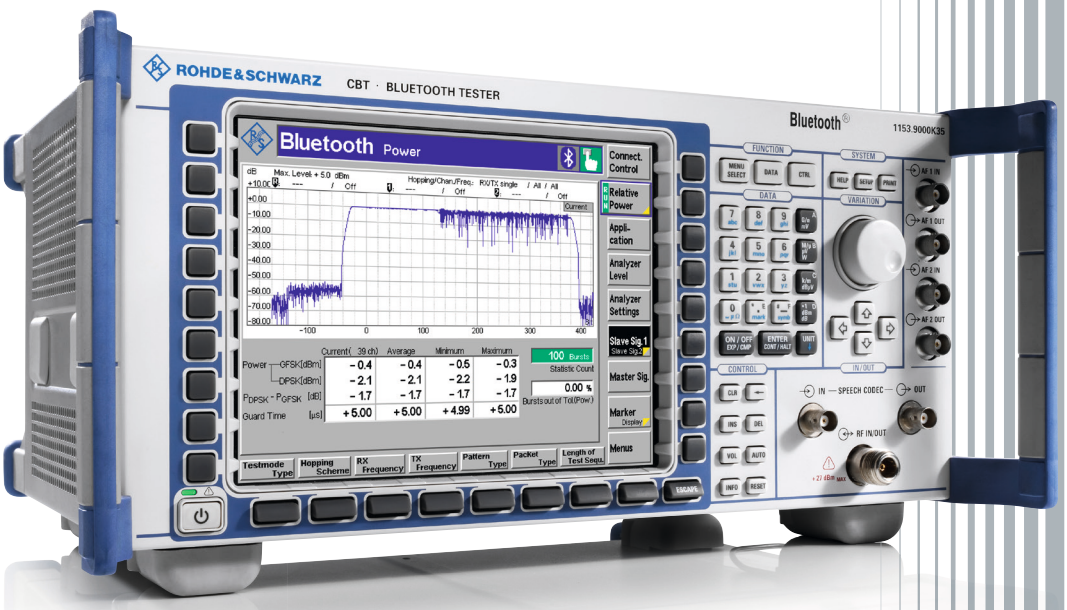
R&S®CBT/R&S®CBT32
Bluetooth® Tester
Fast and comprehensive RF and audio measurements



ROHDE&SCHWARZ

R&S®CBT/ R&S®CBT32 Bluetooth® Tester

At a glance

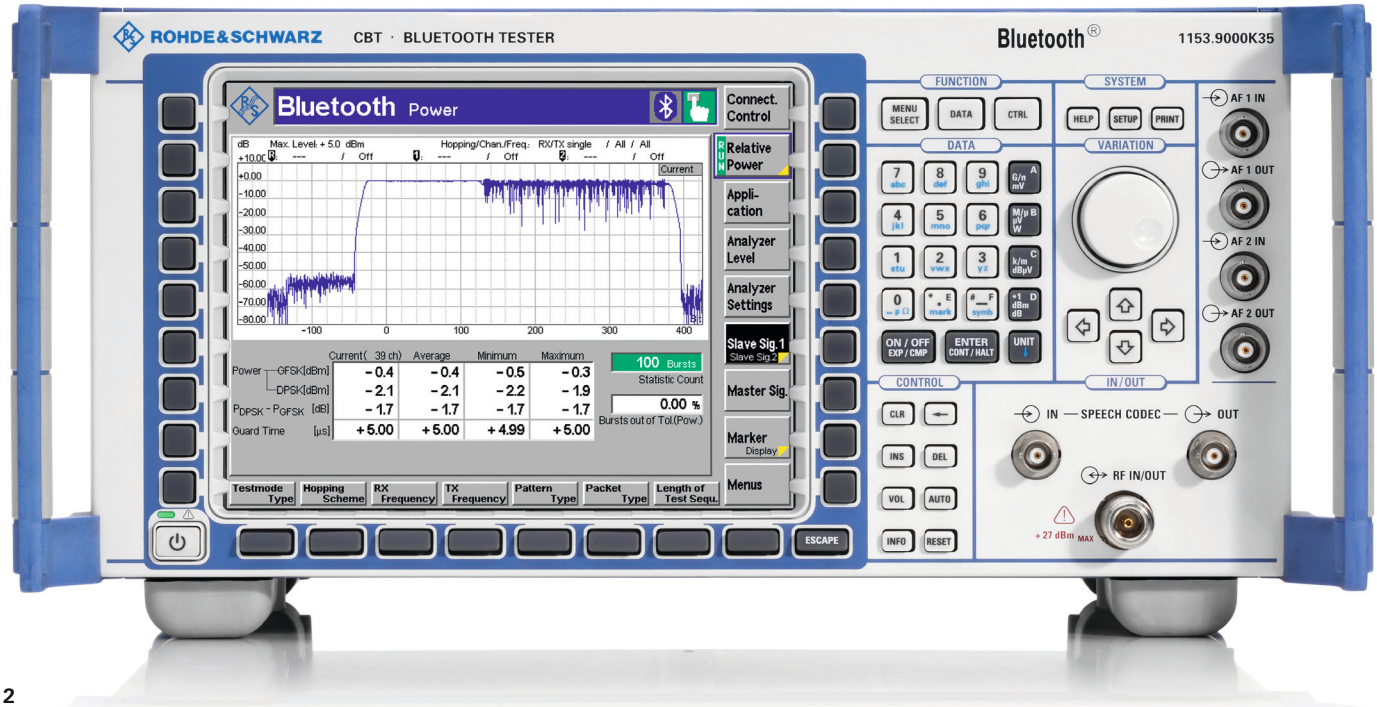
The R&S®CBT/R&S®CBT32 Bluetooth® tester performs fast and comprehensive RF and audio measurements for R&D, production and verification.

The R&S®CBT performs Bluetooth® RF tests at extremely high speed. In addition to power, modulation, frequency and BER tests, the R&S®CBT carries out a variety of spectrum measurements without requiring any extra spectrum analyzers. While conventional Bluetooth® testers sequentially measure power, modulation, frequency accuracy and also frequency drift, the R&S®CBT performs all these measurements in a single test cycle, which makes the instrument very fast in production applications. For use in the lab, the R&S®CBT offers traces for power, modulation and spectrum, which are output in realtime on a large graphical display.

Key facts

- Qualified by Bluetooth® SIG for RF measurements
- Highly flexible troubleshooting in R&D
- Very short measurement times for high throughput in production
- Integrated spectrum measurements
- RF tests on Bluetooth® devices in compliance with Bluetooth® 1.2, 2.0, 2.1, 3.0 + HS and 4.0 core specifications
- R&S®CBTgo software supporting all 38 Bluetooth® RF test cases
- Cost-effective R&S®CBT32 rack version for production applications
- Multiple audio options available
- EDR option (R&S®CBT-K55) for enabling a large number of EDR RF tests
- R&S®CBT-K57 Bluetooth® low energy option for measuring and generating Bluetooth® low energy signals

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



R&S®CBT/ R&S®CBT32 Bluetooth® Tester

Benefits and key features

Fast and highly flexible – in the lab, for R&D and production

R&S®CBT – the most versatile Bluetooth® tester for troubleshooting in the lab

The high versatility of the R&S®CBT results from the use of a parametric measurement concept, which allows all Bluetooth® signal parameters to be set in virtually any desired combination. The effect of different parameter combinations on results can be seen immediately. For example, most measurements can be performed on single frequencies or in hopping mode using any desired bit patterns and packet types.

Traces are output virtually in realtime on the large graphical display of the R&S®CBT. They can be analyzed in detail with the aid of switchable markers. Measurement parameters (e.g. level and frequency) and other settings (e.g. marker positions) can conveniently be varied using the rotary knob. Power control (legacy or enhanced) is available in all TX measurement menus. It is easy to measure modulation or spectral characteristics at different transmit powers. It is possible, for instance, to define tolerances for each measured value, or to stop a measurement sequence after a certain number of measurements or when a tolerance has been exceeded. In addition to the common traces for power, modulation and spectrum, averaged minimum or maximum traces can be displayed over a user-defined number of packets.

The R&S®CBT32 (bottom) is a cost-effective rack version of the R&S®CBT (top) featuring identical test capabilities and has been optimized for use in production.

R&S®CBT – the record holder in speed for Bluetooth® tests in production

The R&S®CBT uses parallel signal processing and therefore performs Bluetooth® tests in production lines at extremely high speed. While conventional Bluetooth® testers sequentially measure power, modulation, frequency accuracy and frequency drift, the R&S®CBT performs all these measurements in a single test cycle, offering unparalleled speed for Bluetooth® TX measurements. The highly flexible remote control programming makes it easy to adapt measurement configurations to any specific test requirements, and measurements are then performed at maximum possible speed. For example, if measurements are to be carried out on five channels instead of the three channels used by conventional testers, the R&S®CBT remote control program can easily be modified to include two more channels. In the case of other testers, this would require running the entire test sequence a second time, which would considerably slow down the measurement process.

R&S®CBT and R&S®CBT32 – the perfect combination for R&D and production

Featuring a wide range of control options and a large display, the R&S®CBT is the ideal choice for R&D applications in the lab. When a product is to be transferred to production, the remote control program for the tester can first be created conveniently on the R&S®CBT, which allows every test step to be verified in manual operation. Later, in the production line, the more favorably priced R&S®CBT32 can be used. The R&S®CBT32 is intended exclusively for remote control and optimized for integration into 19" racks. The R&S®CBT and the R&S®CBT32 have identical hardware and software, the main difference being that the R&S®CBT32 has no control elements.

Rear view of the R&S®CBT.

Basic rate and enhanced data rate (EDR) RF testing

Setting up a Bluetooth® test mode connection

The R&S®CBT acts as a master in a Bluetooth® piconet, the EUT (equipment under test) as a slave. The R&S®CBT can perform the inquiry procedure for the identification of all Bluetooth® devices within range of the R&S®CBT. The Bluetooth® test mode specification stipulates that the EUT has to be locally enabled for the test mode. After a Bluetooth® link is established, the R&S®CBT sends test control commands to the EUT to switch it to the desired test mode. In the test mode, the R&S®CBT can perform a multitude of transmitter and receiver measurements.

Power measurements (TX)

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

Output power

Measurement parameters:

- Nominal power: average power from bit 0 to the last bit of the burst
- Peak power: highest power level within the entire burst including the power ramps
- Leakage power: average power across two measurement windows before and after the burst; the position and length of each window can be defined

Relative power

To determine the power of EDR packets, the R&S®CBT measures the average power within the GFSK portion as well as within the DPSK portion of an EDR packet and calculates the power difference.

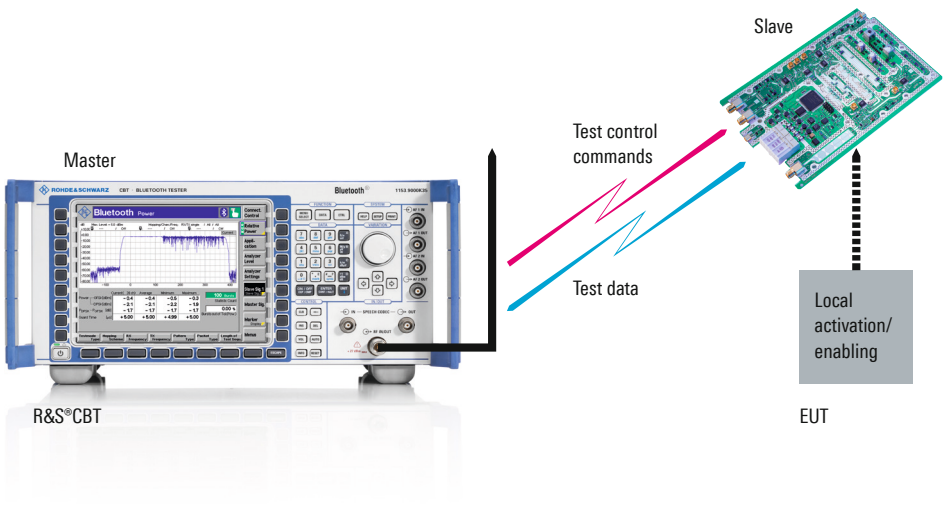
Measurement parameters:

- 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

Power control

The R&S®CBT supports both legacy and enhanced power control. Three keys are available for manual power control: “Power up”, “Power down” and “Power max“. After each keystroke, the R&S®CBT displays the difference power level with respect to the previous level. An outstanding feature of the R&S®CBT is that power control functionality is available also for all frequency, modulation and spectrum measurements.

The R&S®CBT controls the EUT in the test mode via test control commands



Timing measurements (TX)

Measurement parameters:

- Packet timing: time difference between ideal master receiver slot and detected bit 0 of the received burst; this measurement is displayed on the output power screen
- Guard time (EDR): time interval between the end of the last GFSK symbol of the packet header and the beginning of the reference symbol of the synchronization sequence; this measurement is displayed on the relative power screen

Modulation and frequency measurements (TX)

Measurement of basic rate packets

Measurement parameters:

- Frequency accuracy/initial carrier frequency tolerance (ICFT): difference between the measured transmit frequency and the expected transmit frequency, measured in the preamble at the beginning of each packet
- Carrier frequency drift: difference between the frequency at the start of a packet and the frequency in the payload
- Maximum drift rate: maximum drift rate, anywhere within the packet payload
- Frequency deviation: average, maximum and minimum frequency deviation within the packet payload

In compliance with the Bluetooth® RF test specification, a minimum of 99.9 % of all measured bits must have a frequency deviation of at least 115 kHz. The R&S®CBT shows the measured percentage in a dedicated field (bits above threshold) in the GFSK modulation menu. The 115 kHz threshold value can be varied as required.

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 packet header. 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 frequency for each block of the DPSK portion relative to the average frequency within the GFSK portion, i.e. the result ω_0 is the difference in each case. The largest measured ω_0 value is displayed
- RMS DEVM: The R&S®CBT measures the differential error vector magnitude (DEVM) for each of the 50 symbols of a block. It then calculates the RMS DEVM value for each block and displays the largest value
- Peak DEVM: The R&S®CBT determines the peak DEVM value by analyzing all 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

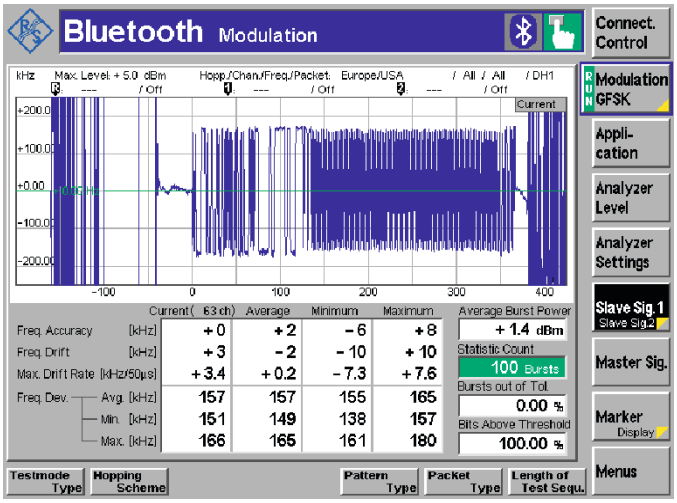
EDR differential phase encoding

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

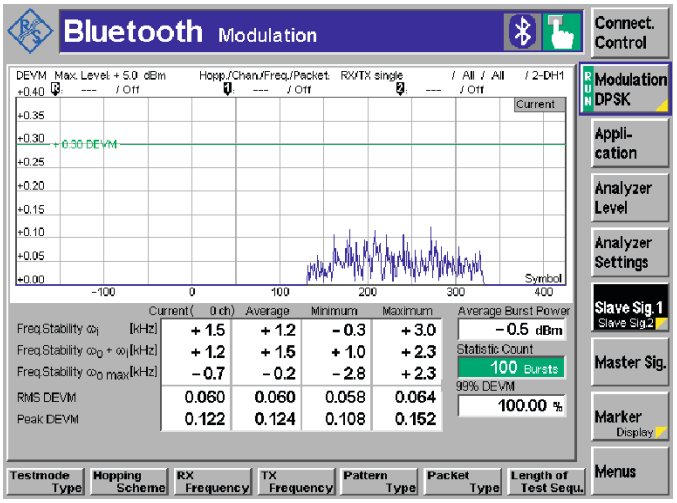
Measurement parameters:

- BER: percentage of bit errors that have occurred within the current statistical cycle
- Percentage of packets with 0 bit errors within the current statistical cycle

Modulation, frequency and drift measurement of a basic rate packet.



Frequency stability and modulation accuracy measurement of an EDR packet.



EDR I/Q constellation diagram and phase difference characteristic

The I/Q constellation diagram displays EDR packets in the I/Q plane. Bluetooth® EDR packets use differential modulation (DPSK); the I/Q diagram in the absolute symbol mode therefore does not provide any information as to the decodability of the signal. For this reason, the R&S®CBT also offers a differential display in the I/Q plane (differential symbol mode), where the preceding symbol is used as a reference in each case. This makes is possible to assess the signal quality.

The phase difference characteristic shows the phase difference of each symbol relative to the preceding symbol as a function of time. The phase difference characteristic contains the bit information of each symbol and allows the individual symbols to be decoded. Using this characteristic, it is also possible to check the DPSK synchronization sequence.

Spectrum measurements (TX)

20 dB bandwidth

The graphic display in the 20 dB bandwidth measurement menu shows the frequency spectrum of the measured Bluetooth® channel. This spectrum measurement can be performed in hopping mode in addition to fixed frequencies.

Measurement parameters:

- f_L: lowest frequency at which the power level drops to 20 dB below the peak power of the measurement channel
- f_H: highest frequency at which the power level drops to 20 dB below the peak power of the measurement channel
- $f_H - f_L$: difference between the two values; should be smaller than 1 MHz

The 20 dB reference value can be varied as required. The R&S®CBT shows the results for the current, average and maximum display modes.

Frequency range

The graphic display in the frequency range measurement menu shows the spectral characteristic of the measured Bluetooth® signal at the upper and the lower end of the Bluetooth® frequency band.

Measurement parameters:

- f_L: lowest frequency at which the power level drops to –30 dBm
- f_H: highest frequency at which the power level drops to –30 dBm

The –30 dBm limit on the R&S®CBT corresponds to a spectral power density of –80 dBm (1 Hz) EIRP.

Adjacent channel power (ACP)

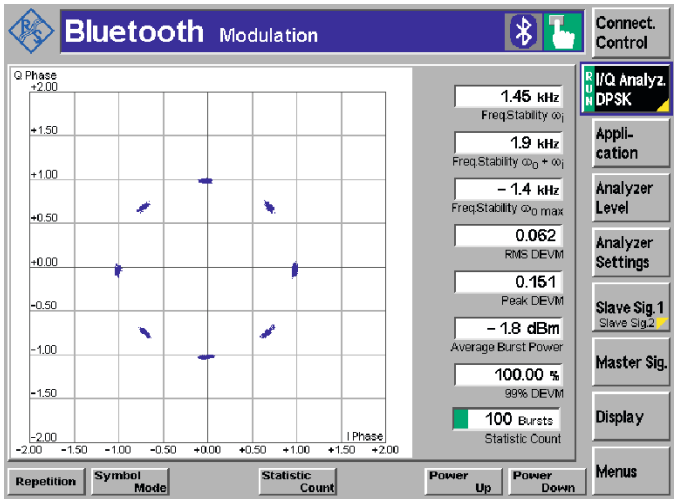
The ACP measurement menu shows the absolute power of a center channel as well as of three upper and three lower channels. All channels are user-selectable. The R&S®CBT performs ACP measurements in compliance with the Bluetooth® RF test specification. The tester starts outputting results for all seven channels after less than a second, which considerably reduces test time in the lab as compared with the use of conventional spectrum analyzers.

EDR in-band spurious emissions (gated ACP)

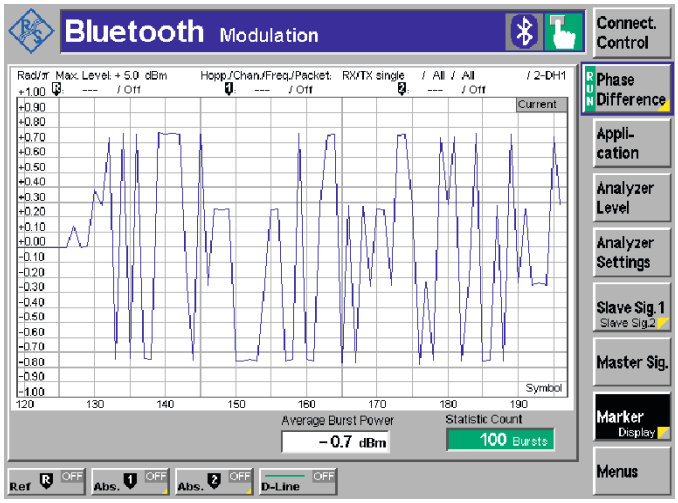
The ACP measurement menu includes a gating switch that allows to change over between normal and gated ACP measurements.

In the gating mode, the R&S®CBT additionally displays the P_{TXref} and $P_{TX-26dB}$ results stipulated by the Bluetooth® RF test specification.

Constellation diagram of an EDR packet in differential symbol mode.



Phase difference characteristic of an EDR packet.



Receiver quality measurements (RX)

For RX measurements, the tester's built-in signal generator delivers a selectable bit sequence, which is sent to the EUT, looped back and demodulated and processed by the R&S®CBT. The TX level of the R&S®CBT can be adjusted. When the EDR option is added, the receiver quality measurement menu offers EDR packet types (2-DH1, 2-DH3 and 2-DH5 as well as 3-DH1, 3-DH3 and 3-DH5) in addition to the basic rate packet types (DH1, DH3, DH5).

BER/PER tests

Measurement parameters:

- Bit error rate (BER): percentage of errored bits returned by the EUT
- Bit errors: number of errored bits returned by the EUT
- NAK rate: percentage of packets returned by the EUT with a negative acknowledgment (NAK); the EUT returns a packet with a NAK if it contains at least one bit error
- Packet error rate (PER): percentage of errored packets returned by the EUT; the R&S®CBT ignores errored packets in the BER calculation

The PER result is broken down according to the following five criteria:

- Missing packets: percentage of packets not returned by the EUT
- HEC error: percentage of returned packets containing noncorrectable bit errors in the header
- CRC error: percentage of returned packets containing at least one error in the payload; these errors are bit errors that occur during retransmission of the packet
- Wrong packet type: percentage of returned packets with incorrect packet type; these are usually null packets
- Wrong payload length: percentage of packets returned with incorrect payload length

The R&S®CBT offers a BER search function that automatically determines the EUT sensitivity level for a predefined BER level.

Dirty transmitter

For BER tests, the Bluetooth® RF test specification stipulates a nonideal transmitter (dirty TX) as a signal source in the tester.

Dirty transmitter for basic rate packets

Every 20 ms, the dirty TX changes the frequency offset, modulation index and symbol timing error. A table in the specification lists ten different value combinations of these three 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.

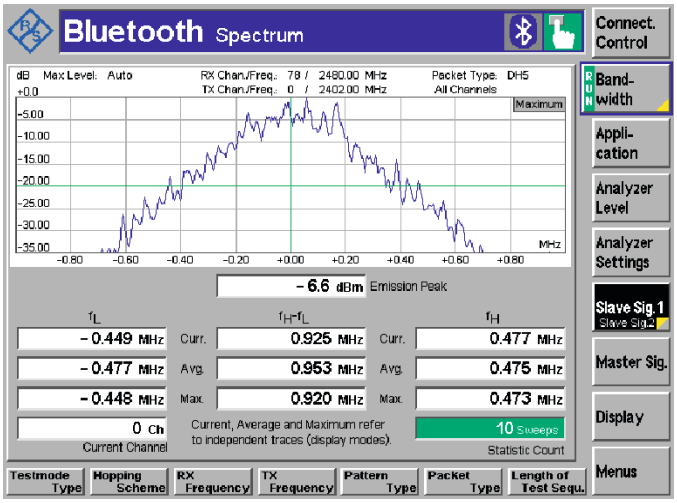
Dirty transmitter for EDR packets

Every 20 packets, the dirty TX changes the frequency offset and symbol timing error. A table in the specification lists 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.

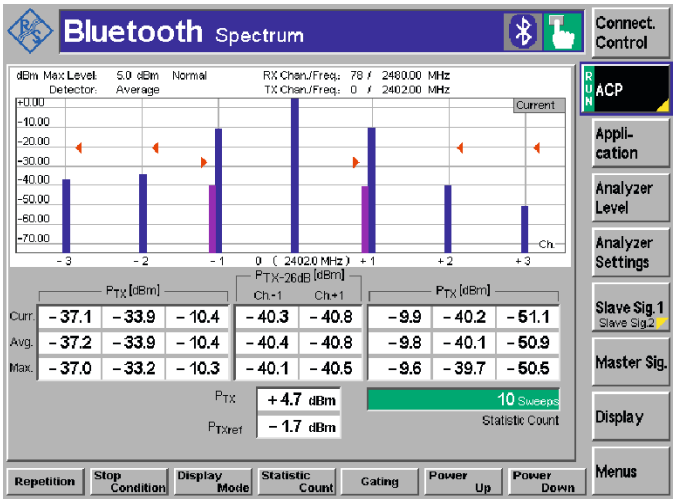
The dirty TX in the R&S®CBT and R&S®CBT32 can be operated in the following modes:

- Dynamic dirty TX using the value table from the specification; drift superposition switched on
- Dynamic dirty TX using a user-defined value table; drift superposition switched on or off
- Static dirty TX; the values for frequency offset, modulation index and symbol timing error can be set in any combination with one another; drift superposition switched on or off

20 dB bandwidth measurement.



EDR in-band spurious emissions measurement.



Bluetooth® low energy (LE) RF testing

Direct test mode

To perform the necessary RF tests, Bluetooth® low energy chips support special direct test modes that can be enabled via the serial interface of the R&S®CBT/R&S®CBT32.

For transmitter measurements, a Bluetooth® chip transmits a defined data packet on a selectable frequency at regular intervals (direct TX mode). The R&S®CBT/R&S®CBT32 measures the RF parameters of the equipment under test (EUT).

For receiver tests, the EUT receives data packets from the R&S®CBT/R&S®CBT32 and checks each packet for bit errors on the basis of the CRC checksum (direct RX mode). Using the result of this check, the R&S®CBT/R&S®CBT32 calculates and displays the packet error rate (PER). With dual-mode chips, test mode control is accomplished via the familiar HCI interface. Single-mode chips use a new, serial (two-wire) interface.

Output power (TX)

Measurement parameters:

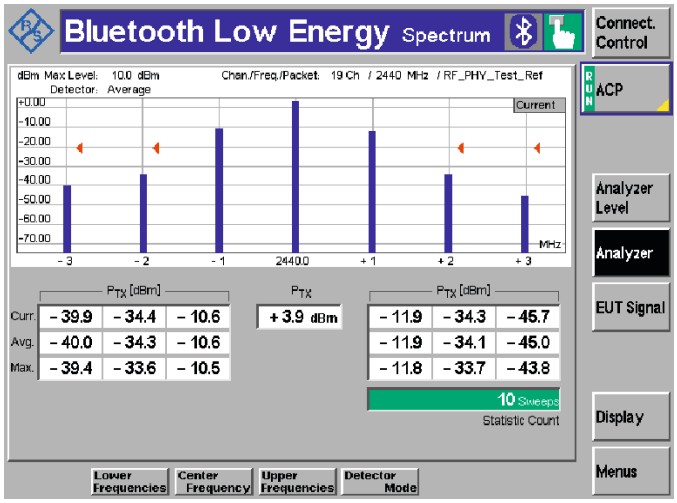
- Nominal power: average power from bit 0 to the last bit of the burst
- Peak power: highest power level within the entire burst including the power ramps
- Maximum difference between peak power and average power
- Leakage power: average power across two measurement windows before and after the burst; the position and length of each window can be defined

Modulation characteristics (TX)

Measurement parameters:

- Frequency deviation: average, maximum and minimum frequency deviation within the packet payload
- Bits above threshold: In compliance with the Bluetooth® RF test specification, a minimum of 99.9 % of all measured bits must have a frequency deviation of at least 185 kHz. The R&S®CBT shows the measured percentage in a dedicated field in the Bluetooth® low energy modulation measurement window. The 185 kHz threshold value can be varied as required

Low energy in-band emissions measurement.



Frequency offset and drift (TX)

Measurement parameters [1]:

- Frequency accuracy: difference between measured transmit frequency (f_0) and expected transmit frequency (f_{TX}) measured in the preamble at the start of a packet
- Initial frequency drift: difference between the frequency at the start of a packet (f_0) and the frequency at the start of the payload (f_1)
- Frequency drift: maximum difference between the frequency at the start of a packet (f_0) and the frequencies measured in the payload (f_2 to f_k)
- Maximum drift rate: maximum drift rate anywhere within the packet payload
- Frequency offset: maximum difference between the frequencies (f_1 to f_k) measured in the payload and the expected transmit frequency (f_{TX})

Spectrum in-band emissions (TX)

The low energy spectrum measurement menu shows the absolute power of the center frequency as well as of three upper and three lower frequencies. Within the Bluetooth® frequency band, all these frequencies can be set with a resolution of 1 MHz. The R&S®CBT performs the in-band emissions spectrum measurement in compliance with the Bluetooth® low energy RF test specification.

Receiver quality measurements (RX)

To measure receiver sensitivity, the R&S®CBT/R&S®CBT32 generates packets in line with the Bluetooth® low energy specification and transmits them at regular intervals.

Signal parameters

The following signal parameters can be set:

- RF level
- Frequency (channel)
- Packet type
- Payload data length
- Payload data pattern

The R&S®CBT generates the correct CRC checksum for each packet. The EUT investigates each received packet for bit errors by comparing the checksum delivered by the R&S®CBT with the checksum calculated in the EUT. The EUT transmits the number of packets received error-free to the R&S®CBT/R&S®CBT32, which then calculates and displays the PER. If the report integrity mode is enabled, the R&S®CBT/R&S®CBT32 generates a corrupt CRC checksum for every second packet. This test allows the PER report mechanism in the EUT to be checked.

Dirty transmitter for Bluetooth® low energy

The Bluetooth® low energy RF PHY test specification stipulates a nonideal transmitter (dirty TX) as a signal source in the tester. Every 50 packets, the dirty TX changes the frequency offset, modulation index and symbol timing error. A table in the specification lists ten different value combinations of these three 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 dirty TX for Bluetooth® low energy in the R&S®CBT and R&S®CBT32 can be operated in the following modes:

- Dynamic dirty TX using the value table from the specification; drift superposition switched on
- Static dirty TX; the values for frequency offset, modulation index and symbol timing error can be set in any combination with one another; drift superposition switched on or off

[1] f_{TX}: f_0 to f_k refer to the Bluetooth® low energy RF test specification.

Audio testing

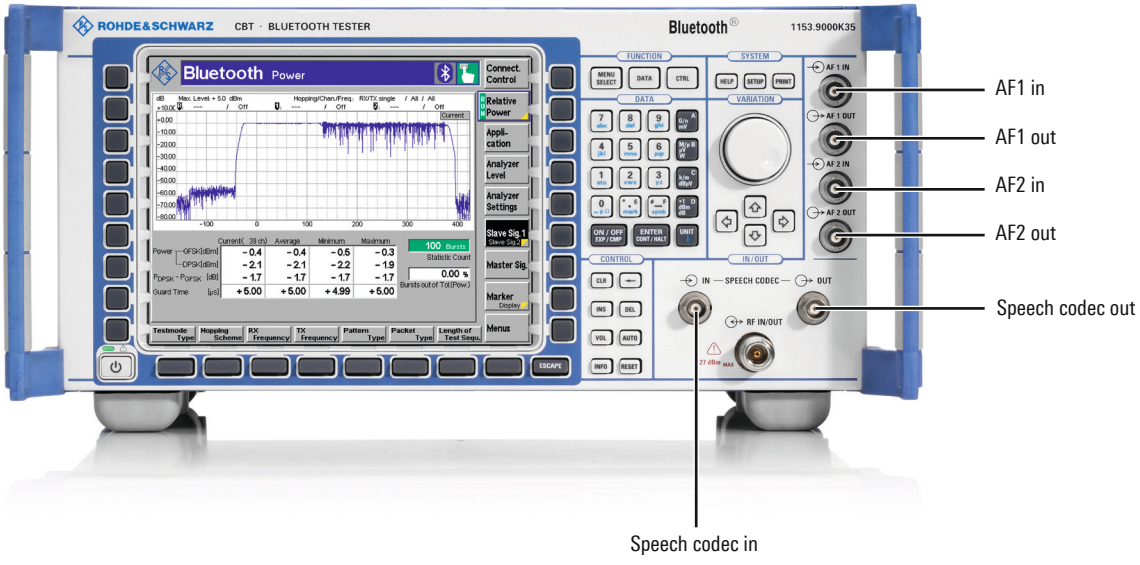
Setting up a Bluetooth® audio connection

To perform audio tests with the R&S®CBT/R&S®CBT32, a normal Bluetooth® connection must be established with the EUT after the inquiry procedure, with the R&S®CBT/R&S®CBT32 always acting as the master. For this purpose, it might be necessary to enter the PIN code required by the EUT on the R&S®CBT. At a keystroke, the R&S®CBT/R&S®CBT32 then switches to a user-selectable submode:

- Audio mode
- HF profile (R&S®CBT-K54 option)
- HF/AG profile (R&S®CBT-K54 option)
- HS profile (R&S®CBT-K54 option)
- HS/AG profile (R&S®CBT-K54 option)
- A2DP(sink) profile (R&S®CBT-K52 option)

In audio mode, the R&S®CBT establishes a synchronous connection-oriented (SCO) link to the EUT. The built-in Bluetooth® speech codec of the R&S®CBT supports CVSD as well as A-law and µ-law coding. External audio generators and analyzers can be connected by means of an analog input and an analog output on the R&S®CBT front panel. The described functionality is provided as standard by the R&S®CBT and R&S®CBT32 base units.

Audio connectors of the R&S®CBT with the R&S®CBT-B41 audio option



Dual-channel audio generator and analyzer

The R&S®CBT-B41 hardware option includes two audio generators and two audio analyzers for measuring the audio characteristics of Bluetooth® EUTs. The option adds four more connectors to the R&S®CBT front panel: two output sockets for the audio generators and two input sockets for the audio analyzers. The audio signals are routed via internal audio switches either to the connectors for external equipment or to the internal Bluetooth® speech codec. Various test scenarios can be implemented.

Microphone test

The EUT microphone, audio input amplifier and A/D converter are tested. The R&S®CBT generates an audio signal, which is applied to the EUT microphone via a reference loudspeaker. The EUT returns the audio signal to the R&S®CBT via the Bluetooth® link, and the R&S®CBT audio analyzer measures the signal.

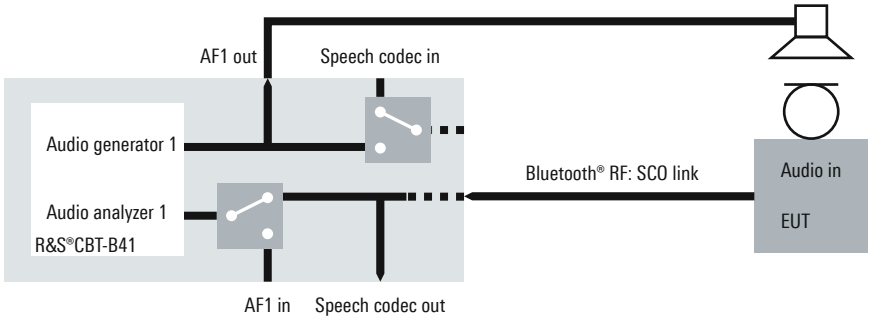
Loudspeaker/ear piece test

The EUT D/A converter, output amplifier and loudspeaker/ear piece are tested. The R&S®CBT generates an audio signal and sends it to the EUT via the Bluetooth® link. The EUT outputs the audio signal via its sound converter. The signal is picked up by a reference microphone and taken via a reference amplifier to the R&S®CBT, where audio analysis is performed.

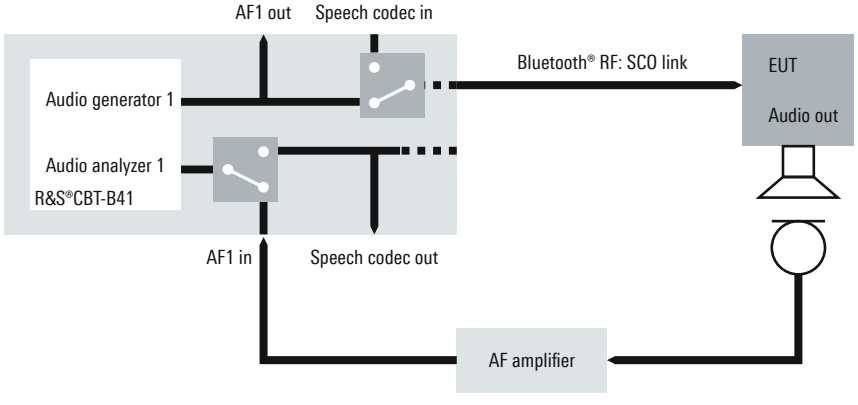
Audio link test

The R&S®CBT generates an audio signal and sends it to the EUT via the Bluetooth® link. At the same time, the R&S®CBT receives the audio signal from the EUT microphone and analyzes it. In this way, it is possible to test the crosstalk and the EUT's echo cancellation.

Audio measurement of a EUT microphone with the R&S®CBT-B41 option



Loudspeaker/ear piece test



Audio measurements

The R&S®CBT-B41 option enables high-speed frequency response measurements in multitone mode. The user can define up to 20 tones in terms of level and frequency for each of the two audio channels.

In single-tone mode, the following measurements can be performed:

- Audio level (RMS, peak)
- DC level
- Frequency
- SINAD
- THD+N (total harmonic distortion + noise)

A THD measurement function is available in addition, which outputs the fundamental plus eight harmonics in the form of a bargraph.

Various filters are available for audio measurements:

- 19 fixed frequency bandpass filters
- One variable bandpass filter (20 Hz to 20 kHz, bandwidth selectable from 10 Hz to 1000 Hz)
- Weighting filters (A, CCITT, C-message)

Digital audio interface

The R&S®CBT-B42 hardware option expands the R&S®CBT by a digital audio interface consisting of an input and an output in line with the S/P-DIF specification. The direct input of digital audio signals avoids any distortion caused by D/A and A/D conversion in signal transmission. For this option, the R&S®CBT-B41 audio generator and analyzer option must be installed.

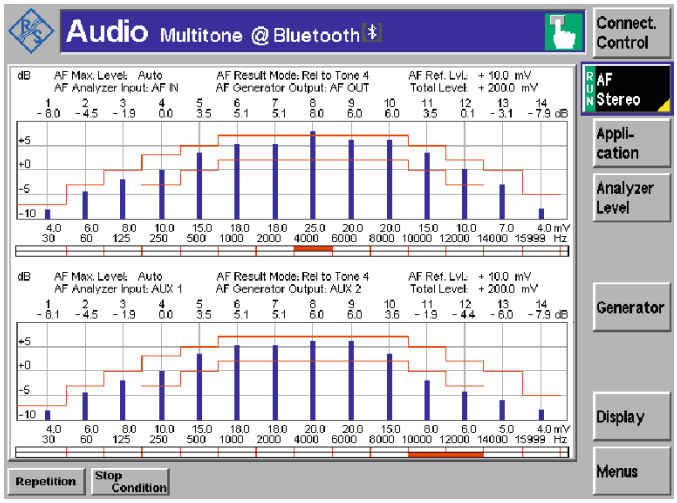
Handsfree and headset profiles

To perform audio measurements on any type of Bluetooth® handsfree or headset equipment, the R&S®CBT must support the handsfree and headset profiles. This capability is provided by the R&S®CBT-K54 software option, which also allows links to be set up to the corresponding audio gateways (mobile phones, laptops). For audio measurements with these profiles, the R&S®CBT supports the Bluetooth® volume control functionality, which allows the speaker level and microphone level on the R&S®CBT to be set as required.

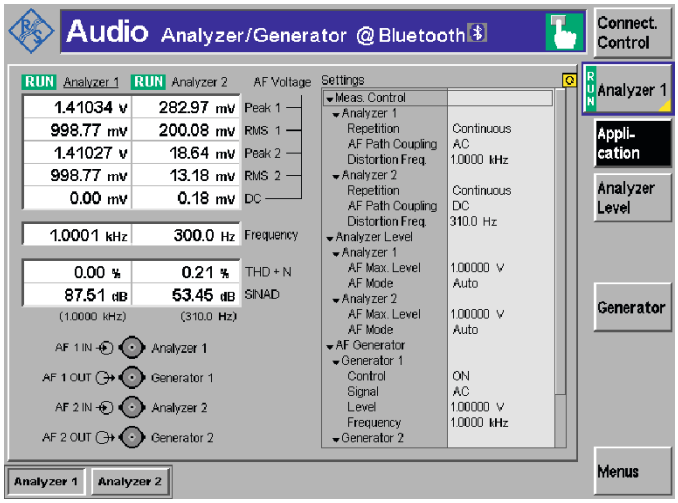
A2DP stereo profile and SBC codec

The R&S®CBT-K52 software option has been designed for audio tests on Bluetooth® stereo receiver EUTs (e.g. headsets). The option supports the SBC stereo codec. This codec is mandatory for all Bluetooth® devices using the A2DP (sink) profile, and the R&S®CBT is able to perform stereo audio tests on all EUTs employing this profile. For the R&S®CBT-K52 option, the R&S®CBT-B41 audio generator and analyzer option must be installed.

Fast frequency response measurement of stereo signals with the R&S®CBT-B41 option in multitone mode.



Measurement menu of the R&S®CBT-B41 option in single-tone mode.



Special features

Information signaled by the EUT

The R&S®CBT can display a variety of information received from the EUT (e.g. device name, version numbers, service class, supported features).

Park, hold, sniff

The power consumption of a Bluetooth® chipset is considerably reduced in these modes, which therefore play an important role in all battery-powered Bluetooth® devices. The R&S®CBT can switch the EUT to the park, hold or sniff mode, and the EUT power consumption can be checked by means of external test equipment.

Channel display in frequency hopping mode

The R&S®CBT makes it possible to conveniently determine all RF channels in which the EUT exceeds specified tolerances. If on limit failure is set as a stop condition in frequency hopping measurements, the R&S®CBT automatically stops when a measured value exceeds a definable limit. The R&S®CBT also displays the number of the channel in which the out-of-tolerance condition has occurred – a very helpful function for laboratory measurements.

Measurements without test mode

The R&S®CBT is also capable of setting up a normal Bluetooth® asynchronous connectionless (ACL) link without activating the test mode. Via this link, the power and frequency accuracy of every EUT can be measured, regardless of whether the EUT has been locally enabled for the test mode. Via the ACL link, the tester can also estimate the receiver sensitivity by determining the percentage of packets for which no response is received from the EUT.

Measurements without link setup

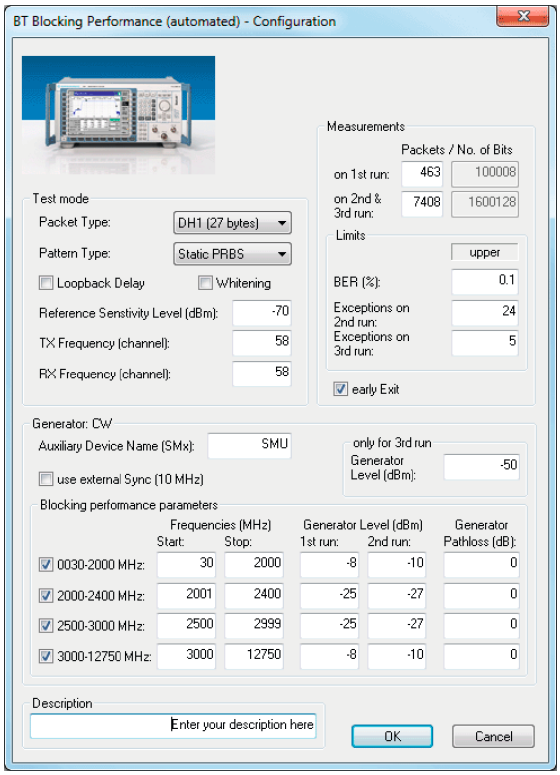
Many Bluetooth® EUTs can be locally switched to a vendor-specific TX test mode via the HCI interface. The R&S®CBT can then carry out power, frequency and modulation measurements on the EUT without requiring a Bluetooth® link.

R&S®CBTgo software for automatic testing

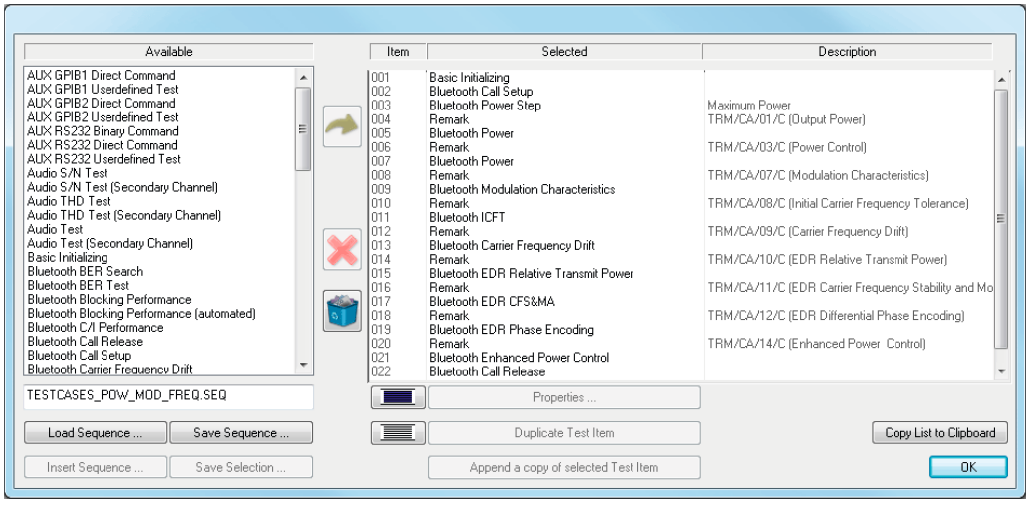
R&S®CBTgo is a PC application software package for remote control of the R&S®CBT and R&S®CBT32. The software can be downloaded free of charge from the Rohde&Schwarz website. R&S®CBTgo can be used to create any desired test sequences by configuring and combining selectable test modules. The software generates measurement reports at the press of a button. Reports can be stored in various formats. R&S®CBTgo offers a number of sample sequences, e.g. for automatically performing the various Bluetooth® RF test cases. The software allows a large number of graphical elements to be integrated into the measurement report and is a valuable tool in R&D and product verification.

R&S®CBTgo supports the 38 Bluetooth® test purposes (see table on next page) as described in the Bluetooth® RF test specifications:

- Radio frequency, test suite structure (TSS) and test purposes (TP) specification 1.2/2.0/2.0 + EDR/ 2.1/2.1 + EDR/3.0/3.0 + HS/4.0 (4.0.3)
- Bluetooth® low energy RF PHY test specification (TS): test suite structure (TSS) and test purposes (TP) (RF-PHY.TS.4.0.2)



The individual items of a test sequence can be configured separately.

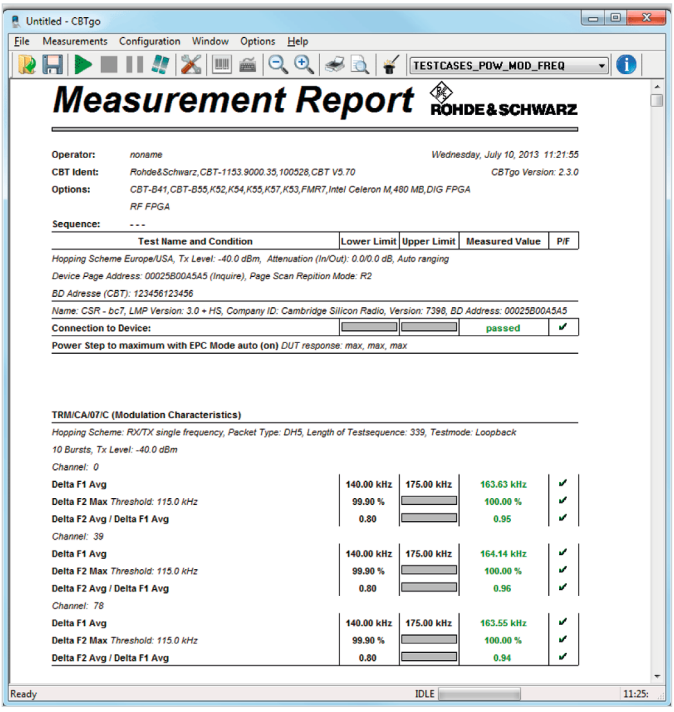


The elements in the left window can be used to generate a user-specific test sequence in the right window.

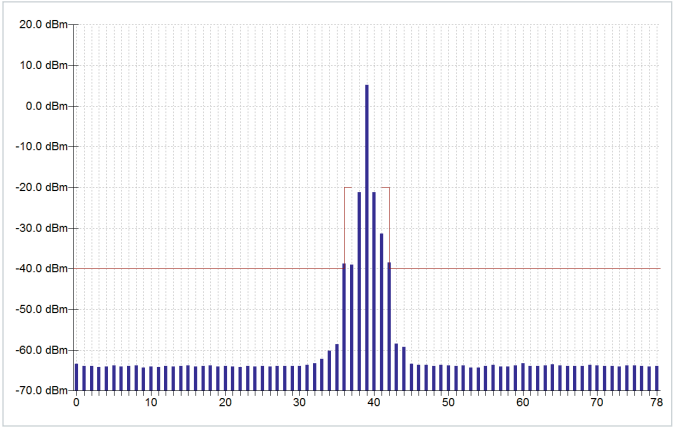
Overview of Bluetooth® test purposes

Test purpose	Required device/option				Described in Rohde&Schwarz application note [1]
	R&S®CBT/ R&S®CBT32	R&S®CBT-K55 EDR option	R&S®CBT-K57 LE option	Rohde&Schwarz signal generator (SG) or spectrum analyzer (SA)	
TRM/CA/01/C (output power)	•				
TRM/CA/02/C (power density)	•			1 SA	1MA106
TRM/CA/03/C (power control)	•				
TRM/CA/04/C (TX output spectrum – frequency range)	•				
TRM/CA/05/C (TX output spectrum – 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)	•	•			
TRM/CA/13/C (EDR in-band spurious emissions)	•	•			
TRM/CA/14/C (enhanced power control)	•	•			
RCV/CA/01/C (sensitivity – single-slot packets)	•				
RCV/CA/02/C (sensitivity – multislot packets)	•				
RCV/CA/03/C (C/I performance)	•			1 SG	1MA106
RCV/CA/04/C (blocking performance)	•			1 SG	1MA106
RCV/CA/05/C (intermodulation performance)	•			2 SGs	1MA106
RCV/CA/06/C (maximum input level)	•				
RCV/CA/07/C (EDR sensitivity)	•	•			
RCV/CA/08/C (EDR BER floor performance)	•	•			
RCV/CA/09/C (EDR C/I performance)	•	•		1 SG	1MA106
RCV/CA/10/C (EDR maximum input level)	•	•			
TRM-LE/CA/01/C (output power at NOC)	•		•		
TRM-LE/CA/02/C (output power at EOC)	•		•		
TRM-LE/CA/03/C (in-band emissions at NOC)	•		•		
TRM-LE/CA/04/C (in-band emissions at EOC)	•		•		
TRM-LE/CA/05/C (modulation characteristics)	•		•		
TRM-LE/CA/06/C (carrier frequency offset and drift at NOC)	•		•		
TRM-LE/CA/07/C (carrier frequency offset and drift at EOC)	•		•		
RCV-LE/CA/01/C (receiver sensitivity at NOC)	•		•		
RCV-LE/CA/02/C (receiver sensitivity at EOC)	•		•		
RCV-LE/CA/03/C (C/I and receiver selectivity performance)	•		•	1 SG	1MA200
RCV-LE/CA/04/C (blocking performance)	•		•	1 SG	1MA200
RCV-LE/CA/05/C (intermodulation performance)	•		•	2 SGs	1MA200
RCV-LE/CA/06/C (maximum input signal level)	•		•		
RCV-LE/CA/07/C (PER report integrity)	•		•		

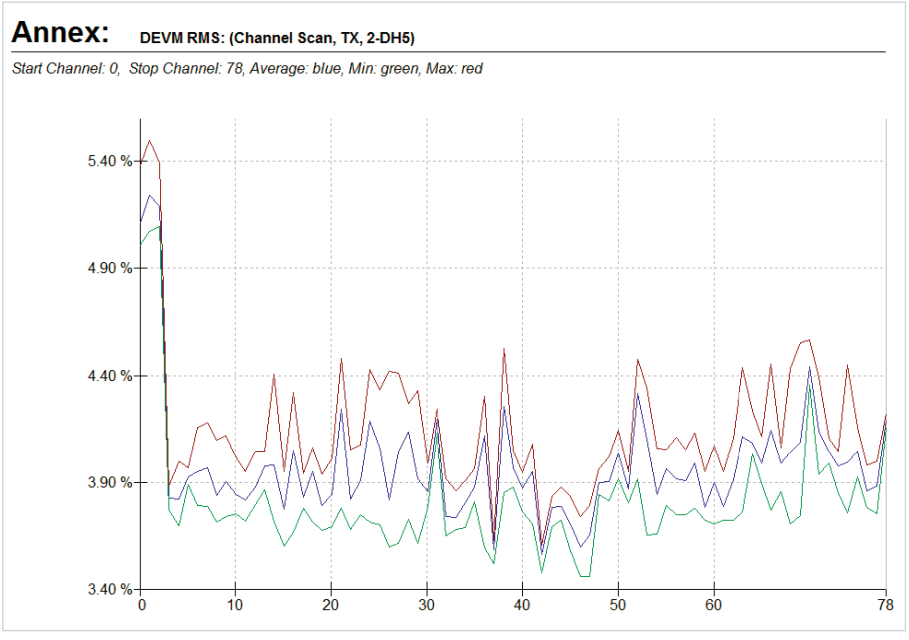
[1] Application notes can be downloaded from the Rohde&Schwarz website.



R&S®CBTgo automatically saves measurement reports.



Graphic display of the ACP measurement results in the R&S®CBTgo measurement report.



Graphic display of the measurement results delivered by R&S®CBTgo for all 79 RF channels.

Ordering information

Designation	Type	Order No.
Base unit		
Bluetooth® Tester with display, 4 HU	R&S®CBT	1153.9000.35
Bluetooth® Tester without display, 19", 2 HU, for remote control	R&S®CBT32	1153.9000.32
Bluetooth® Tester, LE only	R&S®CBT/R&S®CBT32 + R&S®CBT-K77	Please contact your local Rohde&Schwarz sales office.
Hardware options		
Dual-Channel Audio Generator and Analyzer, for R&S®CBT	R&S®CBT-B41	1170.3406.05
Dual-Channel Audio Generator and Analyzer, for R&S®CBT32	R&S®CBT-B41	1170.3406.02
Digital Audio Interface, for R&S®CBT and R&S®CBT32 (S/P-DIF; R&S®CBT-B41 required)	R&S®CBT-B42	1170.3706.03
Software options		
Software for automated testing	R&S®CBTgo	Can be downloaded free of charge from the Rohde&Schwarz website.
A2DP Stereo Profile and SBC Codec, for R&S®CBT and R&S®CBT32 (R&S®CBT-B41 required)	R&S®CBT-K52	1170.4002.02
Handsfree and Headset Profiles, for R&S®CBT and R&S®CBT32	R&S®CBT-K54	1170.3806.02
Enhanced Data Rate (EDR), for R&S®CBT and R&S®CBT32	R&S®CBT-K55	1170.3206.02
Bluetooth® Low Energy Option	R&S®CBT-K57	1170.4102.02
Recommended extras		
19" Adapter, 2 HU, for R&S®CBT32	R&S®ZZA-211	1096.3260.00
19" Adapter, 4 HU, for R&S®CBT	R&S®ZZA-S03	1105.6756.00
Documentation of Calibration Values	R&S®DCV-1	0240.2187.08
RF Shield Box, internal gas springs, assembled	R&S®CMW-Z10	1204.7008.02
RF Shield Box, external gas springs, assembled	R&S®CMW-Z10	1204.7008.04
Antenna Coupler, up to 6 GHz	R&S®CMW-Z11	1204.7108.02

Service options		
Extended Warranty, one year	R&S®WE1CBT/R&S®WE1CBT32	Please contact your local Rohde&Schwarz sales office.
Extended Warranty, two years	R&S®WE2CBT/R&S®WE2CBT32	
Extended Warranty, three years	R&S®WE3CBT/R&S®WE3CBT32	
Extended Warranty, four years	R&S®WE4CBT/R&S®WE4CBT32	
Extended Warranty with Calibration Coverage, one year	R&S®CW1CBT/R&S®CW1CBT32	
Extended Warranty with Calibration Coverage, two years	R&S®CW2CBT/R&S®CW2CBT32	
Extended Warranty with Calibration Coverage, three years	R&S®CW3CBT/R&S®CW3CBT32	
Extended Warranty with Calibration Coverage, four years	R&S®CW4CBT/R&S®CW4CBT32	

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.
To find your nearest Rohde&Schwarz representative, visit
www.sales.rohde-schwarz.com

For data sheet, see 0758.1287.22 and www.rohde-schwarz.com

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About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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PD 0758.1287.12 | Version 04.00 | October 2013 (ch)
R&S®CBT/R&S®CBT32

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