Technical Information

R&S® CBT-B55 and R&S® CBT-K55

EDR options for Bluetooth® Testers R&S® CBT and R&S® CBT32

The two EDR options R&S® CBT-B55 and R&S® CBT-K55 add a large number of RF tests for EDR DUTs to the Bluetooth®Testers R&S® CBT and R&S® CBT32. The available measurement parameters are based on the Bluetooth RF Test Specification 2.0+EDR.

- Bluetooth EDR TX and RX measurements in hopping and non-hopping mode
- Full support of the EDR loopback test mode
- Graphic display of the DEVM test traces
- Dirty transmitter for EDR packets in compliance with the Bluetooth RF Test Specification
- Very short measurement times for high throughput in production

Preliminary

ROHDE&SCHWARZ

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General

The Bluetooth Specification V2.0+EDR contains an expansion of the existing Bluetooth standards V1.1 and V1.2. Bluetooth devices that support enhanced data rate (EDR) functionality still use GFSK modulation (FM) in the packet header, but DPSK modulation (I/Q) is used within the payload. This is either differential QPSK modulation (π/4 DQPSK) or differential 8PSK modulation (8DPSK). The advantages of this new standard are a higher data transmission rate and lower power consumption. The latest version of the Bluetooth RF Test Specification V1.2/V2.0/V2.0+EDR has been expanded to include several test cases for EDR DUTs.

Signaling

Expanded test mode

The EDR options expand the existing test mode signaling of the base unit. The following additional EDR packet types are available both in the TX and loopback test modes:

- π/4 DQPSK-modulated packets:
  2-DH1, 2-DH3, 2-DH5
- 8PSK-modulated packets:
  3-DH1, 3-DH3, 3-DH5

TX measurements

The current measurement values for each parameter are displayed on the R&S® CBT screen. Additionally, average, maximum and minimum values are displayed as a result of a statistical evaluation of a settable number of Bluetooth packets (bursts).
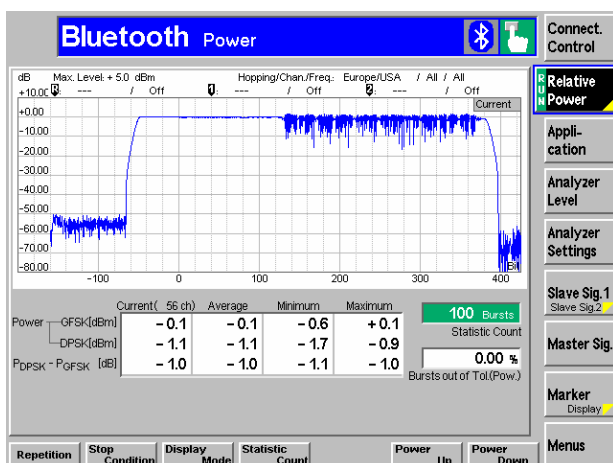

EDR relative power

To measure the power of EDR packets, the R&S® CBT determines the average power within the GFSK portion as well as within the DPSK portion of an EDR packet.

Measurement parameters:

- P_{GFSK} (measured from bit 0 to the last bit of the packet header)
- P_{DPSK} (measured from the first bit of the synchronization sequence to the last bit of the packet – excluding trailer bits)
- $P_{DPSK} - P_{GFSK}$ (difference should be between -4 dB and +1 dB)

The power control functionality is also available for EDR packets.
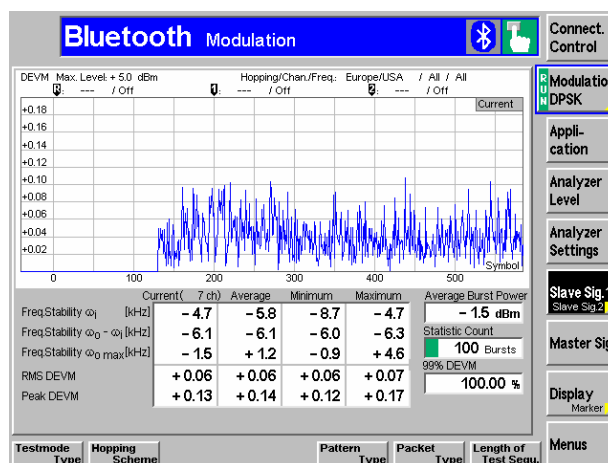

EDR carrier stability and modulation accuracy

To perform these measurements, a Bluetooth packet is first divided into the GFSK portion (packet header) and multiple blocks, each containing 50 symbols of the DPSK portion (payload).

Measurement parameters:

- Carrier frequency stability (ω_i)
  The R&S® CBT determines the average frequency within the GFSK portion of a packet. The result ω_i is the difference between the average frequency and the expected frequency.
- Carrier frequency stability ($\omega_{0\,max}$)
  The R&S® CBT determines the average frequencies (ω_0) for each block of the DPSK portion relative to the average frequency within the GFSK portion, and displays the largest of the measured ω_0 values.

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- RMS DEVM
  The R&S® CBT measures the differential error vector magnitude (DEVM) for all 50 symbols of a block. It then calculates the RMS value for each block and displays the largest value.
- Peak DEVM
  The R&S® CBT determines the peak DEVM value by analyzing the individual symbols of all blocks.
- 99% DEVM
  The R&S® CBT displays the percentage of measured symbols whose DEVM value is at or below an adjustable threshold.
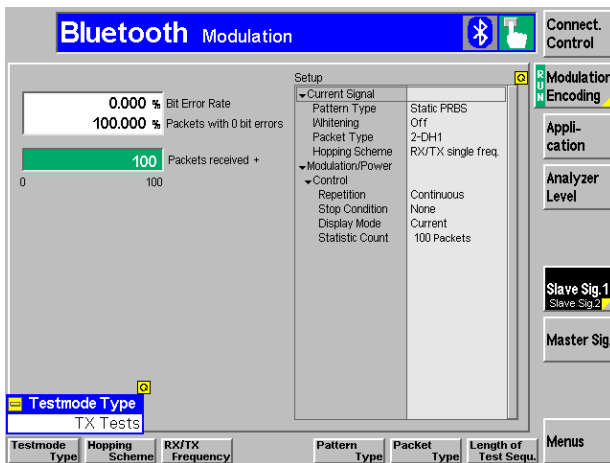
EDR differential phase encoding

This measurement checks whether the EDR encoder in the DUT is functioning properly. This is done using a BER measurement in the TX test mode. The DUT sends a predefined bit sequence to the R&S® CBT, which then compares the received bits with the expected bits.

Measurement parameters:
- BER (percentage of bit errors that have occurred within the current statistical cycle).
- Packets with 0 bit errors (percentage within the current statistical cycle).

RX measurements

When the EDR option is added, the Receiver Quality measurement menu offers the EDR packet types 2-DH1, 2-DH3 and 2-DH5 as well as 3-DH1, 3-DH3 and 3-DH5, in addition to the existing support for Basic Rate packets (DH1, DH3, DH5). The built-in EDR signal generator generates a selectable bit sequence, which is looped back in the DUT and demodulated and processed by the R&S® CBT again. The TX level of the R&S® CBT can be adjusted for this measurement.

EDR sensitivity/floor performance
Measurement parameters:
- BER (percentage of bit errors that have occurred within the current statistical cycle).
- BER search function (sensitivity level for a predefined BER level).
- PER (percentage of packet errors that have occurred within the current statistical cycle).

Dirty transmitter for EDR
For BER tests on Bluetooth EDR packets, the latest Bluetooth RF Test Specification stipulates the use of a dirty transmitter (dirty TX) with parameters specially adapted for EDR packets.

Every 20 ms, the dirty TX changes the frequency offset and symbol timing error. A table in the specification describes three different value combinations of these two parameters, which are used one after the other. The dirty TX additionally superimposes a defined frequency drift on its output signal; the frequency drift phase varies by 180° from packet to packet.

The new dirty TX can also be used in the operating modes already provided by the base unit:

- Dynamic dirty TX using the value table from the specification; drift superimposition switched on.
- Dynamic dirty TX using a user-defined value table; drift superimposition either on or off.
- Static dirty TX; the values for frequency offset and symbol timing error can be set in any combination with respect to each other; drift superimposition either on or off.

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Bluetooth RF test cases

When the EDR options are implemented, the R&S® CBT and R&S® CBT32 can be used to evaluate the following Bluetooth test purposes in accordance with the Bluetooth RF Test Specification V2.0+EDR:

- TRM/CA/01/C (output power)
- TRM/CA/03/C (power control)
- TRM/CA/05/C (TX output spectrum with 20 dB bandwidth)
- TRM/CA/06/C (TX output spectrum – adjacent channel power)
- TRM/CA/07/C (modulation characteristics)
- TRM/CA/08/C (initial carrier frequency tolerance)
- TRM/CA/09/C (carrier frequency drift)
- TRM/CA/10/C (EDR relative transmit power)
- TRM/CA/11/C (EDR carrier frequency stability and modulation accuracy)
- TRM/CA/12/C (EDR differential phase encoding)
- RCV/CA/01/C (sensitivity – single-slot packets)
- RCV/CA/02/C (sensitivity – multislot packets)
- RCV/CA/06/C (maximum input level)
- RCV/CA/07/C (EDR sensitivity)
- RCV/CA/08/C (EDR BER floor performance)
- RCV/CA/10/C (EDR maximum input level)

R&S® CBTGo remote control software

R&S® CBTGo is a PC application software package for remote control of the R&S® CBT and R&S® CBT32. The software can be downloaded free-of-charge from the Rohde & Schwarz website. R&S® CBTGo enables you to perform the test cases listed above and also offers other valuable features for R&D and verification.

R&S® CBT Bluetooth tester with large display for R&D and production

R&S® CBT32 Bluetooth tester: low-cost rack version of the R&S® CBT with same features but without display

Ordering information

Bluetooth® Tester with display, four HU	R&S CBT	1153.9000.35
Bluetooth® Tester without display 19", two HU, for remote control	R&S CBT32	1153.9000.32
Hardware Option for R&S® CBT/R&S® CBT32 EDR Extension (ex factory only)	CBT-B55	1170.3006.02
Hardware Upgrade Kit for R&S® CBT/R&S® CBT32 EDR Extension	CBT-U55	1170.3106.02
Software Option for R&S® CBT/R&S® CBT32 Enhanced Data Rate (EDR)	CBT-K55	1170.3206.02

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