

Version
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2004

Bluetooth® Testers R&S® CBT/CBT 32

Fast and versatile for development, production and verification

- ◆ Bluetooth RF tests on all channels
- ◆ Full dirty transmitter for BER tests
- ◆ Speech codec integrated
- ◆ Cost-effective rack version
R&S® CBT 32 for production applications
- ◆ Very short cycle time for high production throughput



ROHDE & SCHWARZ

General

The *Bluetooth* Testers R&S® CBT offer a large number of statistical monitoring and measurement functions. It is possible, for instance, to define individual tolerances for each measured value and to stop a measurement sequence after a certain number of measurements or when a tolerance has been exceeded. Besides the common traces for power and modulation versus time, averaged minimum or maximum traces can also be displayed over a user-defined number of packets.

Signalling

Setting up a *Bluetooth* connection

The R&S® CBT acts as the master of a *Bluetooth* piconet, the DUT as a slave. The R&S® CBT is able to perform the inquiry procedure for the identification of all *Bluetooth* devices within range of the R&S® CBT. All devices found are listed on the display and

one of them can be selected for the paging procedure. The R&S® CBT then establishes the connection to the DUT and switches it to test mode operation. The inquiry procedure can be skipped, if the *Bluetooth* device address of the DUT is already known. In this case, a shorter setup time for the connection can be achieved. This is important for production tests of *Bluetooth* devices to increase the maximum throughput of a production line. According to the *Bluetooth* test mode specification, the DUT has to be locally enabled for test mode operation. After a *Bluetooth* link is established, the R&S® CBT sends commands to the DUT to switch it to the desired test mode. The R&S® CBT is then able to perform a number of transmitter and receiver measurements. The R&S® CBT is also capable of setting up a normal *Bluetooth* asynchronous connectionless (ACL) link without activating the test mode. Via this normal link, the power and frequency accuracy of every DUT can be measured, regardless of whether the DUT has been

locally enabled for the test mode. If a normal (ACL) link is used, the R&S® CBT can switch the DUT to the audio, hold, park and sniff modes.

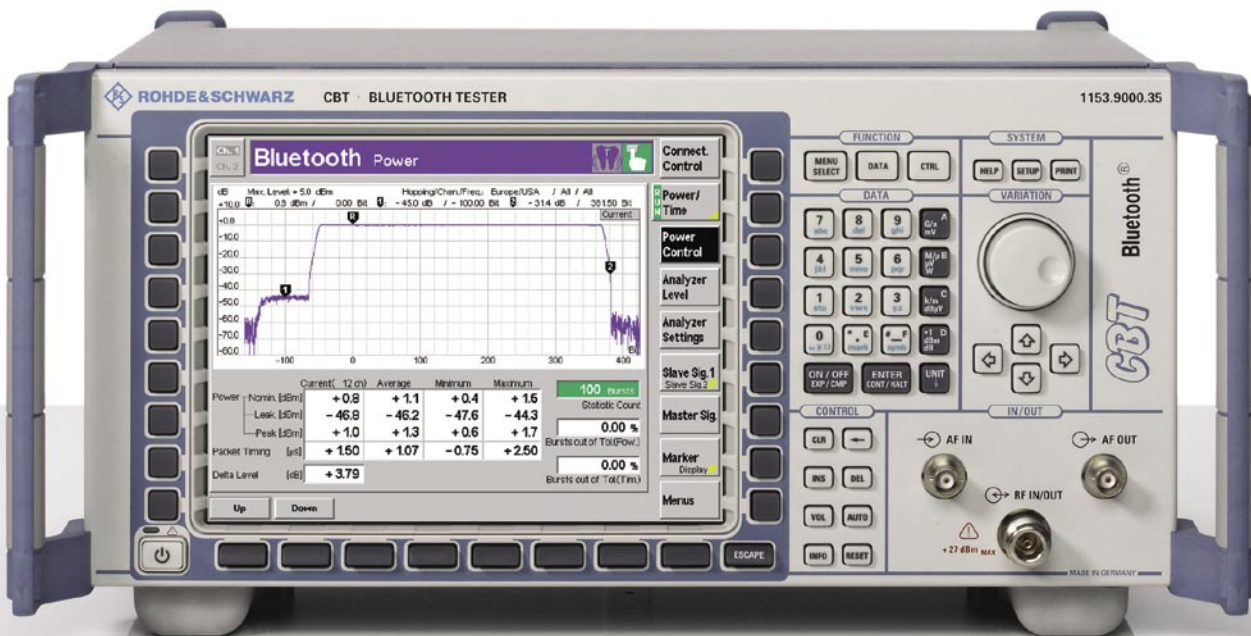
Control commands to the DUT

The R&S® CBT can send user-specific control commands in the form of any type of bytes to the DUT via the normal ACL link. This application, which is very useful in production, allows the control of specific DUT functions via the RF interface, e.g. switching a headset LED on and off.

Audio mode

In the audio mode, the R&S® CBT establishes a synchronous connection-oriented (SCO) link to the DUT in addition to the ACL link. The R&S® CBT's built-in *Bluetooth* audio codec supports CVSD as well as A-law and μ -law coding. External audio generators and analyzers can be connected by means of one analog input and output each on the R&S® CBT front panel.

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

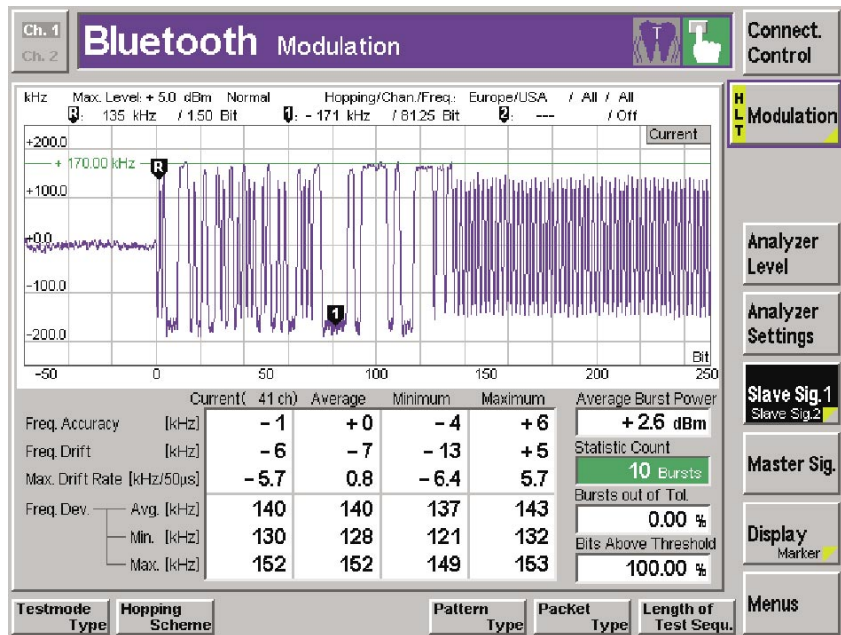


Park, hold and sniff modes

The power consumption of a *Bluetooth* chip set is considerably reduced in these three modes, making them particularly important in all battery-powered *Bluetooth* devices. The R&S® CBT can switch the DUT to the park, hold or sniff mode, making it possible to check the reduced power consumption by means of external test equipment.

Signalling information from the DUT

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



Compliance with existing Bluetooth® standards

The R&S® CBT is compliant with the *Bluetooth* Core Specifications Version 1.1. The *Bluetooth* test mode (Core Spec. Part I:1) is implemented with all commands needed to perform the TX/RX measurements. In addition, the R&S® CBT is capable of testing all DUTs that support the new *Bluetooth* Core Specifications Version 1.2, since the test mode specified in the new version does not include any changes relevant to the R&S® CBT.

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 definable number of *Bluetooth* packets (bursts).

Spec Table	Offset	Modulation Index	Symb. Time Error
Set 1	10 kHz	0.28	- 20 ppm
Set 2	20 kHz	0.30	- 20 ppm
Set 3	30 kHz	0.29	20 ppm
Set 4	40 kHz	0.32	20 ppm
Set 5	50 kHz	0.33	20 ppm
Set 6	- 50 kHz	0.34	- 20 ppm
Set 7	23 kHz	0.29	- 20 ppm
Set 8	- 30 kHz	0.31	- 20 ppm
Set 9	- 20 kHz	0.28	- 20 ppm
Set 10	- 10 kHz	0.35	20 ppm
Drift	Off		

Power measurements (output power)

Measurement parameters:

- ◆ Nominal power (measured as the part of the burst starting at the detected first bit of the preamble (bit 0) to the last bit of the burst)
- ◆ Peak power (shows the highest power level within a burst)
- ◆ Leakage power (measured within defined areas before and after the burst)

Power control

The Power menu enables the power control function of a *Bluetooth* DUT to be checked. In this mode, the R&S® CBT can send the "Power up" and "Power down" commands to the DUT. The user has two keys for manual power control. After each keystroke, the R&S® CBT displays in a measurement window the difference level as compared to each

previous power level. In compliance with the *Bluetooth* specifications, all difference values must be in the 2 dB to 8 dB range. When the maximum or minimum power level is reached, the DUT sends a message which is displayed on the R&S® CBT.

Timing measurements (packet timing error)

Measurement parameter:

- ◆ Packet alignment (distance between ideal master receiver slot and detected bit 0 of the received burst)

This measurement is displayed on the Power screen

Modulation measurements (modulation characteristics/quality)

Measurement parameters:

- ◆ Frequency accuracy/initial carrier frequency tolerance (ICFT, difference between measured frequency and intended transmitted frequency, measured in the preamble at the beginning of a packet)

- ◆ Carrier frequency drift (difference between the frequency at the start of the packet and the frequency in the payload)
- ◆ Maximum drift rate (maximum drift rate anywhere within the packet payload)
- ◆ Average, maximum and minimum frequency deviation (calculated over the packet payload)

In compliance with the *Bluetooth* RF test specifications, 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 measurement results in an additional window in the modulation display.

Channel display in frequency-hopping mode

The R&S® CBT enables the convenient determination of all RF channels in which the DUT exceeds specified tolerances. If "on limit failure" is set as a stop condition in frequency-hopping

measurements, the R&S® CBT automatically stops the measurement when a measured value exceeds the defineable limit values. The R&S® CBT in addition displays the number of the channel in which the out-of-tolerance condition occurred – a very helpful function for laboratory measurements.

Measurements without link setup

Many *Bluetooth* DUTs can be locally switched to the transmitter test mode via the HCI interface. The R&S® CBT can carry out power, frequency and modulation measurements on such DUTs without previously establishing a *Bluetooth* link.

RX measurements

For RX measurements, the built-in 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

R&S® CBT 32 Bluetooth Tester: Cost-effective rack version of the R&S® CBT with identical features but without display



of the R&S® CBT can be adjusted for this measurement. The BER application allows up to five test programs to be defined. Each program can independently set settings such as control parameters, limits, repetition or statistical cycles.

Sensitivity (single slot packets/multislot packets)

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 BER tests, the *Bluetooth* RF test specification stipulates a dirty transmitter as a signal source in the tester. Every 20 ms, the dirty transmitter (dirty TX) changes the frequency offset, modulation index and symbol timing error. A table in the specification describes 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 in the R&S® CBT and R&S® CBT 32 provides the following operating modes:

- ◆ 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 switched on or off (see figure on page 3)
- ◆ Static dirty TX; the values for frequency offset, modulation index and symbol timing error can be set in any combination with respect to each other; drift superimposition either switched on or off

Bluetooth® RF test cases

The R&S® CBT and R&S® CBT 32 can be used for the evaluation of the following *Bluetooth* test purposes as described in the *Bluetooth* RF test specification 0.92:

- ◆ TRM/CA/01/C (output power)
- ◆ TRM/CA/03/C (power control)
- ◆ TRM/CA/07/C (modulation characteristics)
- ◆ TRM/CA/08/C (initial carrier frequency tolerance)
- ◆ TRM/CA/09/C (carrier frequency drift)
- ◆ RCV/CA/01/C (sensitivity – single-slot packets)
- ◆ RCV/CA/02/C (sensitivity – multislot packets)
- ◆ RCV/CA/06/C (maximum input level)

Remote compatibility between the R&S® CMU 200 and the R&S® CBT/CBT 32

All remote scripts generated for the *Bluetooth*/signalling functional group of the R&S® CMU 200 can also be used for the R&S® CBT and R&S® CBT 32 without any modifications. The only prerequisite for compatibility is that in the R&S® CMU remote script one of the shared inputs/outputs RF1 or RF2 of the R&S® CMU is used for the measurement.

Ordering information

Bluetooth® Tester with display, 4HU	R&S® CBT	1153.9000.35
Bluetooth® Tester without display, 19", 2HU, for remote control	R&S® CBT 32	1153.9000.32



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For specifications, see PD 0758.1287.22
and www.rohde-schwarz.com
(search term: CBT)



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