sufficiently low. Thus no additional mixing products can emerge due to non-linear elements inside the CMU. The 10 dB attenuator in the generator's path reduces the 1xEV-DO signals at the generator inputs to a harmless level. The CMU and signal generators are remote-controlled by CMUgo to run the test automatically.

#### **Instruments and accessories:**

- CMU200 and SMU or SMJ or SML
- Hybrid combiners, frequency response depending on the band class (recommended for BC 1: Minicircuits ZFSC-2-2500)

### Path loss compensation:

Measure the RF cable loss between the AT and CMU200 and between the signal generators and the AT. Then proceed as described in the following section *Configure Test Items 1xEVDO INT.SPUR.RESP.ATTEN*.

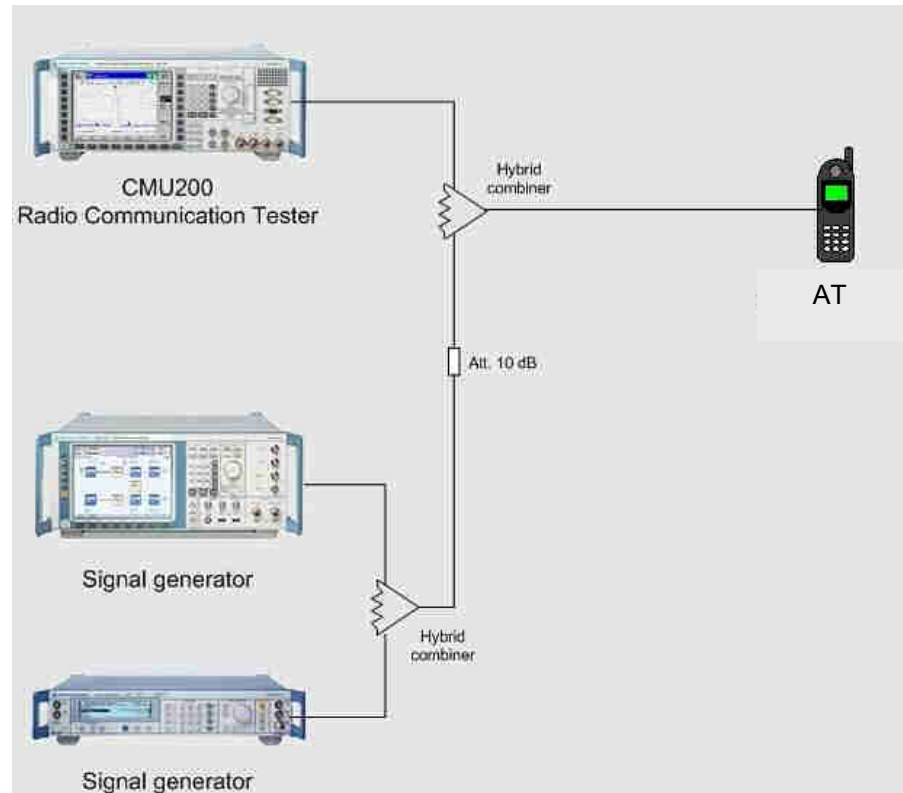


Fig. 3.3.3\_1: Test setup for intermodulation spurious response attenuation.

### Test procedure:

- 1) Connect instruments and mobile station as shown in Fig. 3.3.3\_1.
- 2) Run CMUgo, and then click **CONFIGURATION** → **CONFIGURE TESTS**. The **CONFIGURE TEST** window opens.
- 3) Click **LOAD SEQUENCE**, and select **1xEVDO\_3.3.3\_T1-T6.SEQ**.

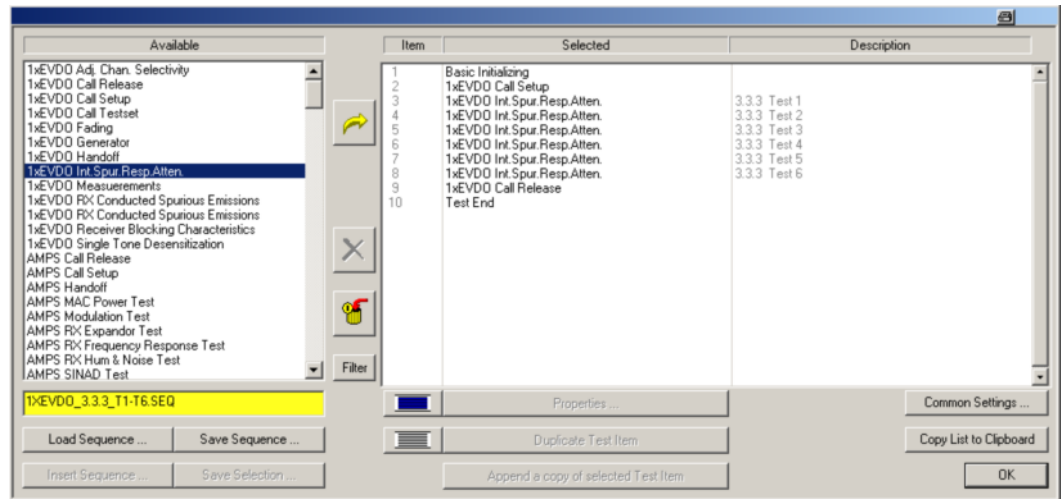


Fig. 3.3.3\_2: Available and selected test items (test sequence) for 1xEV-DO intermodulation spurious response attenuation.

## Check Basic Initializing

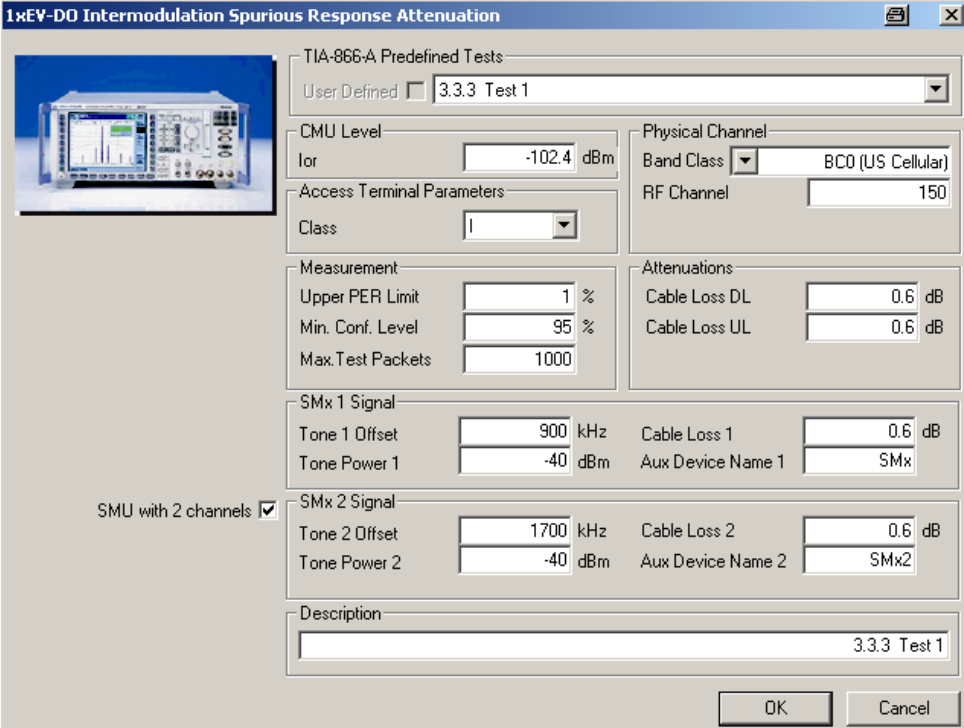
Check whether the correct function group inside the CMU is activated (see Fig. 3.2.2\_6).

## Configure test item 1xEVDO CALL SETUP:

Double-click **1xEV-DO CALL SETUP** in the list of the selected test items (see section 3.2.2).

## Configure test items 1xEVDO INT.SPUR.RESP.ATTEN:

Double-click **1xEV-DO INT. SPUR. RESP. ATTEN.** in the list of the selected test items. The window **1xEV-DO INTERMODULATION SPURIOUS RESPONSE ATTENUATION** appears (see Fig. 3.3.3\_3). It provides parameter entry fields for two interfering generators (**SMX SIGNAL**).



**1xEV-DO Intermodulation Spurious Response Attenuation**

TIA-866-A Predefined Tests  
☐ User Defined ☒ 3.3.3 Test 1

CMU Level  
 Ior: -102.4 dBm

Access Terminal Parameters  
 Class: 1

Physical Channel  
 Band Class: BCD (US Cellular)  
 RF Channel: 150

Measurement  
 Upper PER Limit: 1 %  
 Min. Conf. Level: 95 %  
 Max. Test Packets: 1000

Attenuations  
 Cable Loss DL: 0.6 dB  
 Cable Loss UL: 0.6 dB

SMx 1 Signal  
 Tone 1 Offset: 900 kHz  
 Tone Power 1: -40 dBm

SMU with 2 channels ☒ SMx 2 Signal  
 Tone 2 Offset: 1700 kHz  
 Tone Power 2: -40 dBm

Cable Loss 1: 0.6 dB  
 Aux Device Name 1: SMx

Cable Loss 2: 0.6 dB  
 Aux Device Name 2: SMx2

Description  
 3.3.3 Test 1

OK Cancel

Fig. 3.3.3\_3: Setup for 1xEV-DO intermodulation spurious response attenuation test 1

The pull-down list **IS-866-A PREDEFINED TESTS** offers 6 available tests named in the specification. The test number, Band Class and AT Class affect the SMx parameters **TONE OFFSET** and **TONE POWER.**, **Minimum CONFIDENCE LEVEL** and **UPPER PER LIMIT**.

- 1) Select your **PREDEFINED TEST** for this test item.
- 2) Modify the parameters named above if necessary.

**Listed below are some of the remaining parameters:**

- 3) Enter a channel number at **RF CHANNEL**.
- 4) Enter the previously measured path loss between the AT and the CMU200 as **CABLE LOSS DL** and **UL**.
- 5) Enter the previously measured path loss between the AT and the signal generators as **CABLE LOSS 1** and **2** in the SMx fields.
- 6) Enter as **AUXILIARY DEVICE NAMES** the names you specified for the generator's GPIB configuration (see section *Configuring the GPIB settings* on page 6).
- 7) Optionally add a comment.

After clicking **OK** you return to the **CONFIGURE TEST** window (Fig. 3.3.3\_2).

- 8) Configure another item and create your own sequence, if necessary.

You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 3.3.3\_2).

- 9) Click **OK** in the **CONFIGURE TEST** window to complete the measurement setup.

### **To start the measurement:**

Click the **START** icon in the menu bar of CMUgo (see Fig. 3.2.2\_9).

### **Test description and measurement report:**

When the **BASIC INITIALIZATION** is completed, a pop-up menu instructs you to **SWITCH ON THE MOBILE**. Ignore this message if it is already powered up. After the individual response time of the AT, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established. With the predefined sequence **1xEVDO\_3.3.3\_T1-T6.SEQ**, Test t1 to Test 6 with BC0 and AT Class 1 are subsequently run. After all test steps have been completed, the following or similar Measurement Report is displayed (see Fig. 3.3.3\_7)



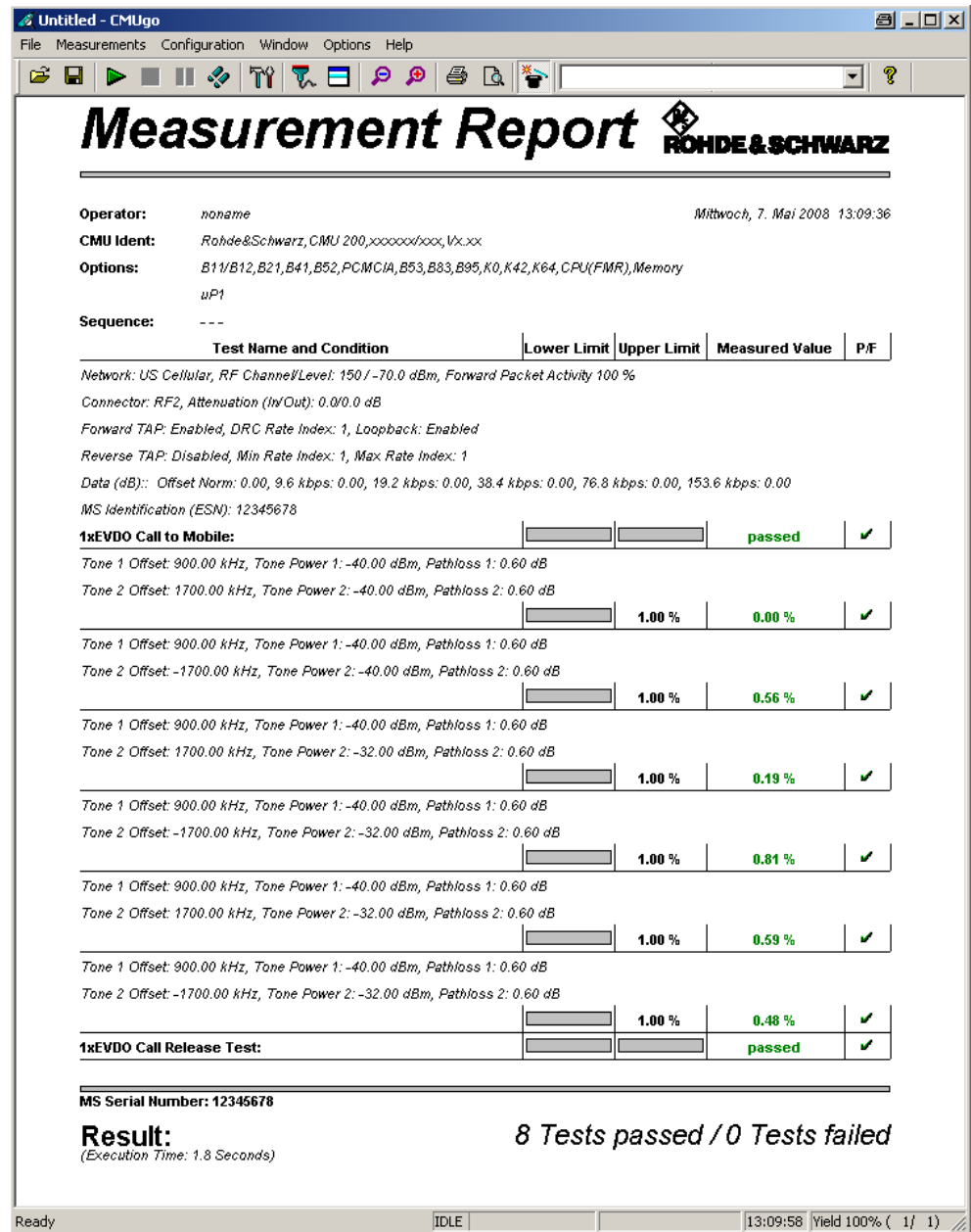


Fig. 3.3.3\_4: Test result for intermodulation spurious response attenuation.

Measurement values below the limits are displayed green, those exceeding the limits red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. To repeat a test sequence, click the start button again (Fig. 3.2.2\_9). If your mobile station supports more than one band class, change the configurations accordingly and start the test sequence again.

### **3.3.4 Adjacent Channel Selectivity**

Adjacent channel selectivity is a measure of a receiver's ability to receive a 1xEV-DO signal at its assigned frequency in the presence of another 1xEV-DO signal that is offset from the center frequency of the assigned channel by  $\pm 2.5$  MHz (for SR 1). The adjacent channel selectivity is measured by the packet error rate (PER). The purpose of test 3.3.4 is to verify that the PER of the mobile station does not exceed 1 % with 95 % confidence level under these conditions. This test is applicable to BC 6 mobile stations only.

#### **Recommended test setup:**

Fig. 3.3.4\_1 shows the test setup for the adjacent channel selectivity test. It is the same setup that is used for test 3.3.2. The RF ports of the Radio Communication Tester CMU200 and the AT under test are connected by means of a resistive combiner. During the test, a call is set up to the mobile station and a connection is established by the CMU using this path. In addition, a signal generator is coupled in to provide the adjacent channel interferer. The resistive combiner ensures a flat frequency response. The 10 dB attenuator in the generator path decouples the instrument and reduces the 1xEV-DO signals at the generator output to a harmless level. Both the CMU and the signal generator are remote-controlled by CMUgo to run the test automatically.

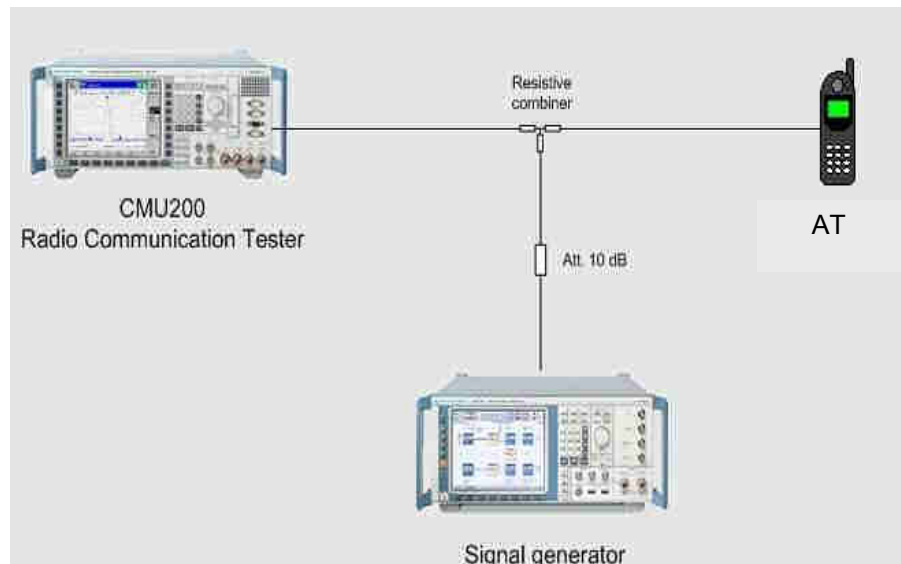


Fig. 3.3.4\_1: Test setup for adjacent channel selectivity test

#### **Instruments and accessories:**

- CMU200 and SMU or SMJ or SML
- Resistive combiner, frequency response depending on the band class (recommended: Weinschel 1515-1, DC to 12.75 GHz)

### Path loss compensation:

Measure the RF cable loss between the AT and CMU200 and between the signal generator and the AT. Then proceed as described in the following section **CONFIGURE TEST ITEMS → 1xEVDO ADJ. CHAN. SELECTIVITY**.

### Test procedure:

- 1) Connect instruments and mobile station as shown in Fig. 3.3.4\_1.
- 2) Run CMUgo and click **CONFIGURATION → CONFIGURE TESTS**.  
The **CONFIGURE TEST** window opens.
- 3) Click **LOAD SEQUENCE** and select **1xEVDO\_3.3.4\_T1-T2.SEQ**.

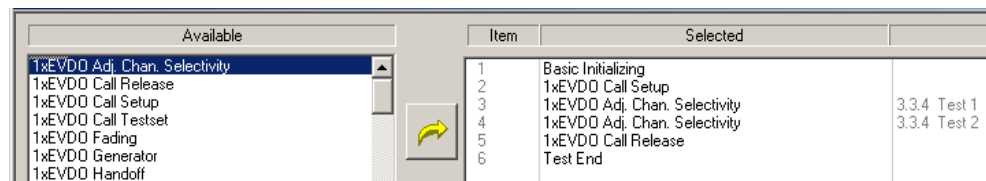


Fig. 3.3.4\_2: Available and selected test items (test sequence) for adjacent channel selectivity.

### Check BASIC INITIALIZING

Check whether the 1xEVDO function group is activated (see Fig. 3.2.2\_6).

### Configure test item 1xEVDO 2000 CALL SETUP:

- 1) Double-click **1xEVDO CALL SETUP** in the list of the selected test items.

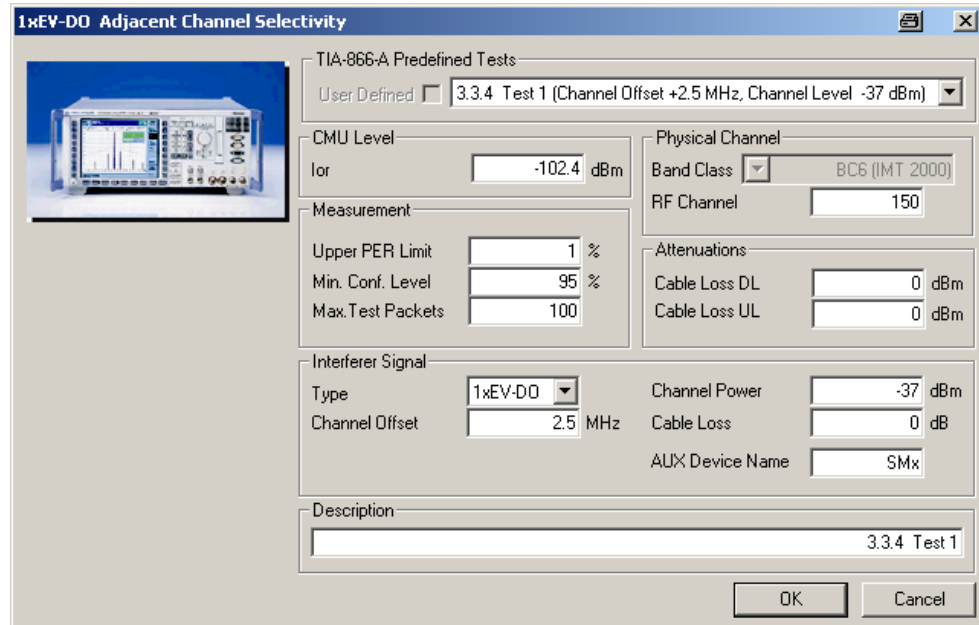
### Configure test item 1xEVDO CALL SETUP:

Double-click **1xEV-DO CALL SETUP** in the list of the selected test items (see section 3.2.2). The adjacent channel selectivity test is applicable to BC 6 mobile stations only.

### Configure test item 1xEV-DO ADJACENT CHANNEL SELECTIVITY:

- 1) Double-click **1xEV-DO ADJ.CHAN.SELECTIVITY / TEST 1** in the list of the selected test items.

The window **1xEV-DO ADJACENT CHANNEL SELECTIVITY** configuration appears (see Fig. 3.3.4\_3).



The screenshot shows the '1xEV-DO Adjacent Channel Selectivity' configuration window. It includes a 'TIA-866-A Predefined Tests' dropdown menu with '3.3.4 Test 1 (Channel Offset +2.5 MHz, Channel Level -37 dBm)' selected. The 'User Defined' checkbox is unchecked. The 'CMU Level' section has 'lor' set to '-102.4 dBm'. The 'Physical Channel' section has 'Band Class' set to 'BC6 (IMT 2000)' and 'RF Channel' set to '150'. The 'Measurement' section has 'Upper PER Limit' set to '1 %', 'Min. Conf. Level' set to '95 %', and 'Max. Test Packets' set to '100'. The 'Attenuations' section has 'Cable Loss DL' and 'Cable Loss UL' both set to '0 dBm'. The 'Interferer Signal' section has 'Type' set to '1xEV-DO', 'Channel Offset' set to '2.5 MHz', 'Channel Power' set to '-37 dBm', 'Cable Loss' set to '0 dB', and 'AUX Device Name' set to 'SMx'. The 'Description' field contains '3.3.4 Test 1'. The window has 'OK' and 'Cancel' buttons at the bottom right.

Fig. 3.3.4\_3: Setup for 1xEV-DO adjacent channel selectivity / Test 1

Opening the pull-down list **IS-866-A PREDEFINED TESTS** shows the available tests (see Fig. 3.3.4\_4):

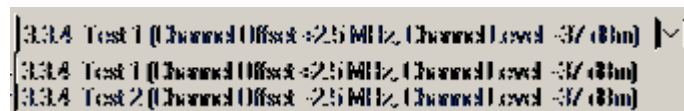


Fig. 3.3.4\_4: Predefined tests for 1xEV-DO adjacent channel selectivity.

Test 1 uses a positive channel offset (interferer above assigned channel); test 2 uses a negative channel offset. Predefined parameters are **CMU Level (lor)** and interferer **CHANNEL POWER**, **CHANNEL OFFSET**, **UPPER PER LIMIT**, **MINIMUM CONFIDENCE LEVEL**, and **MAX. TEST PACKETS**.

If one of these entries is modified, the **USER DEFINED** control is checked.

- 2) Select your test.
- 3) Modify parameters if necessary.

**Listed below are some of the remaining parameters:**

- 4) Enter a channel number at *Physical RF Channel*.
- 5) Enter the path loss you measured between the AT and the CMU200 as **CABLE LOSS DL** and **CABLE LOSS UL**.

- 6) Enter the path loss you measured between the AT and the signal generator as **CABLE LOSS** in the **INTERFERER SIGNAL** field.
- 7) Enter as **AUX DEVICE NAME** the name you specified for the generator's GPIB configuration (see section *Configuring the GPIB settings* on page 6).
- 8) Optionally add a comment.
- 9) Click **OK**.

You are back in the **CONFIGURE TEST** window (Fig. 3.3.4\_2).

- 10) Configure another item and create your own sequence, if necessary.

You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 3.2.2\_5).

- 11) Click **OK** in the **CONFIGURE TEST** window to complete the measurement setup.

### To start the measurement:

- Click the start icon in the menu bar of CMUgo (see Fig. 3.2.2\_9).

### Test description and measurement report:

When the basic initialization is completed, a pop-up menu instructs you to **SWITCH ON THE MOBILE**. Ignore this message if it is already powered up. After the individual response time of the AT, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established.

With the predefined sequence **1xEVDO\_3.3.4\_T1-T2.SEQ**, the two following measurements are subsequently run :

Test 1: The total power of the CMU is set to -102.4 dB and 1xEV-DO interferer channel power is set to -37 dBm. The entered path losses are compensated automatically. A PER measurement is performed with an interferer frequency offset of +2.5 MHz. The result is stored inside CMUgo.

Test 2: The test is repeated with the same levels but with a channel offset of -2.5 MHz. The result is stored inside CMUgo.

Once all test steps have been completed, you get a display similar to Fig. 3.3.4\_6.

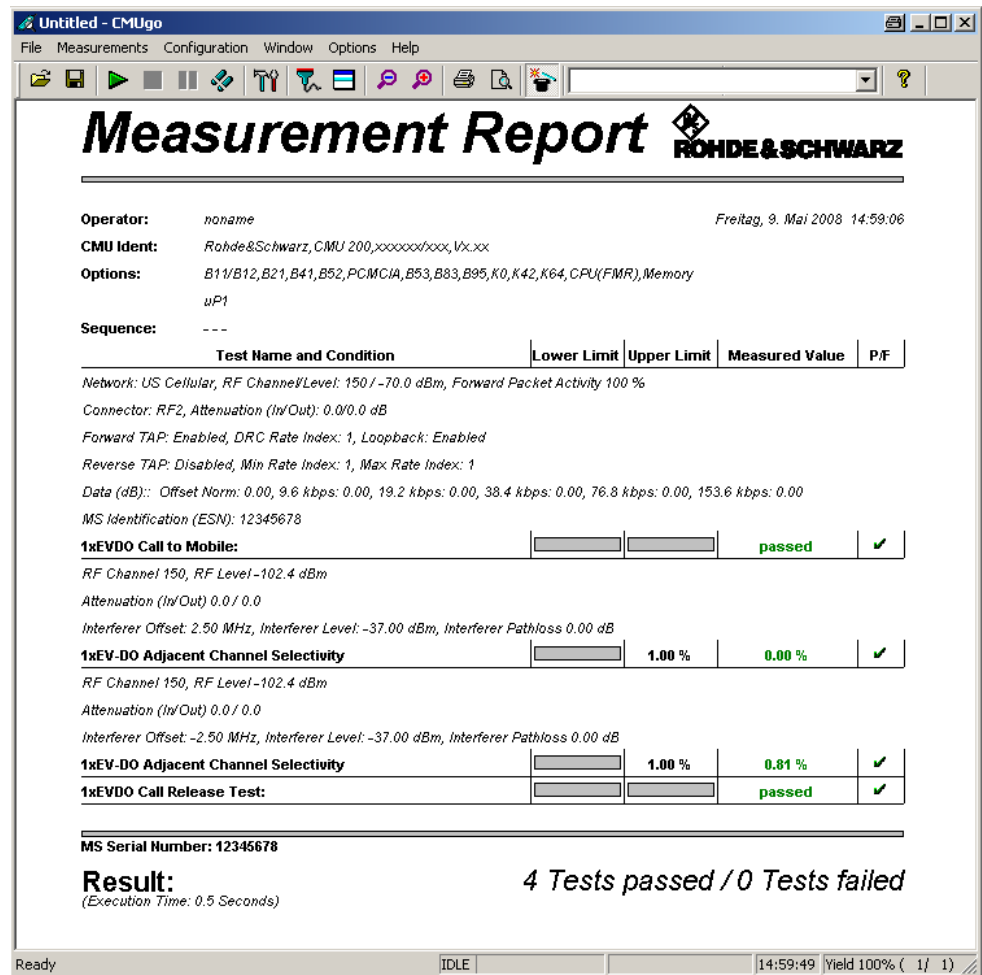


Fig. 3.3.4\_5: Test result for adjacent channel selectivity.

Measurement values that are below the limits are displayed in green; those which exceed the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. To repeat a test sequence, click the start button again (Fig. 3.2.2\_6).

### 3.3.5 Receiver Blocking Characteristics

The receiver blocking characteristics test is a measure of a receiver's ability to receive a CDMA2000® 1xEV-DO signal at its assigned frequency in the presence of a single tone at frequencies other than those of the adjacent channels, without this unwanted signal causing a degradation of the performance of the receiver beyond a specific limit. A receiver's blocking performance is measured by the packet error rate (PER). The purpose of test 3.3.5 is to verify that the PER of the mobile station does not exceed 1% with 95% confidence level under these conditions. This test is applicable to BC6 access terminals stations only.

#### Recommended test setup:

Fig. 3.3.5\_1 shows the test setup for the receiver blocking test. It is the same setup that is used for test 3.5.2 and 3.5.4. The RF ports of Radio Communication Tester CMU200 and the AT under test are connected by means of a resistive combiner. During the test, a call is set up to the mobile station and a connection is established by the CMU using this path. In addition, a signal generator is coupled in to provide the blocking interferer. The resistive combiner ensures a flat frequency response. The 10 dB attenuator in the generator path decouples the instrument and reduces the 1xEV-DO signals at the generator input to a harmless level. Both the CMU and the signal generator are remote-controlled by CMUgo to run the test automatically.

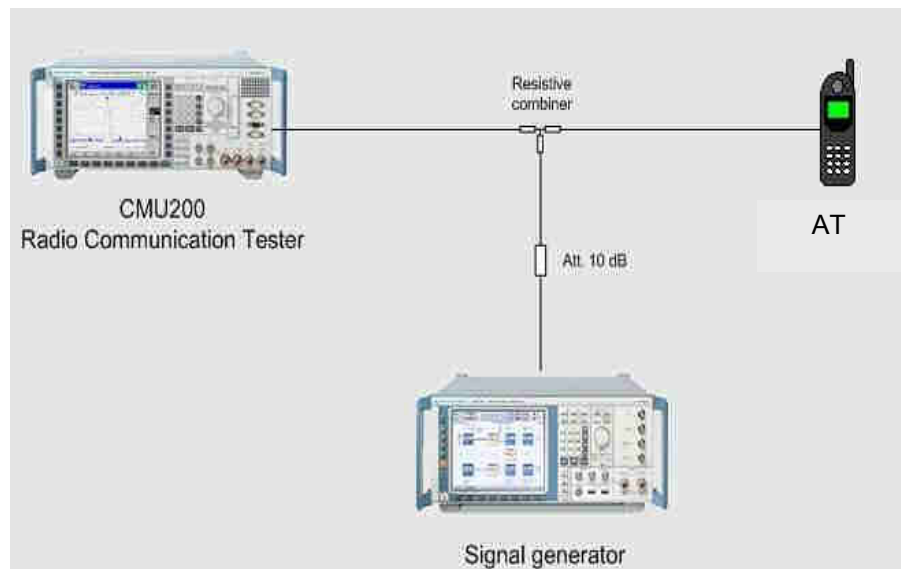


Fig. 3.3.5\_1: Test setup for receiver blocking test.

Seven RX blocking tests can be found in section 3.3.5 of the standard IS-866-A. Tests 1 to 4 are in-band-tests. Here the interfering signal occurs each time at a fixed frequency offset from the assigned channel (inside the 1xEV-DO band). These tests are performed using predefined tests 1 to 4 of **1xEV-DO BLOCKING TESTS**. The interferers of tests 5 to 7 use frequencies outside the 1xEV-DO band. They are not based on only one measurement: The interferer is subsequently applied at all frequencies of a 1 MHz grid between the lower and the upper end of specified frequency bands.



### Check Basic Initializing

Check whether the 1xEVDO function group is activated (see Fig. 3.2.2\_6).

### In-Band Blocking:

#### Instruments and accessories:

- CMU200 and SMU or SMJ or SML
- Resistive combiner (e.g. Weinschel 1515-1, DC to 12.75 GHz)

#### Path loss compensation:

- Measure the path loss between the AT and the CMU200 and between the AT and the signal generator and proceed as described in the following section *Configure test item 1xEVDO CALL SETUP*.

#### Test procedure:

- 1) Connect instruments and AT as shown in Fig. 3.3.5\_1.
- 2) Run CMUgo, then click **CONFIGURATION** → **CONFIGURE TESTS** to open the **CONFIGURE TEST** window.
- 3) Click **LOAD SEQUENCE**, and select **1xEVDO\_3.3.5\_T1-T7.SEQ**.

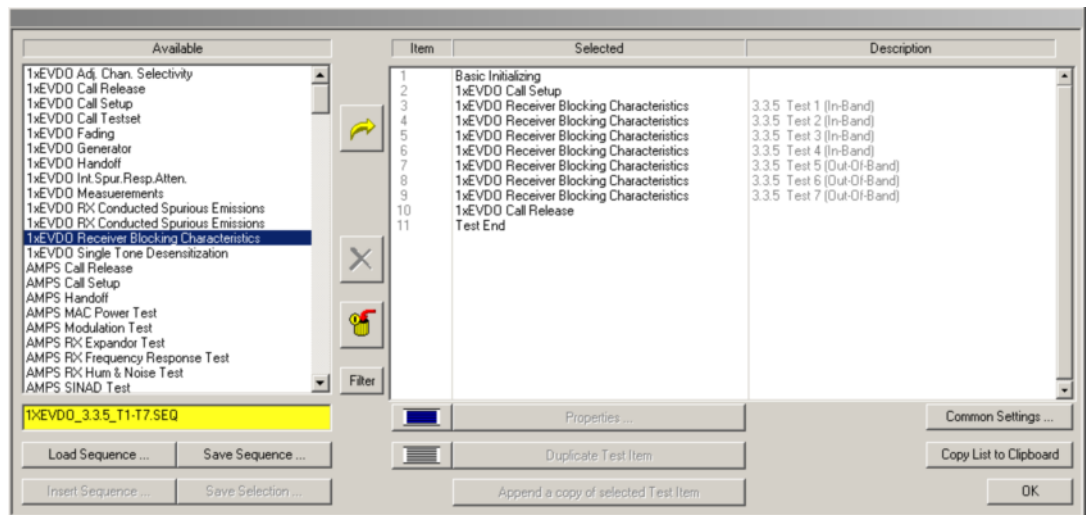


Fig. 3.5.5\_2: Test sequence for in- and out-of-band blocking tests.

#### Configure test item 1xEVDO CALL SETUP:

- 1) Double-click **1xEVDO CALL SETUP** in the list of the selected test items.

#### Configure test item 1xEVDO CALL SETUP:

Double-click **1xEV-DO CALL SETUP** in the list of the selected test items (see section 3.2.2).

## Configure test items 1xEV-DO BLOCKING 1-4 ( In-Band):

- 1) Double-click **1xEVDO RECEIVER BLOCKING CHARACTERISTICS / TEST 1 (IN-BAND)** in the list of selected test items.

The window **1xEV-DO RECEIVER BLOCKING CHARACTERISTICS** appears (see Fig. 3.3.5\_3).

Fig. 3.3.5\_3: Setup for 1xEV-DO in-band blocking / test 1

Opening the pull-down list **IS-866-A PREDEFINED TESTS** shows the available tests (see Fig. 3.3.5\_4):

Fig. 3.3.5\_4: Predefined tests for 1xEV-DO in- an out-of-band blocking characteristics.

For each in-band test, the following parameters are predefined:

**IOR** (CMU Level), the **CW TONE OFFSET**, **CW TONE POWER**, **UPPER PER LIMIT**, **MIN. CONFIDENCE LEVEL** and **MAX. TEST PACKETS**.

If one of these entries is modified, the **USER DEFINED** indicator is checked.

- 2) Select your test.
- 3) Modify parameters if necessary.

Listed below are some of the remaining parameters:

- 4) Enter a channel number at **RF CHANNEL**.
- 5) Enter the path loss you measured between the AT and the CMU200 as **CABLE LOSS DL** and **CABLE LOSS UL**.
- 6) Enter the path loss you measured between the AT and the signal generator as **CABLE LOSS** in the **SMX SIGNAL** field.
- 7) Enter as **AUX DEVICE NAME** the name you specified for the generator's GPIB configuration (see section *Configuring the GPIB Settings*).
- 8) Add a comment if you like.
- 9) Click **OK**.

You are back in the **CONFIGURE TEST** window (Fig. 3.3.5\_2).

**To start the measurement:**

- Click the start icon in the menu bar of CMUgo (see Fig. 3.2.2\_9).

**Test description and measurement report:**

When the basic initialization is completed, a pop-up menu instructs you to *Switch on the Mobile*. Ignore this message if it is already powered up. After the individual response time of the MS, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established. With the predefined sequence **1xEVDO\_3.3.5\_T1-T7.SEQ**, the following measurements are subsequently run:

The total power of the CMU is set to -101 dB, and Pilot and Traffic power are set to -7 dB and -15.6 dB respectively. The CDMA interferer level is set to -56 dBm for tests 1 and 2, and to -44 dBm for tests 3 and 4. The path losses you entered are compensated automatically. FER measurements are performed with the interferer frequency offset as specified in the test items. The result is stored inside CMUgo. Once all test steps have been completed, you get a display similar to Fig. 3.3.5\_5.

# Measurement Report



Operation: *analog* Donnerstag, 17. Juli 2008 15:22:00  
 Cell Link: *Rohde&Schwarz, CNU 200,xxxxxxxxxxxx*  
 Options: *311/312,321,341,352,1,CMCMA,RS3,RS3,RS5,K0,K32,K64,CPU(FIRQ),Memory*  
*atM*  
 Sequence: *1MA123 130300 1303000 3.3.5 71-77*  
 Shortcut:

Test Name and Condition	Lower Limit	Upper Limit	Measured Value	P/F
<i>Network: US Cellular, RF Channel Power: 150.7 -70.0 dBm, Forward Packet Activity 100 %</i>				
<i>Connector: RF2, Attenuation (In/Out): 0.00/0.0 dB</i>				
<i>Forward TAP: Disabled, DRC Rate Index: 1, Loopback: Enabled</i>				
<i>Reverse TAP: Disabled, Min Rate Index: 1, Max Rate Index: 1</i>				
<i>Data (dB): Offset Norm: 0.00, 9.6 kbps: 0.00, 19.2 kbps: 0.00, 38.4 kbps: 0.00, 76.8 kbps: 0.00, 153.6 kbps: 0.00</i>				
<i>MS Identification (SSN): 12345678</i>				
Test 000 Call to Mobile:			[[00000000]]	✓
<i>CW CRs 5000.00kHz, CW Pwr -56.00dBm</i>				
Test 000 Receiver Blocking Characteristics 3.3.5 Test 1 (In)		10.00 %	9.500 %	✓
<i>CW CRs 5000.00kHz, CW Pwr -56.00dBm</i>				
Test 000 Receiver Blocking Characteristics 3.3.5 Test 2 (In)		10.00 %	9.176 %	✓
<i>CW CRs 7500.00kHz, CW Pwr -44.00dBm</i>				
Test 000 Receiver Blocking Characteristics 3.3.5 Test 3 (In)		10.00 %	9.500 %	✓
<i>CW CRs 7500.00kHz, CW Pwr -44.00dBm</i>				
Test 000 Receiver Blocking Characteristics 3.3.5 Test 4 (In)		10.00 %	9.500 %	✓
Test 000 Receiver Blocking Characteristics 3.3.5 Test 5 (Out)			[[00000000]]	✓
Test 000 Receiver Blocking Characteristics 3.3.5 Test 6 (Out)			[[00000000]]	✓
Test 000 Receiver Blocking Characteristics 3.3.5 Test 7 (Out)			[[00000000]]	✓
Test 000 Call Release: Test:			[[00000000]]	✓

MS Serial Number: 12345678

**Result:** 9 Tests passed / 0 Tests failed  
*(Execution Time: 2369.3 Seconds)*

Fig. 3.3.5\_5: Measurement report for blocking tests 1 to 4 (In Band) and 5 to 7 (Out of Band).

Measurement values that are below the limits are displayed in green; those which exceed the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. Unlike the in-band tests 1 to 4 the out-of-band tests 5 to 7 are not based on only one measurement: The interferer is subsequently applied at all frequencies between the lower and the upper end of specified frequency bands in 1 MHz steps. Apart from that, there are no differences to the in-band-blocking tests.

**Notes:** For the higher frequencies of test 7, you need the SMR signal generator. We recommend splitting this test into several measurements with smaller frequency sections than the two wide frequency sections specified by the standard. For the smaller sections you can enter a more precise attenuation.

Due to the large number of FER measurements the test duration is considerable long.

**To stop a running measurement:**

see section 3.2.2.

## **3.4 Limitations on Emissions**

### **3.4.1 RX Conducted Spurious Emissions**

RX conducted spurious emissions are spurious emissions generated or amplified in the mobile station's receiver that appear at the mobile station antenna connector. There is no forward or reverse 1xEV-DO channel active during this test. The conducted spurious emissions are measured with a spectrum analyzer connected to the mobile station's antenna port. The purpose of test 3.4.1 is to verify that the emissions of the mobile station do not exceed a specific set of limits. This test is performed for each band class the mobile stations supports.

#### **Recommended test setup:**

Fig. 3.4.1\_1 shows the test setup for test RX conducted spurious emissions. The RF ports of the mobile station and the analyzer are simply connected to each other. There is no call setup or radio connection established between the CMU and the mobile station. Nevertheless, the CMU is needed to start program CMUgo. The spurious emission measurements are made automatically, remotely controlled by CMUgo.

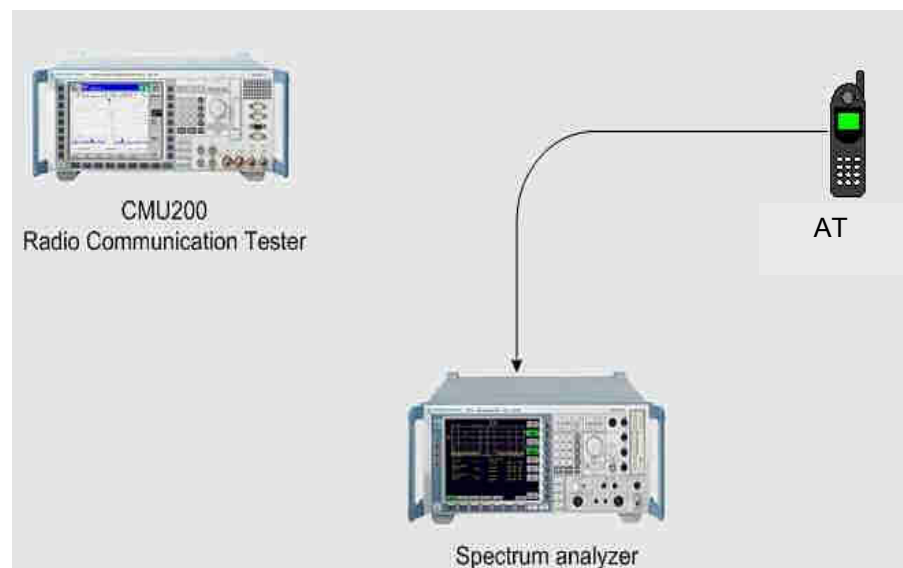


Fig. 3.4.1\_1: Test setup for RX spurious emission test.

Test 3.4.1 contains in-band (RX / TX) and out-of band measurements.

**Notes:** In the RX band very low emissions are measured. This requires high sensitive test equipment and good shielding. The RF attenuation of the analyzer is set to 0 dB for this tests.

- To avoid overloading the analyzer make sure that the DUT does not transmit during the test.
- Use a shielded chamber for the DUT (e.g. CMU-Z11).
- Use well shielded cables.

### Instruments and accessories:

- CMU200
- FSQ or FSU or FSP or FSL with preamplifier FSL-B22.

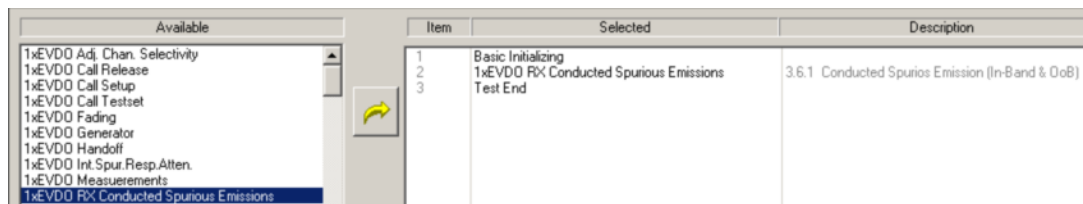
### Path loss compensation:

(see previous section)

- Measure the path loss between the AT and the spectrum analyzer

### Test procedure:

- 1) Connect the analyzer and the mobile station as shown in Fig. 3.4.1\_1.
- 2) Run CMUgo, and then click **CONFIGURATION** → **CONFIGURE TESTS**.  
The **CONFIGURE TEST** window opens.
- 3) Click **LOAD SEQUENCE** and select **1xEVDO\_3.4.1.SEQ**.



Available	Item	Selected	Description
1xEVDO Adj. Chan. Selectivity	1	Basic Initializing	
1xEVDO Call Release	2	1xEVDO RX Conducted Spurious Emissions	3.6.1 Conducted Spurious Emission (In-Band & Out-Band)
1xEVDO Call Setup	3	Test End	
1xEVDO Call Testset			
1xEVDO Fading			
1xEVDO Generator			
1xEVDO Handoff			
1xEVDO Int. Spur. Resp. Altn.			
1xEVDO Measurements			
1xEVDO RX Conducted Spurious Emissions			

Fig. 3.4.1\_2: Available and selected test items (test sequence) for RX spurious emission test.

For each band class, the standard IS-866-A provides a set of limits for various frequency ranges such as the receive band, the transmit band and out-of-band sections. The sequence **1xEVDO\_3.4.1.SEQ** contains the test item **1xEVDO RX SPURIOUS EMISSIONS** for in-band and out-of-band measurements.

- in-band
- below the TX band
- between the TX and RX bands, and
- above the RX band.

There is no Call Setup, no Call Connection, no Forward or Reverse signal present during this test. Nevertheless, CMUgo does not start without the **BASIC INITIALIZING**, which requires that the CMU200 is connected to the GPIB port.

### Configure test item 1xEVDO RX SPURIOUS EMISSIONS:

- 1) Double-click **1xEVDO RX SPURIOUS EMISSIONS** in the list of the selected test items.

The window **1xEV-DO RX CONDUCTED SPURIOUS EMISSIONS** appears (see Fig. 3.4.1\_3).

**1xEV-DO RX Conducted Spurious Emissions**

IS-866-A Band Class  
User Defined ☐ **BC0 (US Cellular)**

**In Band** On/Off ☒

Parameter	TX	RX
Lower	824.025 MHz	869.025 MHz
Upper	848.985 MHz	893.985 MHz
Limit	-61 dBm	-76 dBm
RBW	1 MHz	1 MHz
Analyzer Input Attenuation	0 dB	0 dB

**Out of Band** On/Off ☒

Band Class	Lower	Upper	Limit	RBW	Analyzer Input Attenuation
Below TX	1 MHz	824.025 MHz	-47 dBm	0.03 MHz	0 dB
Between TX/RX	848.985 MHz	869.025 MHz	-47 dBm	0.03 MHz	0 dB
Above RX	893.985 MHz	2600 MHz	-47 dBm	0.03 MHz	0 dB

Auxiliary Device Name: **FSx**

Description: **3.6.1 Conducted Spurious Emission (In-Band & OoB)**

OK Cancel

Fig. 3.4.1\_3: Setup for 1xEV-DO RX conducted spurious emissions

The in-band window defines the spurious emissions in the RX as well as in the TX band. Opening the pull-down list **IS-866-A BAND CLASS** shows you the available band classes (see Fig. 3.4.1\_4):

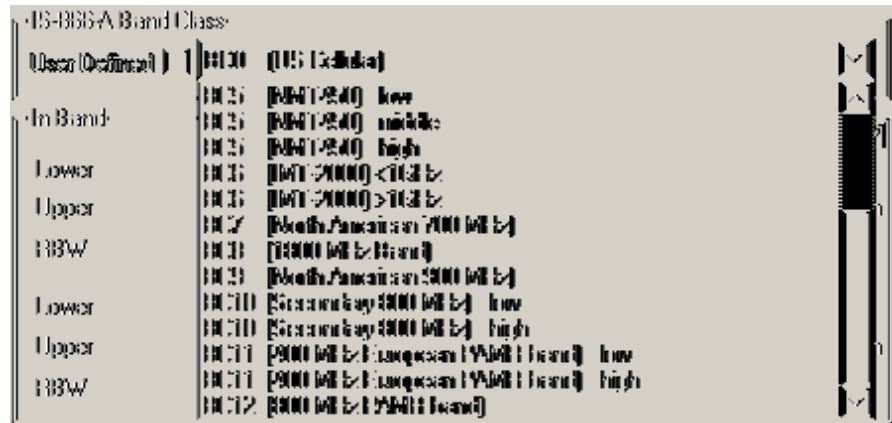


Fig. 3.4.1\_4: Predefined in-band tests for 1xEV-DO RX conducted spurious emissions.

For BC3, BC5, BC10, and BC11, the RX and TX bands are not continuous but have gaps. Consequently you can select In-Band and/or Out-of-Band.

Predefined parameters are the **LOWER** and **UPPER** frequencies, the **RBW**, and the **LIMITS**.

If you modify one of these entries, the selection changes to **USER DEFINED**.

- 2) Select your test.
- 3) Modify parameters if necessary.

## Listed below are some of the remaining parameters:

- 1) Enter the path loss you measured between the AT and the spectrum analyzer as **ANALYZER INPUT ATTENUATION**.
- 2) Enter as **AUXILIARY DEVICE NAME** the name you specified for the analyzer's GPIB configuration (see section *Configuring the GPIB settings* on page 6).
- 3) Add a **DESCRIPTION** if you like.
- 4) Click **OK**.

You are back in the **CONFIGURE TEST** window (Fig. 3.4.1\_2).

- 5) Configure the next test item.
- 6) If necessary, create your own sequence.

You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 3.4.1\_2).

- 7) Finally click **OK** (in the **CONFIGURE TEST** window).

This completes the measurement setup.

## To start the measurement:

- Click the start icon in the menu bar of CMUgo (see Fig. 3.5.2\_9).



## Test description and measurement report:

When the basic initialization is completed, the specified sections of the spectrum are scanned one after the other. For each section scanned, the maximum measured value is stored in CMUgo. Once all steps have been completed, you get a display similar to Fig. 3.4.1\_5.

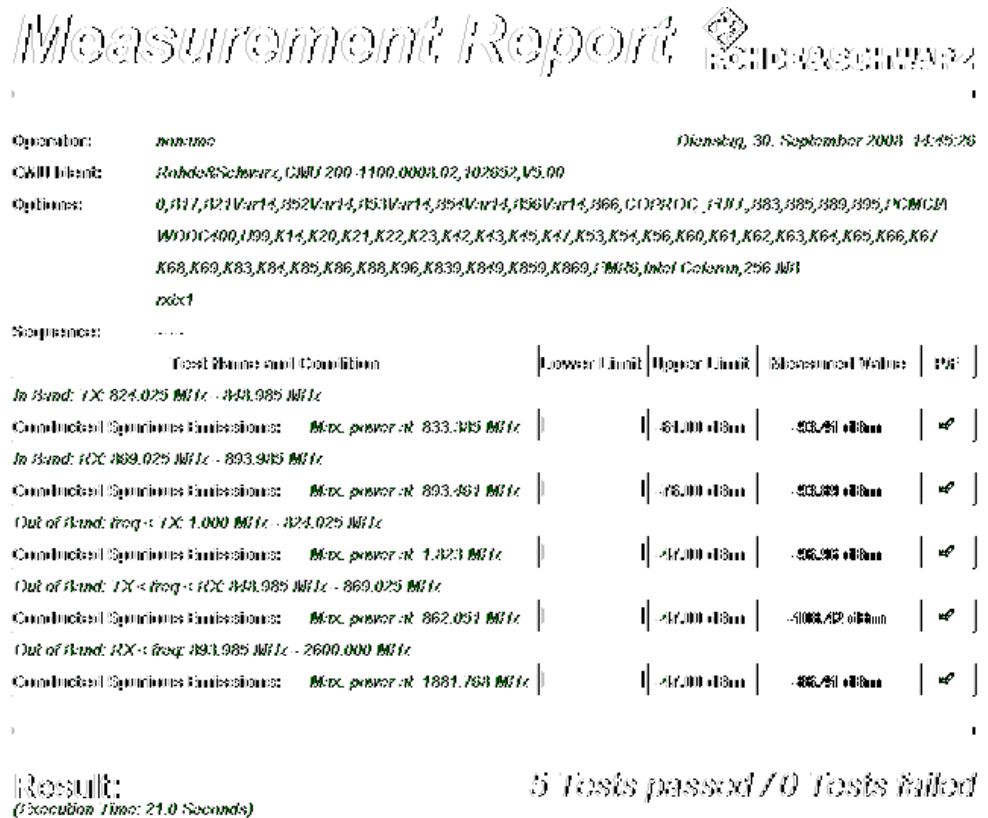


Fig. 3.4.1\_5: Test result for 1xEV-DO RX conducted spurious emissions.

The report screen displays the maximum emission and the frequency at which the maximum has been detected. Measurement values that are below the limits are displayed in green; those which exceed the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. To repeat a test sequence, click the start button again (Fig. 3.5.2\_9). If your access terminal supports more than one band class, change the item configurations accordingly and start the test sequence again.

## **4 Physical Layer Transmitter Minimum Standards**

### **4.4 Limitations on Emissions**

#### **4.4.1 TX Conducted Spurious Emissions**

TX conducted spurious emissions are spurious emissions at frequencies that are outside the assigned CDMA2000® 1xEV-DO channel. The emissions are measured during continuous TX transmission with a spectrum analyzer connected to the mobile station antenna port. The purpose of test 4.4.1 is to verify that the emissions of the mobile station do not exceed a specific set of limits. This test is performed for each band class the mobile stations supports.

##### **Recommended test setup:**

Fig. 4.4.1\_1 shows the test setup for the TX conducted spurious emissions. The RF ports of the Radio Communication Tester CMU200 and the mobile station under test are connected by means of a resistive combiner. During the test, a call is set up to the mobile station and a connection is established by CMU using this path. In addition, a spectrum analyzer is coupled in to measure the spurious emissions. The resistive combiner ensures a flat frequency response. The notch filter prevents the TX carrier to overdrive the spectrum analyzer input. Both the CMU and the spectrum analyzer are remote-controlled by CMUgo to run the test automatically.

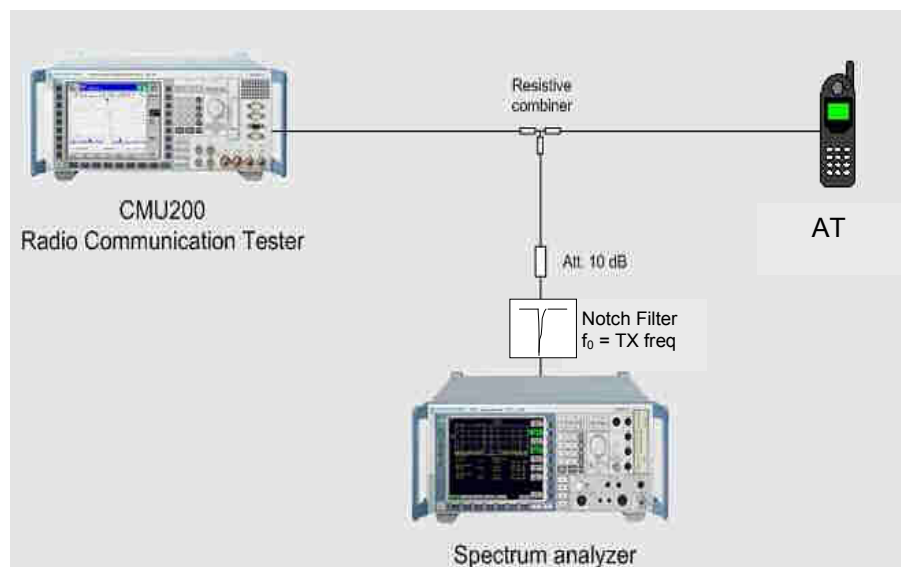


Fig. 4.4.1\_1: Test setup for TX conducted spurious emission test

##### **Instruments and accessories:**

- CMU200, FSQ, FSU, FSP or FSL
- Resistive combiner (recommended: Weinschel 1515-1, DC to 12.75 GHz)
- Notchfilter with  $f_0 = \text{TX frequency}$

### Path loss compensation:

(see previous section)

- Measure the path loss between the AT and the CMU200
- Measure the path loss between the AT and the spectrum analyzer

### Test procedure:

- 1) Connect instruments and mobile station as shown in Fig. 4.4.1\_1.
- 2) Run **CMUGO**, and then click **CONFIGURATION** → **CONFIGURE TESTS**.

The **CONFIGURE TEST** window opens.

- 3) Click **LOAD SEQUENCE**, and select **1xEVDO\_4.4.1\_BC0.SEQ**.

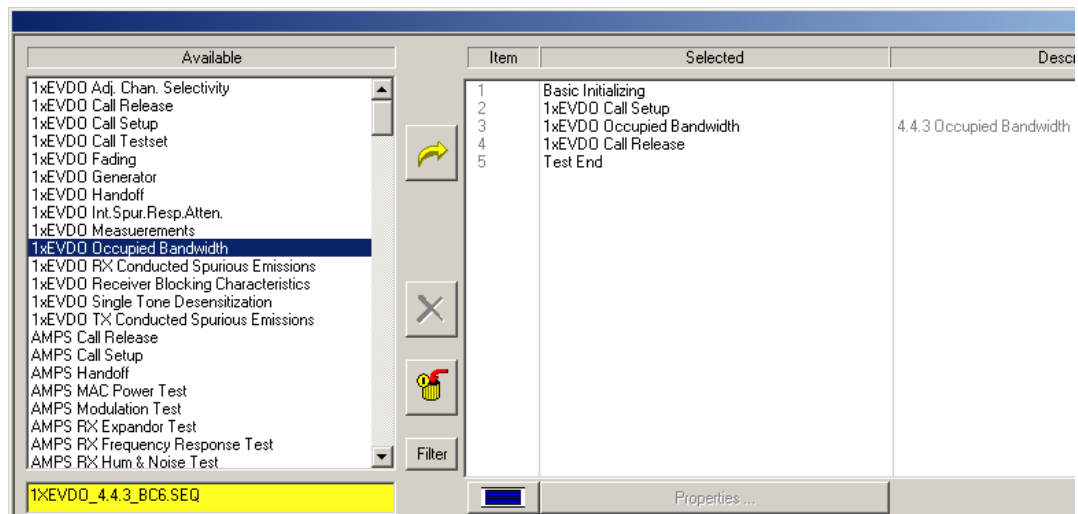


Fig. 4.4.1\_2: Available and selected test items (test sequence) for TX conducted spurious emissions.

The sequence **1xEVDO\_4.4.1\_BC0.SEQ** contains as an example the test suite in accordance with the IS-866-A specification. The test item **1xEVDO TX CONDUCTED SPURIOUS EMISSIONS** causes the CMU to continuously send '0' power control bits to the mobile station. This sets the mobile station's output power to maximum.

### Check Basic Initializing

Check whether the 1xEVDO function group is activated (see Fig. 3.2.2\_6).

### Configure test item 1xEVDO Call Setup:

- 1) Double-click **1xEVDO 2000 CALL SETUP** in the list of the selected test items.

The window **CALL SETUP CONFIGURATION** opens.

The screenshot shows the '1 x EVDO Call Setup' dialog box. It is divided into several sections:   
- **Network:** Network Standard: US Cellular (BC0), Release 0 (selected), Release A.   
- **Parameter:** SID: 1, AN Signal, RF Channel: 150, Tx Level (dBm): -70, Forward Packet Activity: 100%.   
- **UE Identification Mode:** ESN (selected), MEID, UATI.   
- **RF:** CMU Connector: RF1 (selected), RF2. Attenuation In (dB): 1, Attenuation Out (dB): 1.   
- **Layer:** Subtype 0 (Physical Layer).   
- **Forward TAP:** Forward TAP (checked), DRC Rate Index: 1.   
- **Reverse TAP:** Reverse TAP (unchecked), Min Rate Index: 1, Max Rate Index: 1.   
- **MAC Layer:** Control Channel Data Rate: 38400 bps (MAC3).   
- **DRC:** Data Nominal Offset (dB): 0, Data Offset for 9.6 kbps (dB): 0, Data Offset for 19.2 kbps (dB): 0, Data Offset for 38.4 kbps (dB): 0, Data Offset for 76.8 kbps (dB): 0, Data Offset for 153.6 kbps (dB): 0.   
- **Other options:** Skip Positioning Dialog (unchecked), No Message to Power Cycle the Mobile (unchecked), Maximum Time for Session Open State (Sec.): 30.   
- **Buttons:** OK, Cancel.

Fig. 4.4.1\_3: Call setup configuration for TX Conducted Spurious Emissions test.

- 2) Select the **NETWORK STANDARD** and **RELEASE** of the AT.
- 3) Enter the desired **RF CHANNEL**, **TxLEVEL** and **FORWARD PACKET ACTIVITY**.
- 4) Enter the path loss you measured between the AT and the CMU200 as **INPUT ATTENUATION** and **OUTPUT ATTENUATION**.  
You may modify the other parameters if necessary.
- 5) Click **OK** to return to the **CONFIGURE TEST** window (Fig. 4.4.1\_2).

### Configure test items 1xEVDO TX CONDUCTED SPURIOUS EMISSIONS:

- 1) Double-click **1xEVDO TX CONDUCTED SPURIOUS EMISSIONS** in the list of selected test items.

The window **1xEVDO TX CONDUCTED SPURIOUS EMISSIONS** appears (see Fig. 4.4.1\_4).

fmin / MHz	fmax / MHz	RBW / kHz	Limit / dBm	On/Off
0.885	1.98	30	-32	<input checked="" type="checkbox"/>
1.25	4	30	-13	<input type="checkbox"/>
1.98	4	30	-44	<input checked="" type="checkbox"/>
2.25	4	6.25	-35	<input type="checkbox"/>
0.009	0.15	1	-13	<input checked="" type="checkbox"/>
0.15	30	10	-13	<input checked="" type="checkbox"/>
30	1000	100	-13	<input checked="" type="checkbox"/>
1000	5000	1000	-13	<input checked="" type="checkbox"/>
0.885	1.12	30	-43	<input type="checkbox"/>
1.12	1.98	30	-57	<input type="checkbox"/>
1.98	4	30	-72	<input type="checkbox"/>
4	10	100	-51	<input type="checkbox"/>

Fig. 4.4.1\_4: Setup example for 1xEV-DO TX conducted spurious emissions.

Depending on **BAND CLASS** and **ITU CATEGORY** the parameters **FMIN**, **FMAX**, **RBW** and **LIMIT** are changed according to the IS-866-A specification. In case one or more these parameters are modified the **USER DEFINED** indicator is checked.

### Listed below are some of the remaining parameters:

- 2) **TX LEVEL** – specified AT output RF level.
- 3) **CMU ATTEN** – compensates level loss from CMU to AT.
- 4) **FSx ATTEN** – compensates level loss from AT to analyzer.
- 5) **AUX DEVICE** – Auxilliary Device of the analyzer need by CMUgo.
- 6) Add a **DESCRIPTION** if you like.
- 7) Click **OK** to return to the **CONFIGURE TEST** window (Fig. 4.4.1\_2).
- 8) Configure the next test item, e.g. BC2.
- 9) If necessary, create your own sequence.

You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 4.4.1\_2).

- 10) Finally click **OK** (in the **CONFIGURE TEST** window) to complete the measurement setup.

## To start the measurement:

- Click the start icon in the menu bar of CMUgo (see Fig. 3.5.2\_7).

## Test description and measurement report:

When the basic initialization is completed, the specified sections of the spectrum are scanned one after the other. For each section scanned, the maximum measured value is stored in CMUgo. Once all test steps have been completed, you get a display similar to Fig. 4.4.1\_5.



Fig. 4.4.1\_5: Test result for TX conducted spurious emissions.

Measurement values that are below the limits are displayed in green; those which exceed the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. To repeat a test sequence, click the start button again (Fig. 3.5.2\_9). If your mobile station supports more than one band class, change the configurations accordingly and start the test sequence again.

### 4.4.3 Occupied Bandwidth

The occupied bandwidth (OBW) is defined as the frequency range, where the fractions of the total radiated power of a modulated carrier above and below the edge frequency are 0.5 % each, averaged over the frequency. The occupied bandwidth is measured directly by the OBW procedure of the analyzer's firmware. The purpose of test 4.4.3 is to verify that the OBW of the mobile station does not exceed 1.48 MHz for SR 1, nor 4.6 MHz for SR 3. This test is applicable to BC 3 and 6 mobile stations only.

#### Recommended test setup:

Fig. 4.4.3\_1 shows the test setup for the occupied bandwidth test. It is the same setup that is used for test 4.4.1. The RF ports of the Radio Communication Tester CMU200 and the mobile station under test are connected by means of a resistive combiner. During the test, a call is set up to the mobile station and a connection is established by the CMU using this path. In addition, a spectrum analyzer is coupled in to measure the OBW. The resistive combiner ensures a flat frequency response. Both the CMU and the spectrum analyzer are remote-controlled by CMUgo to run the test automatically.

#### Instruments and accessories:

- CMU200, FSQ, FSU, or FSP, or FSL
- Resistive combiner (recommended: Weinschel 1515-1, DC to 12.75 GHz)

#### Path loss compensation:

(see previous section)

- Measure the path loss between the AT and the CMU200
- Measure the path loss between the AT and the spectrum analyzer

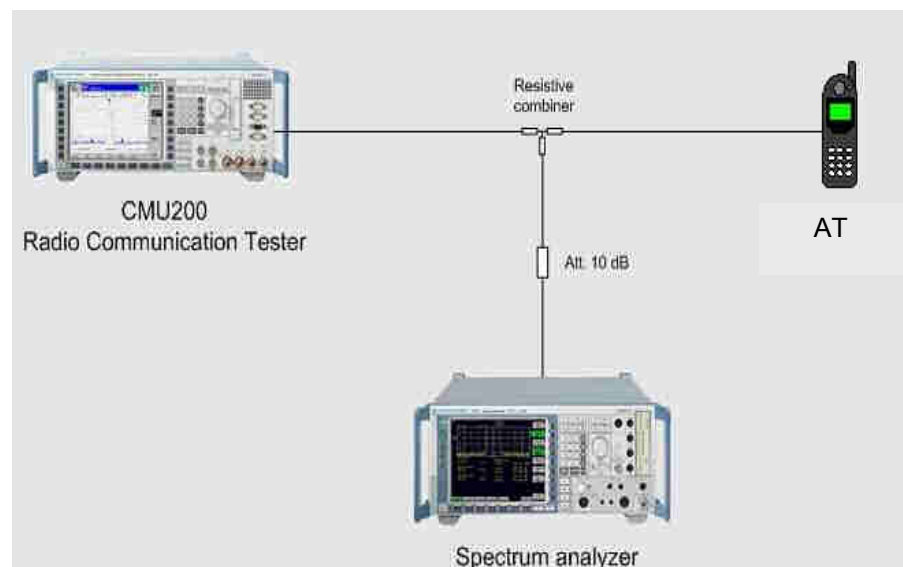


Fig. 4.4.3\_1: Test setup for occupied bandwidth test.

### Test procedure:

- 1) Connect instruments and mobile station as shown in Fig. 4.4.3\_1.
- 2) Run CMUgo, and then click *Configuration, Configure Tests*.  
The *Configure Test* window opens.
- 3) Click *Load Sequence*, and select *CDMA2000\_4.4.3.seq*.

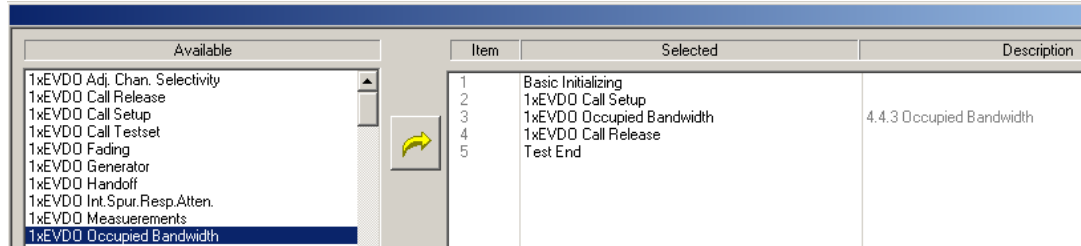


Fig. 4.4.3\_2: Available and selected test items (test sequence) for occupied bandwidth.

### Check Basic Initializing

Check the 1xEV-DO The predefined sequence uses BC3. If you work with BC6, activate 1xEV-DO IMT2K Band (see table 4.4.3\_3).

BC3	1xEV-DO Cellular Band	CMU-K849 option
BC6	1xEV-DO IMT2K Band	CMU-K869 option

Table 4.4.3\_1: Band classes and function groups.



### Configure test item **1xEVDO CALL SETUP**:

- 1) Double-click **1xEVDO CALL SETUP** in the list of the selected test items.

The window **1xEVDO CALL SETUP** opens.

The screenshot shows the '1 x EVDO Call Setup' dialog box. It is divided into several sections: 'Network' (Network Standard: IMT-2000 (BC6), Release 0/Release A), 'Parameter' (SID: 1), 'AN Signal' (RF Channel: 150, Tx Level (dBm): -70, Forward Packet Activity: 100 %), 'Mac Index (Rev 0): 8', 'MAC Index (Rev A): 8', 'UE Identification Mode' (ESN/MEID/UATI, Decimal conversion of the reported ESN, Hide the ident in reports), 'Shortcut Extension Mode ...', 'Sector Color Code: 0', 'AN PN Offset: 0', 'RF' (CMU Connector: RF1/RF2, Attenuation In (dB): 1, Attenuation Out (dB): 1, Skip Positioning Dialog, No Message to Power Cycle the Mobile), 'Layer' (Subtype 0 (Physical Layer)), 'Test Applications' (Stream Number: 1), 'Forward TAP' (Forward TAP checked, DRC Rate Index: 1), 'Reverse TAP' (Reverse TAP unchecked, Min Rate Index: 1, Max Rate Index: 1), 'MAC Layer' (Control Channel Data Rate: 38400 bps (MAC3)), 'DRC' (Data Nominal Offset (dB): 0, Data Offset for 9.6 kbps (dB): 0, Data Offset for 19.2 kbps (dB): 0, Data Offset for 38.4 kbps (dB): 0, Data Offset for 76.8 kbps (dB): 0, Data Offset for 153.6 kbps (dB): 0), 'Maximum Time for Session Open State (Sec.): 30', and 'activate Check'. There are 'OK' and 'Cancel' buttons on the right.

Fig. 4.4.3\_3: Call setup configuration for occupied bandwidth.

The occupied bandwidth test is applicable to BC 3 or BC 6 mobile stations only.

- 2) Select your band class at **NETWORK STANDARD**.
- 3) Select the **FORWARD PACKET ACTIVITY** as specified.
- 4) Select the **LAYER** Subtype 0 or 1.
- 5) Enter a channel number for the call setup at **PHYSICAL RF CHANNEL**.
- 6) Enter the path loss you measured between the AT and the CMU200 as **INPUT ATTENUATION** and **OUTPUT ATTENUATION**.

Modify the other parameters if necessary.

- 7) Click **OK** to return to the **CONFIGURE TEST** window (Fig. 4.4.3\_2):

### Configure test item **1xEVDO OCCUPIED BANDWIDTH**:

- 1) Double-click **1xEVDO OCCUPIED BANDWIDTH** in the list of the selected test items.

The window **1xEVDO OCCUPIED BANDWIDTH CONFIGURATION** appears (see Fig. 4.4.3\_4).

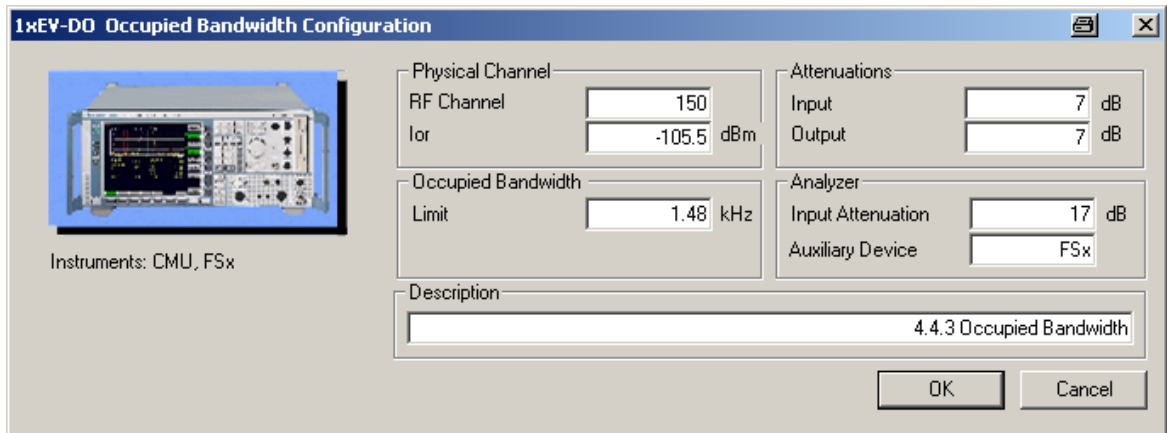


Fig. 4.4.3\_4: Setup for CDMA2000® 1xEV-DO occupied bandwidth test.

- 1) Enter a channel number at **PHYSICAL RF CHANNEL**.
- 2) Enter the path loss you measured between the AT and the CMU200 as **INPUT** and **OUTPUT ATTENUATIONS**.
- 3) Enter the path loss you measured between the AT and the analyzer as **INPUT ATTENUATION** in the Analyzer field.
- 4) Enter as **AUXILIARY DEVICE NAME** the name you specified for the generator's GPIB configuration (see section **CONFIGURING THE GPIB SETTINGS** on page 6).
- 5) Add a **DESCRIPTION** if you like.
- 6) Click **OK** to return to the **CONFIGURE TEST** window (Fig. 4.4.3\_2).
- 7) Configure another item. If necessary, create your own sequence.  
You may want to store your sequence. Use the button **SAVE SEQUENCE** in the **CONFIGURE TEST** window (see Fig. 4.4.3\_2).
- 8) Clicking **OK** (in the **CONFIGURE TEST** window) completes the measurement setup.

### To start the measurement:

- Click the start icon in the menu bar of CMUgo (see Fig. 3.5.2\_7).

## Test description and measurement report:

When the basic initialization is completed, a pop-up menu instructs you to **SWITCH ON THE MOBILE**. Ignore this message if it is already powered up. After the individual response time of the AT, the CMU200 automatically registers the mobile station and sets up a call connection. The pop-up menu disappears when the call is established. Then the analyzer is set to the center frequency of the assigned channel, and the section that contains 99 % of the total power is evaluated. You get a display similar to Fig. 4.4.3\_5.

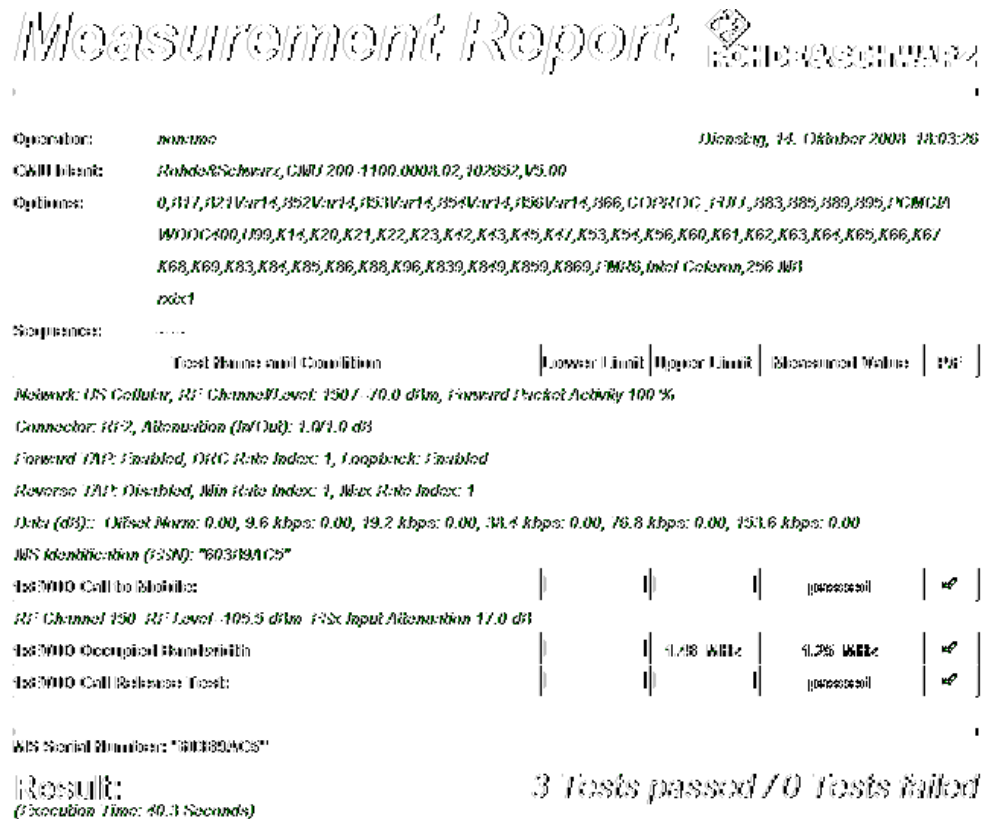


Fig. 4.4.3\_5: Test result for occupied bandwidth

Measurement values that are below the limits are displayed in green; those which exceed the limits are displayed in red. In addition, the right-hand column (P/F, for Pass/Fail) indicates whether a test was passed or failed. To repeat a test sequence, click the start button again (Fig. 3.2.2\_9).

## **5 Summary**

The program CMUgo has been enhanced by adding new test items for the CDMA2000® 1xEV-DO standard IS-866-A. For seven tests of IS-866-A predefined test sequences are included to provide a basic parameter setting which can easily be adapted to an individual test scenario. These tests use the Radio Communication Tester CMU200 together with other instruments such as signal generators and spectrum analyzers. For each of the tests mentioned above, the Application Note 1MA123 gives a short overview of the test itself, a recommended hardware setup, predefined test sequences, and step-by-step instructions on how to perform this test using the CMUgo software, and, finally, measurement results obtained with these predefined sequences.

For comments and suggestions to this Application Note, please contact  
[TM-Applications@rohde-schwarz.com](mailto:TM-Applications@rohde-schwarz.com).

## **6 References**

- [1] Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Terminal, IS-866-A
- [2] Additional Tests on CDMA200 Mobile Stations in Accordance with Standard TIA-98, Application Note 1MA86, Rohde & Schwarz, 2006

## 7 Ordering Information

### Universal Radio Communication Testers

R&S® CMU200		1100.0008.02
R&S® CMU-B83v22	1xEV-DO Signalling Module	1150.0301.xx
R&S® CMU-B89	1xEV-DO Signalling Module	1159.3090.02
R&S® CMU-K839	1xEV-DO Signalling, 450 MHz Band	1200.8300.02
R&S® CMU-K849	1xEV-DO Signalling, Cellular Band	1200.8400.02
R&S® CMU-K859	1xEV-DO Signalling, PCS Band	1200.8500.02
R&S® CMU-K869	1xEV-DO Signalling, IMT-2000 Band	1200.8600.02
or		
R&S® CMU-PK800	1xEV-DO Signalling, all bands	1200.8600.02
R&S® CMU-B17 <sup>1)</sup>	I/Q-IF Interface	1100.6906.02
R&S® CMU-Z10	Antenna Coupler for Mobile Phones	1150.0801.10
R&S® CMU-Z11	Shielded Cover for CMU-Z10	1150.1008.02

### Vector Signal Generators

R&S® SMU200A	Vector Signal Generator	1141.2005.02
R&S® SMU-B10x	RF Path A: 100 kHz to 6 GHz	1141.8x03.02
R&S® SMU-B13 <sup>1)</sup>	Baseband Main Module	1141.8003.04
R&S® SMU-B14 <sup>1)</sup>	Fading Simulator (SMU-B13 required)	1160.1800.02
R&S® SMU-B15 <sup>1)</sup>	Fading Simulator extension (AMU-B14 requ.)	1160.2288.02
R&S® SMJ100A	Vector Signal Generator	1403.4507.02
R&S® SMJ-B10x	Frequency Range 100 kHz to 6 GHz	1403.8x02.02

### Fading Simulators

R&S® AMU200A <sup>1)</sup>	Baseband Signal Generator	1402.4090.02
R&S® AMU-B13 <sup>1)</sup>	Baseband main module (factory fit only)	1402.5500.02
R&S® AMU-B14 <sup>1)</sup>	Fading Simulator (AMU-B13 required)	1402.5600.02
R&S® AMU-B15 <sup>1)</sup>	Fading Simulator extension (AMU-B14 requ.)	1402.5700.02

### Signal Generators

R&S® SMR20	1 GHz to 20 GHz	1104.0002.20
R&S® SMR-B11	0.01 GHz to 1 GHz	1104.4250.02
R&S® SMP02	2 GHz to 20 GHz	1035.5005.02
R&S® SMP-B11	0.01 GHz to 1 GHz	1036.6240.02
R&S® SML0x	9 kHz to 2.2 GHz	1090.3000.1x

### Signal Analyzers, Spectrum Analyzers and Options

R&S® FSPxx	9 kHz to 40 GHz	1093.4495.xx
R&S® FSQxx	20 Hz to 26,5 GHz	1155.5001.xx
R&S® FSUxx	20 Hz to 46 GHz	1166.1660.xx
R&S® FSMRxx	20 Hz to 50 GHz	1166.33.11.xx
R&S® FSLx	Spectrum Analyzer 6 GHz	1300.2502.0x
R&S® FSL-B22	RF Preamplifier	1300.5953.02
R&S® FSQ-K85 <sup>2)</sup>	1xEV-DO mobile station test application firmware for FSMR, FSP, FSQ, FSU	1300.6689.02

1) required for 3.3.2 Multipath Fading test.

2) required for 4.4.3 Occupied Bandwidth test



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