IS-136

Products: CMD80, CMD-B84, SMIQ

BER Measurements on IS-136 Signals under Fading Conditions

Application Note

This application note describes how bit error measurements under fading conditions on the digital traffic channel can be carried out simply and cost-effectively by using the CMD80 Digital Radiocommunication Tester and the SMIQ Signal Generator.

ROHDE & SCHWARZ

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1 Overview

Use bit error measurements under fading conditions to evaluate the reception of mobiles in simulated propagation. The IS-136 standard stipulates measurements on mobile phones with Rayleigh fading at speeds of 8, 50 and 100 km/h. Combining a CMD80 Digital Radiocommunication Tester equipped for IS-136 and the I/Q Mod. Output option, and a SMIQ Signal Generator with fading option, Bit error measurements can easily be performed on the digital traffic channel.

2 Principle of Operation

Two RF channels are normally provided for a digital radio link by IS-136: the digital control channel (DCCH) and digital traffic channel (DTC). Like a real base station, the CMD80 provides both channels.

The forward faded DTC signal is not formed from the RF output signal of the CMD80 but is fully processed in the SMIQ Signal Generator. The corresponding CMD80 signal is no longer required.

SMIQ is modulated with the baseband I and Q signals supplied from the CMD80 by option CMD-B17.

With the SMIQB14 Fading Simulator, multipath profiles with up to 6 independent paths can individually be configured using the signal generator. For NADC, suitable profiles with two paths at the required three speeds are already regarded as standard. For receiver measurements complying with IS-137A / section 2.3.2.1 it is sufficient to deactivate a path in the corresponding setting.

Additionally, you can impose an adjustable noise signal upon the multipath carriers using the SMIQ option NDSIM (Noise Generator and Distortion Simulator). See application note 1MA05 for details.

To perform the BER measurement, the mobile station to be tested is switched to the correct operating mode via a remote-control connector, the DCCH channel of the CMD80 is not required. The two TX signals from the CMD80 are removed from of the test path as described in the following..
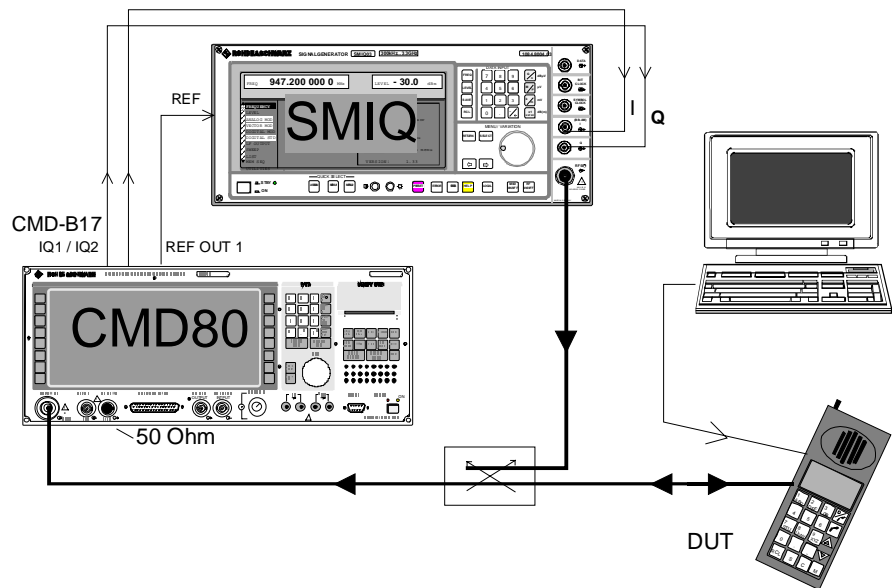
3 Connecting the Instruments

Fig. 1:   Test setup

A directional coupler is inserted into the RF path between the and the faded DTC signal generated by SMIQ CMD80 and the DUT. Take the insertion loss of this path into consideration when setting the SMIQ output level.

Using the CMD80 configuration described below, the RF output signals from the CMD80 are taken to connector RF OUT2, where a 50 Ω termination is provided. The path between the directional coupler and CMD80 only carries the transmit signal of the mobile station to the tester.

Connect I, Q and 10 MHz connectors of the CMD80 and the SMIQ as shown.

To carry out bit error measurements a loop has to be completed from the receive to the transmit path in the mobile. This is done by a (manufacturer-specific) remote control unit shown as a PC in Fig. 1.

➢ Connect the RF paths as shown in Fig. 1. Note that the DUT is not yet to be connected. Use well-shielded cables.

➢ Terminate connector RF OUT2 with 50 Ω.

➢ For 800 MHz systems connect the I input of SMIQ with IQ2 of CMD80 and the Q input with IQ1. For 1900 MHz systems the reverse order applies. I and Q cables must be the same length.

➢ Connect connector REF OUT 1 from the CMD80 with connector REF from the SMIQ.

➢ Connect your remote-control unit to the DUT.

4 Presettings

Presettings on the CMD80

The CMD80 is operated in the same way as for measurements without fading conditions. The only difference is that the TX signals from the CMD80 are taken to a termination at connector RF OUT2. The default configuration of the unit after Reset is the starting point.

➢ Press **RESET** (hardkey), **ALL DATA**

➢ Select **NETWORK, IS-136**,

➢ Select **CONFIG MENU**,

RF CONNECT, EXT ATTEN, RF IN / RF OUT2

➢ Go back to main menu with

MENU HOME

➢ Press **MODULE TEST**

The CMD80 now generates an IS-136 signal with the I/Q signals for the DTC output at connectors IQ1 and IQ2.

➢ If required, modify RF CHANNEL number.

➢ Evaluate the transmit frequency of TRAFFIC CHANNEL from the channel number N set on the CMD80 according to the following formulae:

For 800 MHz systems:

Channels 1 to 799 f = 870 MHz + (N * 0.03 MHz)

Channels 990 to 1023 f = 870 MHz + ((N – 1023) * 0.03 MHz)

For 1800 MHz- systems:

f = 1930.02 MHz + (N * 0.03 MHz)

Presettings on SMIQ

Start from the default setting of the SMIQ

➢ Press   **PRESET**

➢ Select   **UTILITIES, REF OSC, SOURCE, EXT**

➢ Set the frequency calculated from the channel number.

➢ **FREQUENCY**
> eg. 881.01 MHz for Channel 367

➢ Temporarily set the level to –30 dBm.

> **LEVEL -30 dBm**

➢ Switch on vector modulation.

> **VECTOR MOD, STATE, ON**

An IS-136-DTC signal (without ramps) is now available at the test connector.

➢ Set the fading profile you are planning to use.

> **FADING SIM, STANDARD,** z.B. **IS-136**

Do not yet activate fading.

5   System Calibration

With the above settings an IS-136 traffic signal (without ramps) is generated through the test setup.

Now measure the level at the DUT connector. Use a broadband power meter with rms display (R&S recommendation: NRVS with Power Sensor NRV-Z4).

Example:	level measured at DUT connector::	-43.2 dBm
	set level at SMIQ:	-30 dBm
	Difference:	13.2 dB

➢ Enter as an offset the difference between the measured value at the DUT connector and SMIQ level in the level window into the level submenu:

> **LEVEL, LEVEL, OFFSET** eg**. 13.2 dB**

The SMIQ level is increased so that the attenuation loses in the test setup are fully compensated for.
(The level at the SMIQ output is displayed in the SMIQ level window)

From now on enter levels (without conversions) as specified in test regulations into the Level submenu only:

> **LEVEL, LEVEL, AMPLITUDE** eg. **– 103 dBm**

6 Measurement

The bit error measurement with the configuration described is performed in the same way as the measurement without the SMIQ. The level and fading profile must be set on the SMIQ. Since the remote control of a mobile varies depending on the manufacturer, the test procedure cannot be described in all details.

➢ Connect DUT to test point and switch on.

➢ Program the frequency, slot and level for the mobile on your remote-control unit.

➢ Activate loop mode in the mobile.

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➢ Press **RECEIVER QUALITY** key at the CMD80, as Bit error measurements are receiver measurements
The **MODULE TEST RX QUAL** menu of the CMD80 will be displayed.

➢ Specify your test parameters on the CMD80.

➢ Set your test level on the SMIQ.

➢ Activate fading in SMIQ using **FADING SIM, STATE ON**.

➢ Start the bit error measurement.

7 Literature

IS-136, IS-137 A

Lüttich, F.: Fading Simulator and Signal Generator in One Unit. News from Rohde & Schwarz No 155, p. 9

8   Ordering Information

Digital Radiocommunication Tester

CMD80		1050.9008.84

Options for CMD80

CMD-B84	IS-136 Extension	1059.5806.02
CMD-B17	I/Q-Mod. Output	1099.3003.02
CMD-B82	Analog Extension	1059.4344.12
CMD-K1	CDMA Cellular Extension (800 MHz)	1082.2550.02
CMD-K2	CDMA Cellular Extension (1800 / 1900 MHz)	1082.2650.02

Signal Generator

SMIQ02	300 kHz to 2.2 GHz	1084.8004.02

Options for SMIQ02

SMIQB14	Fading Simulator (6 paths)	1085.4002.02
SMIQB17	NDSIM	1104.9000.02

Power Meter (single channel)

NRVS		1020.1809.02

Options for NRVS

Power Sensor (50 Ω)	NRV-Z4	0828.3618.02

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