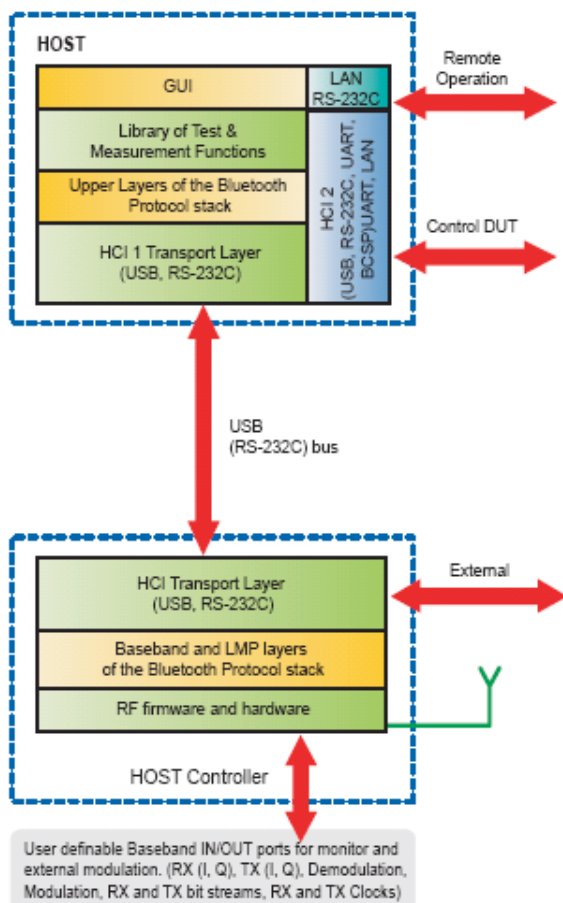


TC-3000C Bluetooth Tester



Product Instructions

TC-3000C Bluetooth Tester is able to analyze the data of every packet that is transmitted to the upper application protocol layer using the protocol stack, which is developed by us. In addition, it enables the user to examine the transmitting and receiving signal function. Since it has built-in signal waveform analysis functions such as spectrum analysis, modulation analysis and period power analysis, this enables the user to perform various RF tests simply and conveniently. Moreover, since it has important test cases include EDR built-in, it enables the user to check the eligibility of the product standard simply and easily.



System Structure

TC-3000C uses the general structure of the Bluetooth system and consists of two parts, which includes the RF/DSP module (Host Controller) that is connected by the internal HCI (Host Control Interface) and host CPU module (Host).

The RF/DSP module consists of the RF Modem and highly functional DSP. The Host CPU (Internal PC) manages the UI (User Interface), screen key input, and I/O control (extra extensions such as RS-232C, USB, LAN, etc.) based on optimized Linux OS. This structure is designed to perform efficiently and safely through its internal PC and high performance of DSP.

Protocol Stack and Analysis function

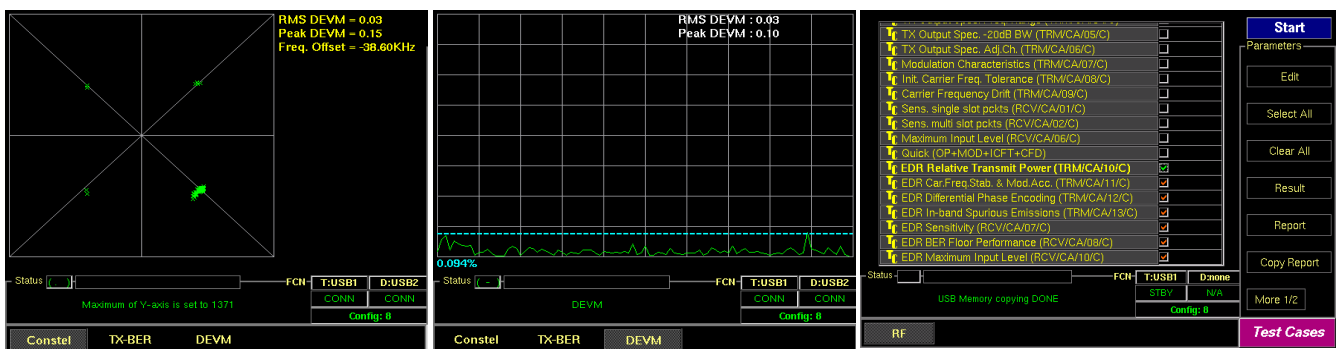
The built-in Bluetooth protocol stack of TC-3000C was developed using our own technology from the Baseband to the upper profile to improve the performance of equipment and ability to measure Bluetooth devices. By using the convenient structure, which 'Queue' is located between each level of the protocol, it enables the user to manage

the upgrading of equipment or additions of function. The user is able to check the status of the DUT protocol by analyzing and transmitting data related to Baseband, LMP, HCI Command, L2CAP, RFCOMM, SDP, AVDTP, AVRC and Profile, and it can be analyzed through the Link Analyzer and Host Analyzer function.

EDR

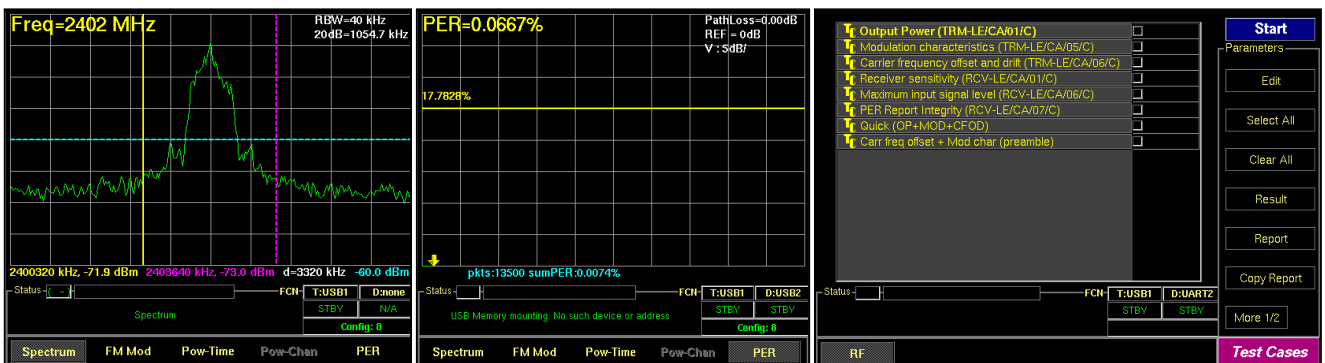
Bluetooth is wireless telecommunication technology to exchange data and voice by connecting devices that are within close range. However, the speed of data transmission is quite low, 1 Mbps, and its application range is limited. Hence, EDR is added to Bluetooth2.0 to overcome this problem. Now, it is able to support 2 Mbps and 3 Mbps data transmission speeds.

TC-3000C supports both 2 Mbps and 3 Mbps EDR functions and provides EDR Measurement for measuring the performance of RF and Baseband. Users analyze the PSK modulation of DUT by using the I-Q Constellation function of EDR Measurement. They are able to check the eligibility of EDR performance for the test through 7 EDR related RF test cases (EDR Relative Transmit Power, EDR Carrier Frequency Stability and Modulation Accuracy, EDR Differential Phase Encoding, EDR In-band Spurious Emissions, EDR Sensitivity, EDR BER Floor Performance, EDR Maximum Input Level).



Bluetooth Low energy (BT_LE)

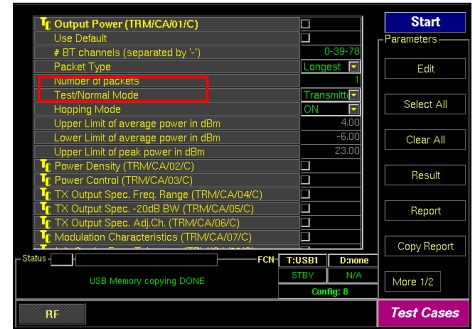
Bluetooth Low energy version 4.0 (BLE) compared to the Classic Bluetooth significantly reduces power consumption owing to relatively slow data transfer rates. BLE is implemented in a single mode product used in sports gear, health care device, sensors, and machine controllers as well as in a dual-mode product where both Bluetooth technologies co-exist. TC-3000C presents 7 RF Test Cases and BLE Measurement capabilities for obtaining RF performance of diverse BLE devices.



When measuring RF performance, the direct test mode must be supported on a DUT which can be connected through HCI (Host Controller Interface) or 2-wire UART Interface. Even though the direct test mode is not available on the DUT, TC-3000C can measure the RF performance through Non-signaling test mode or Advertising test mode.

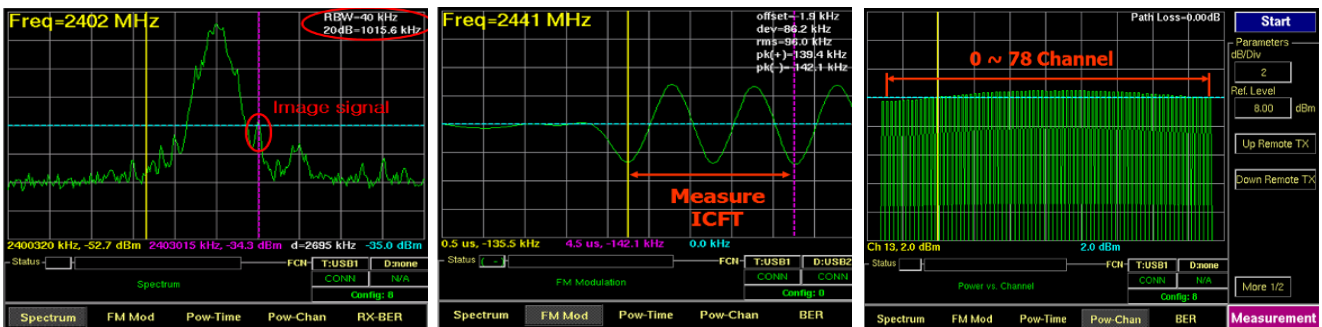
Speed Test Mode

TC-3000C provides a Quick Test Case function that enables the user to measure by setting up the best conditions to suit the user's manufacturing system with the combination of the four most used RF test cases (Output Power, Modulation Characteristic, Initial Carrier Frequency Tolerance, Carrier Frequency Drift). Thus, through this function, it increases the manufacturing efficiency by reducing unnecessary measurement time.



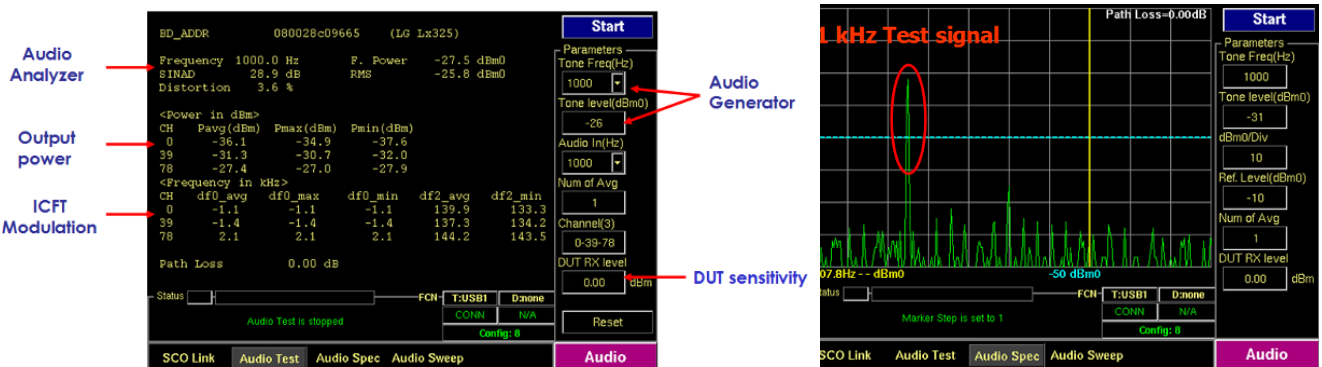
Measurement Function

Measurement of TC-3000C is the specialized function for measuring Bluetooth. It can monitor the spectrum of the device, modulation features power, power for each channel and RX-BER. From EDR measurement, the user is able to check IQ Constellation, TX-BER, and DEVM. The various and powerful waveform analysis functions of TC-3000C are the best equipment for checking and solving the RF functions of the device.



Audio Analyzer

Different from common audio analyzers that only check simple audio functions by applying Headset, Handsfree, Audio gateway, A2DP profile of Bluetooth, the audio analyzing function of TC-3000C transmits the tone signal through the Bluetooth link and analyzes the signal received from the reception. Hence, the user is able to examine not only audio but also the RF function simultaneously. The audio analyzer of TC-3000C provides a wide range of usages through various analyzing functions, which provide more than the standard analyzing functions offered by most devices (i.e., distortion of audio signal, SINAD, RMS, etc.). Additional functions of TC-3000C include Audio Spectrum, SCO loopback, Audio Sweep, etc.



Key Feature

- Supports Bluetooth 1.x/2.x/3.0/4.0
- Integrated measurement (RF, Audio, Protocol)
- Measures the suitability of Bluetooth specifications, overall auto measurement function according to test case
 - Supports 12 RF test cases
 - Supports Dirty Transmitter
- Audio performance (SCO Link) Measurement function (Option 3000-10)
 - Audio test function using Headset, Handsfree, A2DP profile(stereo headset)
 - Audio quality verification (SINAD, Distortion), Audio spectrum, SCO loopback function
- RF signal analyzer function (Option 3000-20)
 - Spectrum Analyzer, Analyze Modulation wave form, power vs. time, power vs. channel, RX-BER
- Protocol analyzer function
 - Baseband, LMP, HCI, L2CAP, RFCOMM, SDP, AVDTP, AVRCP Profile packet analysis
 - Execute function of HCI command
- EDR Test Function (Option 3000-40)
 - I-Q Constellation, DEVM (Differential Error Vector Magnitude), TX Bit Error Rate (TX-BER)
 - Supports 7 EDR RF test cases
- LE Test Function (Option 3000-50)
 - Supports 7 LE RF test cases
 - Spectrum Analyzer, Analyze Modulation wave form, power vs. time, PER
- User definable Baseband IN/OUT ports for real-time signal monitoring, external modulation, audio source and audio analyzer
- HCI interface for DUT connection: USB, RS-232C (UART, BCSP)
- Remote control: TCP/IP (LAN), RS-232C, USB
- Simple upgrade using the USB

Bluetooth Measurement Structure

Normally for Bluetooth measurement, a JIG that fixes the DUT (Device under test), TEM Cell, and Shield Box are needed in addition to the Bluetooth tester. In a shield box, the connection method would be changed depending on the configuration of DUT. Because of their size, most Bluetooth products do not have a connector for other extra measurement. Hence, it measures RF signal by air coupling through the built-in antenna and conducts using the probe when in Module or PCB status. An efficient RF shielding environment is important for accurate and correct measurement under in any circumstances. Measurement error could occur by a simple shield box that has irregular RF coupling or a resonance problem. All test cells of Tescom remove these problems and provide a reliable RF coupling environment with efficient shielding. In addition, we provide a perfect Bluetooth measurement system with TC-3000C.

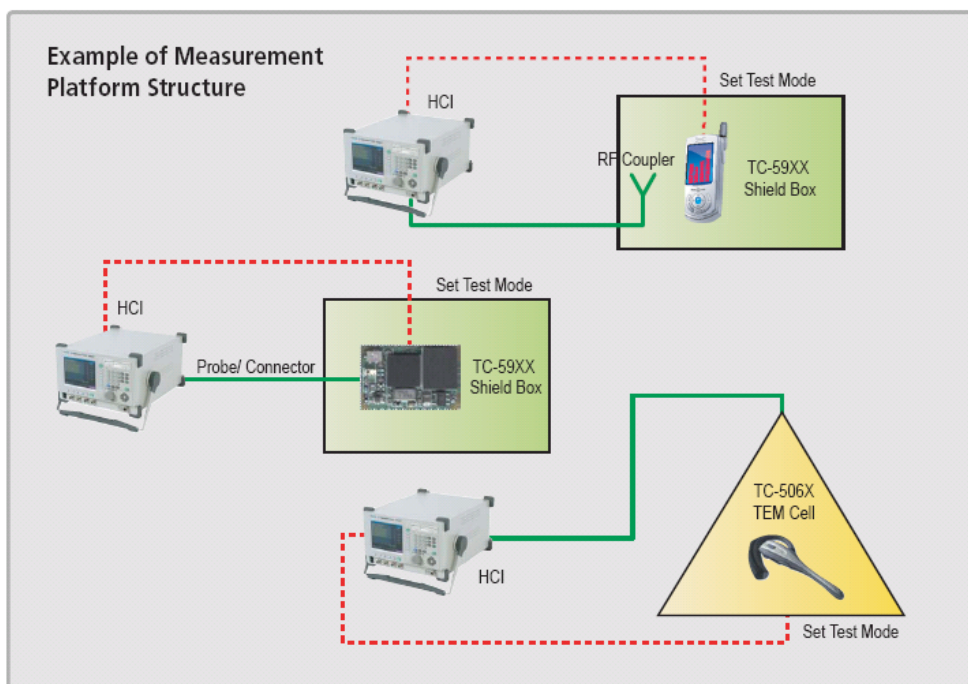
RF Performance Test and Test Mode

The RF function measurement of the Bluetooth device refers to the measurement test standard specified in the Bluetooth RF test specifications. Since the TC-3000C has 12 built-in RF test cases and 7 built-in EDR related test cases, the user is able to measure automatically using only one operation.

According to the Bluetooth RF test specifications, DUT must be measured in loopback or Transmitter test mode, and this would be the most important consideration for Bluetooth measurement. The test mode is activated by TC-3000C control through the HCI port of DUT. When there is no HCI port, use the user's DUT control program in PCB status or activate the test mode through operating the secret key in the status of the completed product and the TC-3000C controls. If the method of test mode activation is not prepared, you have to use a verification method that can check the performance of the product in Normal mode such as the audio measurement method.

Measurement of Audio Performance

Bluetooth products such as mobile phones and headsets are audio products that have speakers and a microphone. Hence, not only the RF measurement but also inspection of audio performance is important. Since the TC-3000C has a built-in Audio Analyzer that is specially designed for the measurement of Bluetooth devices, the user is able to measure the performance of devices that include the audio feature accurately and easily without using any additional test equipment. In addition, since it has built-in low level of protocol stack and a profile that is related to audio, even if the device has no HCI port for activation of the test mode, the user is able to examine the device in Normal mode status. Through the audio measurement solution of TESCOM, it supports RF special measurement of the test case and inspects faulty audio. Thus, the user is able to perform a perfect measurement of the system range from development to the whole manufacturing process.



Product Specification

RF SOURCE

Output Frequency

Range: 2400 MHz ~ 2500 MHz

Accuracy: same as frequency reference

Resolution: 1.0 kHz

Switching Time: < 160 us @ ± 75 kHz of the final frequency

Output Level

Range: 0 ~ -80 dBm

Accuracy: < ± 1.0 dB

Resolution: 0.1 dB

Modulation

- GFSK modulation at Classic BT

GPSK bit rate: 1 Mbps, B X T = 0.5

Modulation index: 0.32

Modulation index range: 0.28 ~ 0.35 (Frequency deviation range: 140 kHz ~ 175 kHz)

Modulation index resolution: 0.01

- DPSK modulation at EDR

$\pi/4$ DQPSK bit rate: 2 Mbps

8DPSK bit rate: 3 Mbps

- GPSK modulation at Low energy

GPSK bit rate: 1 Mbps, B X T = 0.5

Modulation index: 0.5

Modulation index range: 0.45 ~ 0.55 (Frequency deviation range: 225 kHz ~ 275 kHz)

Modulation index resolution: 0.01

RF ANALYZER

Input Frequency

Range: 2400 MHz ~ 2500 MHz

Accuracy: same as frequency reference

Resolution: 1.0 kHz

Switching time: < 160 us @ ± 75 kHz of the final frequency

Input Level

Range: -10 ~ -80 dBm (+20 dBm ~ -30 dBm with 30 dB attenuator ON)

Absolute Max: +25 dBm

Accuracy: < ± 1.0 dB

Resolution: 0.1 dB

Intermediate Frequency

IF Frequency: 70 MHz
Filter BW: 10 MHz Max.
Sampling Rate: 40 MHz
1.3 MHz Digital Filter ON/OFF

SPECTRUM ANALYZER

Frequency Range: 2400 MHz ~ 2500 MHz
Span: 1, 1.25, 2, 2.5, 5, 10 MHz
Resolution BW: ~40 kHz @ 10 MHz Span.
Averaging: 1~50

FM MODULATION ANALYZER

Modulation: FM, GFSK
Frequency Response: 1.3 MHz with channel filter selected
Deviation range: 0~4 MHz
Resolution: 0.1 kHz
Frequency Accuracy: $< \pm 1.0$ ppm

POWER-TIME

Level accuracy: $< \pm 1.0$ dB
Resolution: 0.1 dB
Trigger Method: Access Code (BT), Power Level

POWER-CHANNEL (BT Mode)

Level accuracy: $< \pm 1.0$ dB
Resolution: 0.1 dB
DUT Mode : Null Packet or Test Mode

RX BER TEST (BT Mode)

DUT Mode: Requires Loopback Test Mode
Graph: Log Scale BER-Time
Reading: %, Instantaneous, Cumulative
Parameters: RX Power, Measurement Data Length, Packet Length/Type

I-Q CONSTELLATION (EDR BT Mode)

DUT Mode: Requires EDR Test Mode
Graph: Display I-Q symbol of DPSK
Parameters: Symbol start point, Number of symbol

TX BER TEST (EDR BT Mode)

DUT Mode: Requires EDR Transmitter Test Mode

Graph: Log Scale TX BER-Time and PER (Packet Error Rate)

Reading: %, Instantaneous, Cumulative

Parameters: Number of packet, Packet Length/Type

DEVM (Differential Error Vector Magnitude)

DUT Mode: Requires EDR Test Mode

Graph: Display DEVM on time axis.

Useful test for measuring DEVM variance in a packet.

FREQUENCY REFERENCE

Internal Reference Stability: $< \pm 1.0$ ppm/year @ operating temperature

External Reference: 10 MHz

FRONT PANEL

RF In/Out Port: N-type, 50 ohm, VSWR < 1.6

Baseband In/Out ports: 4 BNC

- IN: input impedance 50 ohms, Max input level is ± 1 Vpp

- OUT: output impedance 50 ohms, normal output level is ± 1 Vpp, DC coupled

- RX (I, Q), TX (I, Q), Demodulation, Modulation, RX and TX bit streams, RX and TX Clocks

REAR PANEL

HCI Interface for DUT: RS-232C, USB

Remote Programming Interface: TCP/IP (LAN), RS-232C

MISCELLANEOUS

Operating temperature: 5 ~ 40 °C

Line Voltage: 100 to 240 VAC, 50/60 Hz

Dimension: 375(w) x 432(d) x 220(h) mm

Weight: 10 kg

Packing Size: 445(w) x 515(d) x 310(h) mm

Packing Weight: approx. 14 kg

Ordering Information

TC-3000C, Bluetooth Tester, Protocol Analyzer and Signal Generator that includes 12 RF Test Cases

Option

3000-10: Audio Analyzer, Includes SCO Link, Audio Test, and Audio Spectrum

3000-20: Measurement Function, Includes Spectrum, FM Modulation, Power vs. Channel, Power vs. Time, RX- BER

3000-40: EDR(Enhanced Data Rate) Function, Includes 7 EDR RF Test Cases, *EDR Measurement (Constellation, DEVM, TX-BER)

3000-50: LE(Low Energy) Function, Includes 7 EDR RF Test Cases, *Measurement (Spectrum, FM Modulation, Power Time, PER)

*Ordering 3000-20 options together is necessary to use the Measurement function

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.