

With the new Bluetooth® standard V2.0 + EDR (enhanced data rate), you can use I/Q modulation methods for Bluetooth® packets. For the RF Testers R&S® CBT and R&S® CBT32, Rohde & Schwarz now offers an option to carry out transmitter and receiver measurements on EDR Bluetooth® devices and modules. The option supports the loopback test mode and, owing to the very high measurement speed, yields a high throughput in production.

Bluetooth® RF Testers R&S® CBT / R&S® CBT32

Transmitter and receiver measurements for Bluetooth® V2.0 + EDR

New comprehensive measurement requirements

The new Bluetooth® standard V2.0 + EDR (see box on page 18) offers a data transmission rate up to three times as high as that of the previous standards V1.1 and V1.2. The higher data rate is obtained through $\pi/4$ -DQPSK or 8DPSK I/Q modulation for the payload of Bluetooth® packets. The header of an EDR Bluetooth® packet continues to be GFSK-modulated. Using two modulation methods within one Bluetooth® packet is a real challenge for RF design engineers and calls for flexible and versatile measuring instruments. The production lines for Bluetooth® modules or devices now require measuring instruments that, in addition to previous tests, are also able

to measure the relevant EDR parameters in next to no time. The Bluetooth® RF Testers R&S® CBT and R&S® CBT32 (in short R&S® CBT) in combination with the new EDR option are ideal for meeting these requirements.

Measuring the new EDR RF test cases

The Bluetooth® RF test specifications V1.2 / 2.0 / 2.0 + EDR comprise a total of eight new test cases for measurements with EDR Bluetooth® packets:

Transmitter measurements

- ◆ 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)
- ◆ TRM/CA/13/C (EDR inband spurious emissions)

Receiver measurements

- ◆ RCV/CA/07/C (EDR sensitivity)
- ◆ RCV/CA/08/C (EDR BER floor performance)
- ◆ RCV/CA/09/C (EDR C/I performance)
- ◆ RCV/CA/10/C (EDR maximum input level)

The R&S®CBT with EDR option can evaluate seven of these new test cases. An additional external signal generator is required for measuring the C/I performance.

New EDR transmitter measurements

To carry out the four new EDR transmitter measurements, the R&S®CBT with EDR option offers four additional measurement menus that directly display the results stipulated by the RF test specification:

Relative transmit power

Evaluates the power difference between the GFSK portion and the DPSK portion of an EDR packet. The power difference must be within a certain tolerance range (FIG 1).

Carrier frequency stability and modulation accuracy

Measures the frequency accuracy within the packet header and the frequency drift within the DPSK-modulated payload, and calculates various DEVM results (DEVM = delta error vector magnitude). The R&S®CBT displays the current DEVM results versus time as a graph with the high updating rate known from the base unit (FIG 2). You can perform all measurements on individual frequencies or in the frequency

hopping mode and thus quickly find RF channels with a critical DUT behavior in the laboratory. Since the EDR packets use differential PSK modulation methods, only differential EVM measurements provide information on signal quality. EVM measurement results or the I/Q constellation diagram are not enough to assess signal quality.

Differential phase encoding

Tests the EDR encoder in the DUT. The R&S®CBT performs a BER measurement in the TX test mode. The DUT sends packets with a defined PRBS9 bit pattern, and the R&S®CBT compares the received bits with the expected ones. 99% of the received packets must be free of bit errors.

Inband spurious emissions

Adjacent channel power measurement (ACP) that only evaluates the DPSK portion of a Bluetooth® EDR packet. The menu in the R&S®CBT used for this measurement corresponds to the ACP measurement menu of the R&S®CBT base unit.

FIG 1 Relative power measurement of GFSK and DPSK portions of an EDR Bluetooth® packet.

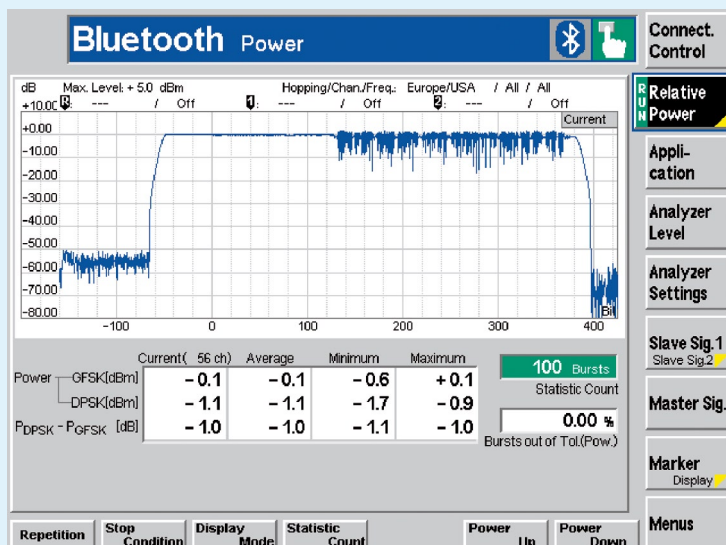
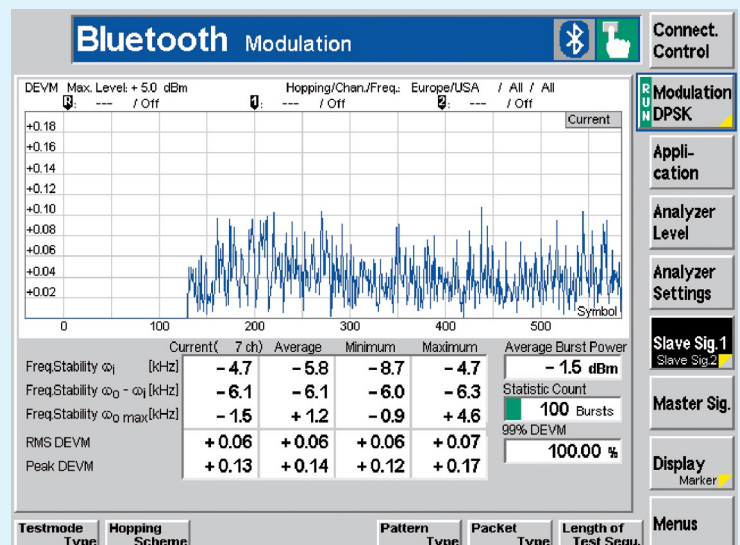


FIG 2 Graphical display of the DEVM characteristic within the payload of an EDR Bluetooth® packet.



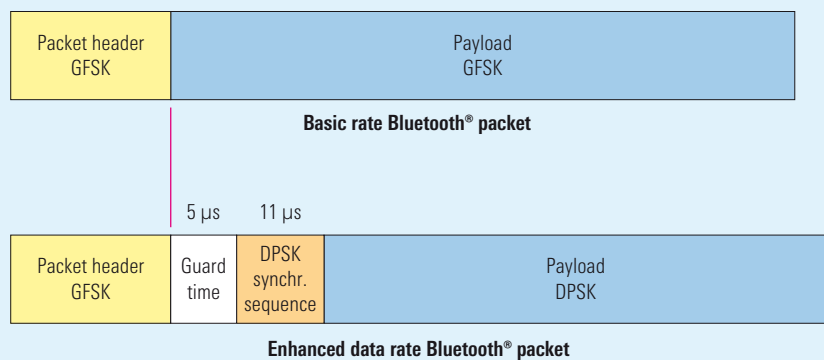
The new Bluetooth® standard V2.0 + EDR at a glance

The new Bluetooth® standard distinguishes between basic rate and enhanced data rate packets. Basic rate packets are already known from the standards V1.1 and V1.2. The additional EDR packets use the same packet header as basic rate packets (GFSK modulation) but transmit the payload by using DPSK modulation ($\pi/4$ -DQPSK or 8DPSK). The Bluetooth® transmitter must therefore be able to switch over from GFSK to DPSK modulation within 5 μ s.

The DPSK modulation of the EDR packets yields a data transmission rate that is up to three times as high as that of basic rate packets. The Bluetooth® technology thus opens up new applications,

e.g. the uncompressed transmission of CD audio signals. When EDR packets are used for all applications that do not require higher data rates, smaller packet

lengths are obtained. The power consumption is thus reduced, which is particularly important for battery-powered devices (e.g. Bluetooth® headsets).



- ▶ The R&S®CBT performs all EDR transmitter measurements with the very high measurement speed already known from the base unit. This not only allows fast working in the laboratory but is also particularly beneficial in production, since the testing time (and thus the costs for testing) can be reduced to a minimum.

Loopback test mode for EDR receiver measurements

To carry out the new EDR receiver measurements, the R&S®CBT supports the loopback test mode in accordance with Bluetooth® specification V2.0 + EDR. Proprietary solutions of the various chip manufacturers are no longer needed to evaluate the receiver sensitivity. The BER measurement menu of the R&S®CBT known from the base unit additionally allows you to set the new EDR packet types in combination with the EDR option. Moreover, the R&S®CBT

also includes the new dirty transmitter for EDR packets in accordance with the Bluetooth® RF test specification and offers various setting options for the different parameters of the dirty transmitter. This is particularly beneficial for laboratory tests.

evaluate the measurement results of all Bluetooth® channels and can graphically display their characteristic in a test report. R&S®CBTGo can be downloaded free of charge from the Rohde&Schwarz website.

Dieter Mahnken

R&S®CBTGo supports work in the laboratory

R&S®CBTGo is PC application software allowing remote control of the R&S®CBT and R&S®CBT32. You can thus very easily configure any desired test sequence. Running a test sequence generates a test report that can be stored or whose results can be processed in a spreadsheet. R&S®CBTGo supports the Bluetooth® test cases that can be performed with the R&S®CBT and additionally offers further interesting features for working in the laboratory. The software can, for example, automatically

More information and data sheet at
www.rohde-schwarz.com
 (search term: CBT or CBTGo)