



# **BER Measurements on DECT Receivers under Conditions of Fading**

Application Note 1MA03\_1E

## Products:

Signal Generator SMIQ  
Radiocommunication Tester Digital CMD60/65

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## 1. Overview

Measurements on DECT receivers under conditions of fading (multipath reception) furnish important information about the receiver quality. The combination of a Digital Radiocommunication Tester CMD60/65 and a Signal Generator SMIQ allows simple performance of these measurements on DECT portable and fixed radio terminations.

Note that fading simulation for SMIQ has a basic delay of ca. 6.5  $\mu$ s. The DECT radio termination (PT) must compensate for this time difference.

## 2. Principle of Operation

DECT portable radio termination (PT) or DECT fixed radio termination (FT) are connected to the CMD and operated as usual. The transmit signal of the CMD is however replaced by a signal from the SMIQ. For this purpose, signals for the modulation data, modulation clock and amplitude control of the signal are taken from the CMD and used for modulation of the SMIQ.

## 3. Test Setup

The digital signals required are derived from the rear-panel connector CONTROL IN/OUT on the CMD and applied to the PAR DATA connector of the SMIQ. Fig. 1 shows the connections to be made:

If the **SPECTRUM output** on the rear panel of the CMD is not used otherwise, the signal from the SMIQ may be directly fed into this output. The signal attenuated by 18 dB is then available at the front-panel connector RF IN / RF OUT of the CMD.

A directional coupler is not required in this case.

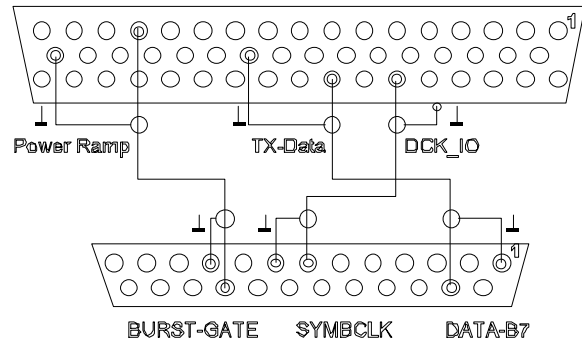


Fig. 1: Connections between CONTROL IN/OUT connector on CMD and PAR DATA connector on SMIQ (view of wiring side of pins)

**Without** use of the **SPECTRUM output** of the CMD, the RF signal from the SMIQ is taken to the DUT via a directional coupler with approx. 20 dB attenuation (Fig. 2). The attenuation of the directional coupler has to be taken into account when setting the SMIQ output level.

Note:

- The type of connection between CMD and SMIQ is uncritical. To avoid RF leakage however the connections should be as short as possible and shielded.
- All RF signals must be routed via low-loss coaxial cables with tight shielding. The cable loss must be taken into account in the level measurement.

## 4. Presettings

The **CMD** is preset according to the instructions in the CMD operating manual. Operation is the same as for measurements without fading conditions.

The RF LEVEL of the CMD must be set to a minimum level of -100 dBm.

Based on a **Preset**, the following settings have to be made on the **SMIQ**:

|           |   |
|-----------|---|
| PRESET    |   |
| Frequency | 1897.344 MHz                                |
|           | RF frequency of channel number 0 (Table 1). |
| Level     | -40 dBm                                     |

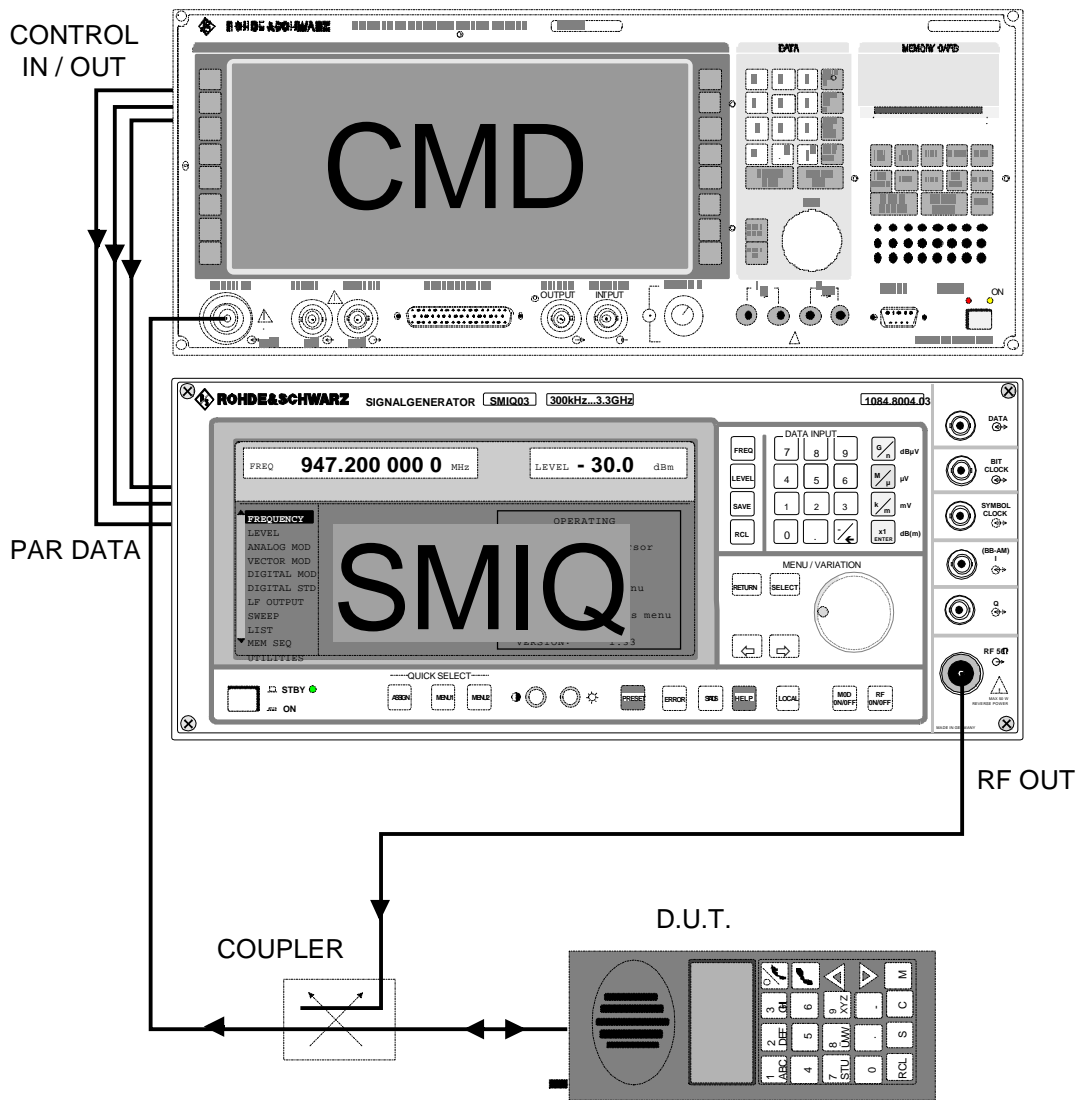


Fig. 2: Test setup with directional coupler and without use of SPECTRUM output of CMD

|             |          |             |
|-------------|----------|-------------|
| DIGITAL MOD | STATE    | OFF *)      |
|             | SOURCE   | EXT_PAR     |
|             | SELECTED | DECT        |
|             | STANDARD |             |
|             | POWER    | EXT_DIGITAL |
|             | RAMP     |             |
|             | CONTROL  |             |
|             | STATE    | ON *)       |

\*) The digital modulation must first be switched off in the DIGITAL MOD menu by means of STATE OFF. This is to avoid error messages during setting of the SMIQ.

## 5. DECT Fading Tests

For DECT measurements, fading tests can usually be simplified to a certain extent, eg for the simulation of the last kilometer between transmitter and receiver. It can be assumed for instance that the DECT portable radio termination (PT) is at a fixed position. Movements of the PT can therefore be neglected. In this case the speed parameters in the FADING SIMULATION menu of the SMIQ can be set to 0.

## 6. Measurement

First the DECT PT or the DECT FT must be switched to the test mode. The loopback that is required for the BER measurement is only provided in the test mode with DECT.

The frequency of the SMIQ is set to the desired TRAFFIC CARRIER in the FREQUENCY menu. The assignment of channel number and RF frequency is shown in the following table.

| Channel number | RF frequency |
|----------------|--------------|
| 0              | 1897.344 MHz |
| 1              | 1895.616 MHz |
| 2              | 1893.888 MHz |
| 3              | 1892.160 MHz |
| 4              | 1890.432 MHz |
| 5              | 1888.704 MHz |
| 6              | 1886.976 MHz |
| 7              | 1885.248 MHz |
| 8              | 1883.520 MHz |
| 9              | 1881.792 MHz |

Table 1 RF frequency and channel number

DECT has not jet predefined standards for the fading simulation.

The following example for two paths fading (Fig. 3) can be adapted to any other simulations required.

The following settings have to be made in the FADING SIM menu of the SMIQ.

```
RESET *)
STANDARD *)
CONFIGURATION 1CH_6P or 1CH_12P **)
```

```
PATH          1          2
STATE         ON         ON
PROFILE       pDOPP      pDOPP
SPEED         0.0        0.0
PATH LOSS     0.0        8.0
DELAY         0.0        2.0
```

```
MODE ***)          RUN
```

\*) Default setting

\*\*\*) Setting depending on SMIQ options.

\*\*\*) Enable

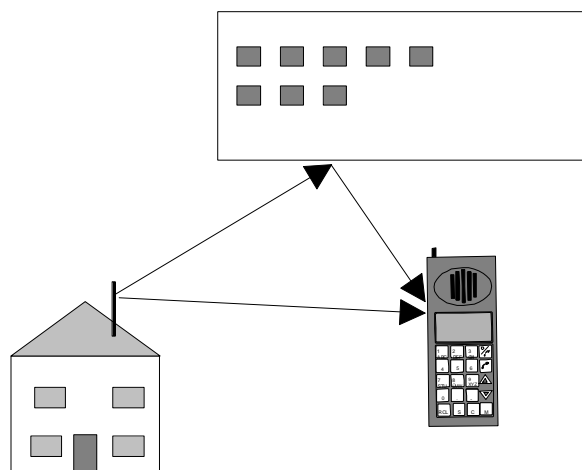


Fig. 3: Two paths fading

After the call setup, fading can be selected on the SMIQ and the receiver tested with a faded signal.

The bit error rate measurement is carried out on the CMD without fading. Channel switchover and level changes are however not made on the CMD but on the SMIQ.

## 7. Required Instruments and Options

The following instruments and options are required for the measurements:

- **Vector Signal Generator SMIQ:**  
Modulation Coder SMIQB10, Data Generator SMIQB11, Fading Simulator SMIQB14, Second Fading Simulator SMIQB15 (for 12 fading paths)
- **CMD60 or CMD65**

## 8. References

- Operating manuals of CMD60, CMD65, SMIQ.
- Franz Lüttich: Signal Generator SMIQ + SMIQ-B14, fading simulator and signal generator in one unit, News from Rohde & Schwarz No.155

## 9. Ordering Information

|   |         |              |
|---|---------|--------------|
| Vector Signal Generator   | SMIQ    | 1084.8004.02 |
| Modulation Coder  | SMIQB10 | 1085.5009.02 |
| Data Generator  | SMIQB11 | 1085.4502.02 |
| Fading Simulator  | SMIQB14 | 1085.4002.02 |
| Second Fading Simulator   | SMIQB15 | 1085.4402.02 |
| Digital Radiocommunication Tester for DECT                        | CMD60   | 1050.9008.60 |
| or<br>Digital Radiocommunication Tester for GSM, DCS1800 and DECT | CMD65   | 1050.9008.65 |



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