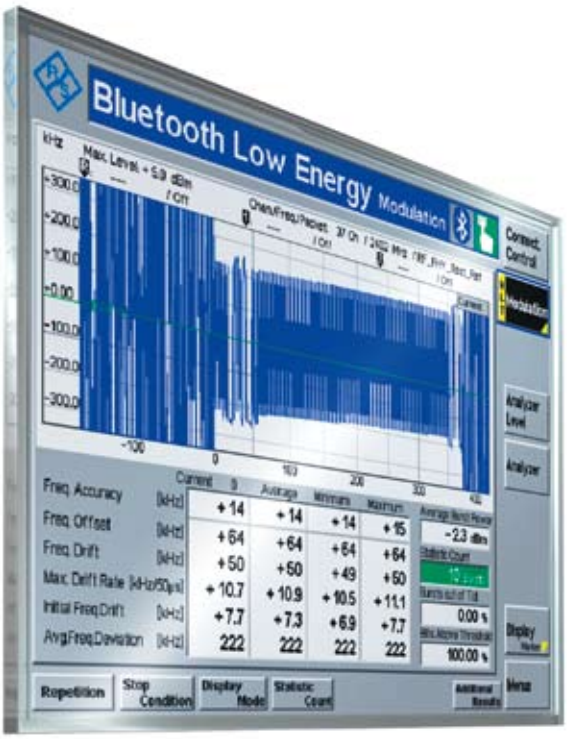
R&S®CBT-K57 Bluetooth® Low Energy Option

For R&S®CBT and R&S®CBT32 Bluetooth® testers



ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 02.00

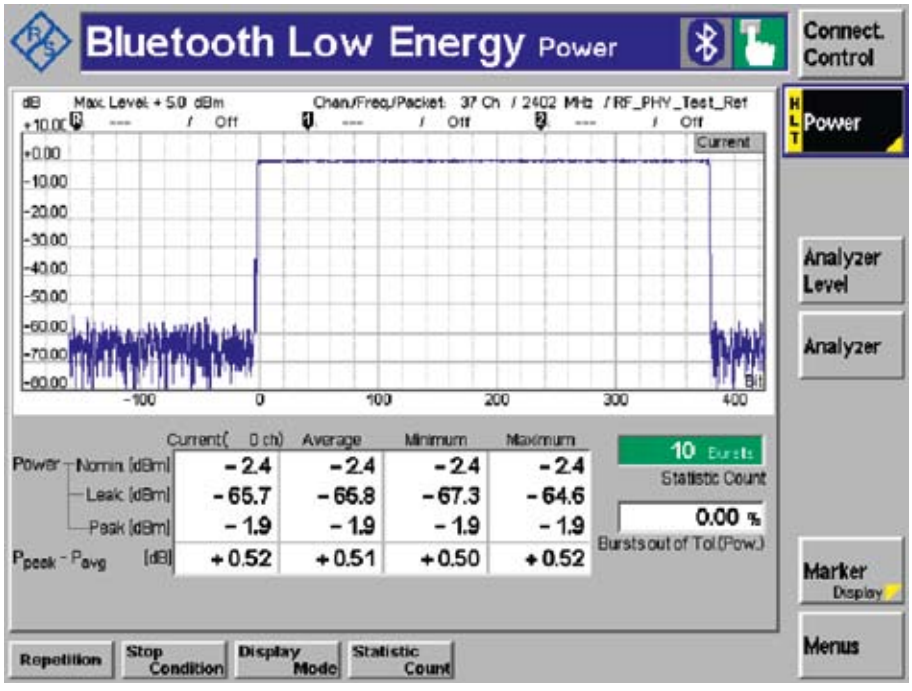
R&S®CBT-K57 Bluetooth® Low Energy Option

The R&S®CBT-K57 Bluetooth® low energy option expands the R&S®CBT and R&S®CBT32 Bluetooth® testers by adding the capability to measure and generate Bluetooth® low energy signals. R&S®CBT-K57 offers measurement functionality for power, modulation, frequency and receiver quality.

Testing Bluetooth® low energy devices

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/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/CBT32 measures the RF parameters of the device under test (DUT). For receiver tests, the DUT receives data packets from the R&S®CBT/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/CBT32 calculates and displays the packet error rate (PER). With dual-mode chips [1], test mode control is accomplished via the familiar HCI interface. Single-mode chips [1] use a new, serial (2-wire) interface.

[1] See general information about Bluetooth® low energy test specification on page 5.



Power measurements on Bluetooth® low energy packets.

Bluetooth® low energy transmitter (TX) measurements

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

Output power

Measurement parameters:

- Nominal power: average power from bit 0 to the last bit of a burst
- Peak power: highest power level within the entire burst including the power ramps
- Maximum difference between peak power und 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

Measurement parameters:

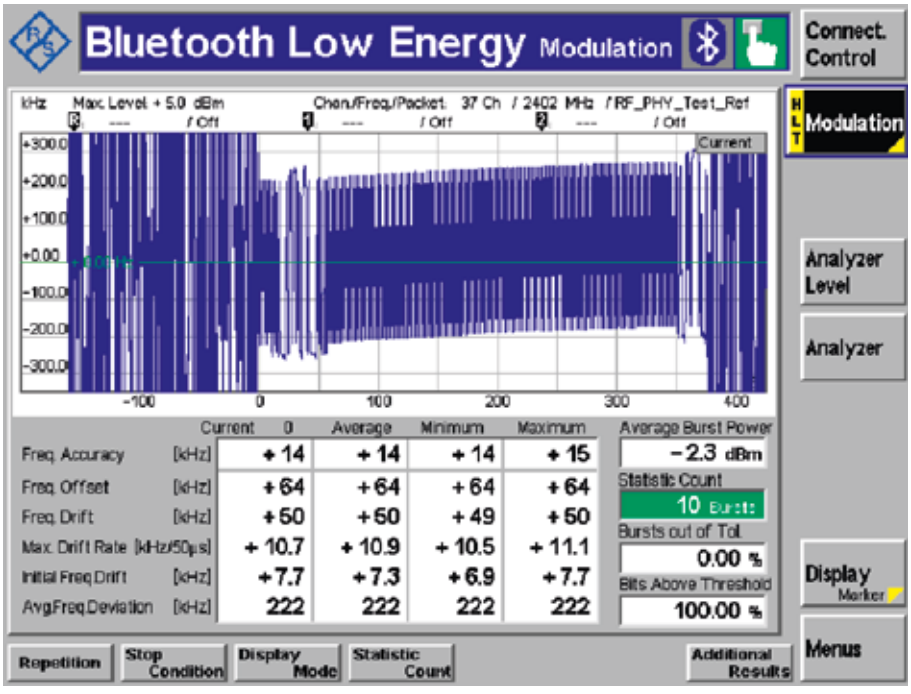
- Frequency deviation: average, maximum and minimum frequency deviation within the packet payload
- Bits above threshold: In compliance with the Bluetooth® low energy RF test specification, a minimum of 99.9% of all measured bits must have a frequency deviation of at least 185 kHz. The R&S®CBT shows 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

Frequency offset and drift

Measurement parameters[2]:

- 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})

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



Combined modulation, frequency and drift measurement.

Bluetooth® low energy generator for RX tests

To measure receiver sensitivity, the R&S®CBT/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
- Advertiser address
- Sync word/access address

Dirty transmitter

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

Bluetooth® low energy RF test cases

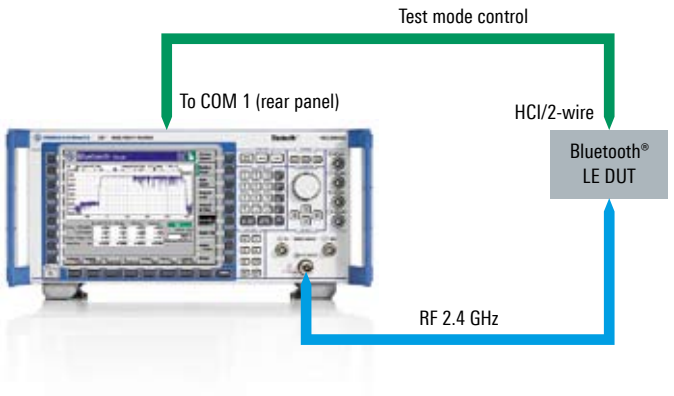
The R&S®CBT/CBT32 with the R&S®CBT-K57 option can be used to perform measurements for evaluating the following Bluetooth® test cases (test purposes) described in the Bluetooth® Low Energy RF PHY Test Specification RF PHY.TS/4.0.0:

- TRM-LE/CA/01/C (output power at NOC)
- TRM-LE/CA/02/C (output power 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/06/C (maximum input signal level)

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. Using R&S®CBTgo, you can conveniently create any desired test sequences by configuring and combining selectable test modules. Test modules for the Bluetooth® low energy test cases listed above will be available on request.

Direct test mode control of the low energy DUT



Bluetooth® low energy specification

The new Bluetooth® low energy (previously Bluetooth® ultra low power) specification makes it possible to integrate a Bluetooth® interface into any type of device where minimal energy consumption is a crucial requirement. In particular, this allows devices running on button cell batteries to be wirelessly connected to PCs, PDAs or mobile phones that support the Bluetooth® low energy technology.

This extremely energy-saving technology addresses the following applications, for example:

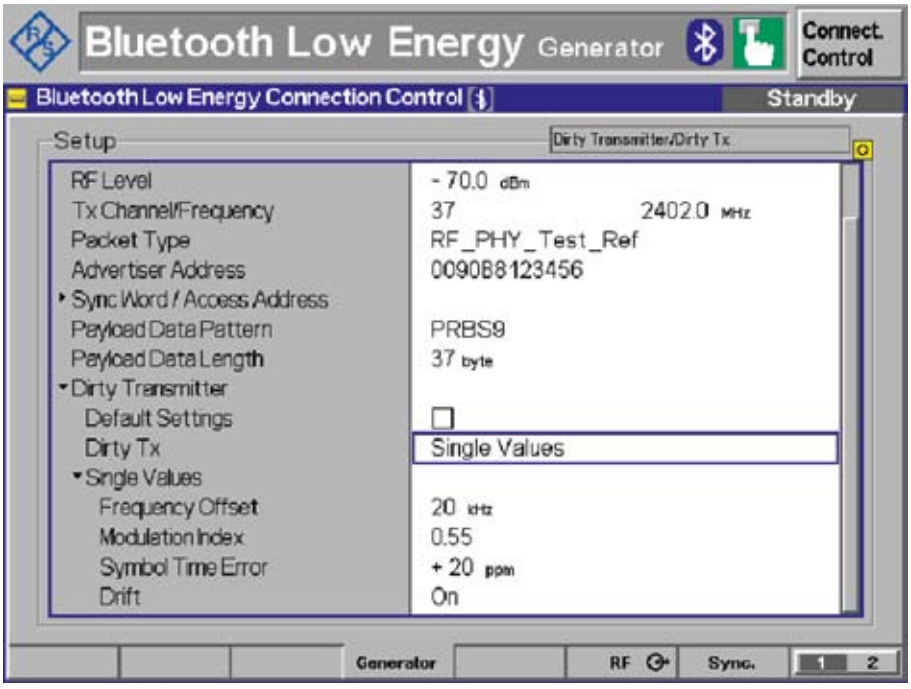
- Wristwatches working as remote displays for mobile phones
- Sensors attached to a user's body for sports and medical applications
- Remote controls of any type to replace infrared technology
- Applications in the automotive sector (e.g. tire pressure sensors)

There will be two types of Bluetooth® low energy chipsets:

- Single-mode chips, which exclusively support the low energy mode; possible product versions may include chipsets featuring no receiver but transmitting data at regular intervals
- Dual-mode chips, which support the established operating modes (basic rate and enhanced data rate) plus the low energy mode; such chips will be typically used in PCs, PDAs and mobile phones

Ordering information

Designation	Type	Order No.
Software option for the R&S®CBT/CBT32: Low Energy Non-Signaling Measurements	R&S®CBT-K57	1170.4102.02



Setting parameters for the Bluetooth® low energy generator.

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- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

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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