Bluetooth®

TC-3000C
Bluetooth Tester

TESCOM

Introduction

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 defined in the Bluetooth test specification, it enables the user to check the eligibility of the product standard simply and easily.

Benefits and key features

- Supports Bluetooth v1.0 ~ v5.0
- Measures the suitability of Bluetooth specifications, overall auto measurement function according to test case
- Protocol analyzer function
  - LMP, HCI, L2CAP, RFCOMM, SDP, AVDTP, AVRCP Profile packet analysis
  - Execute function of HCI command
- Audio performance (SCO Link) Measurement function (Option 3000-10)
  - Audio test function using Headset, handsfree, A2DP profile(stereo headset)
  - Audio quality verification (Distortion, SINAD), Audio spectrum, SCO loopback function
- Measurement function (Option 3000-20)
  - Spectrum Analyzer, Analyze Modulation waveform, power vs. time, power vs. channel, RX-BER
- BR(Basic Rate) Test Function (Classic BT Basic 3000-00)
  - Supports 12 RF test cases

- EDR Test Function (Option 3000-40)
  - I-Q Constellation, DEVM (Differential Error Vector Magnitude), TX Bit Error Rate
  - Supports 7 EDR RF test cases
- LE Test Function v4.2 (Option 3000-50)
  - Supports 7 LE RF test cases
  - Spectrum Analyzer, Analyze Modulation wave form, power vs. time, PER
- LE Test Function v5.0 (Option 3000-60)
  - Supports 31 LE v5.0 test cases
  - 11 Transmitter / 20 Receiver RF Test Cases
  - Supports LE 2 Mbps PHY
  - Supports Long Range (S=2, S=8 Coding)
  - Supports Measurement Function for LE v5.0
- LE Simple Signaling Test Function
  - Supports OTA(Over-The-Air) test
  - Output Power, PER test
- HCI interface for DUT connection: USB, RS-232C (UART, BCSP, 2WIRE)
- Remote control: RS-232C
- Simple upgrade using the USB

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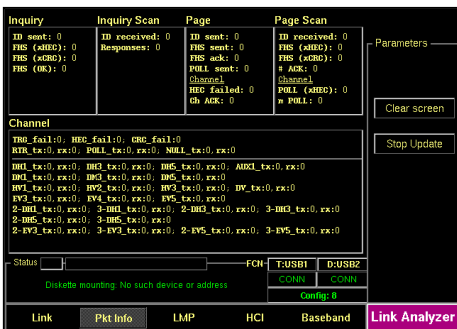
The built-in Bluetooth protocol stack of TC-3000C was developed using our own technology from the Baseband to the upper profile to improve the performance of equipment and ability to measure Bluetooth devices. By using the convenient structure, which 'Queue' is located between each level of the protocol,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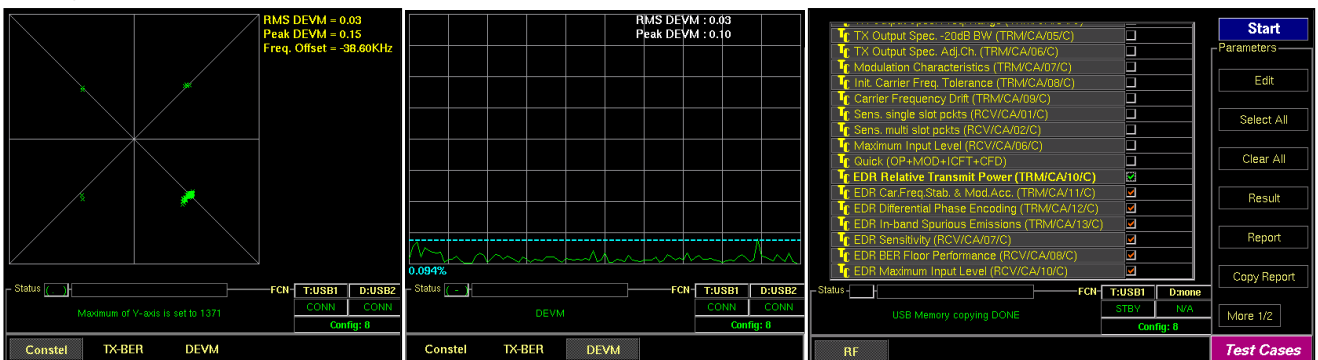
Bluetooth Low energy (BLE)

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.
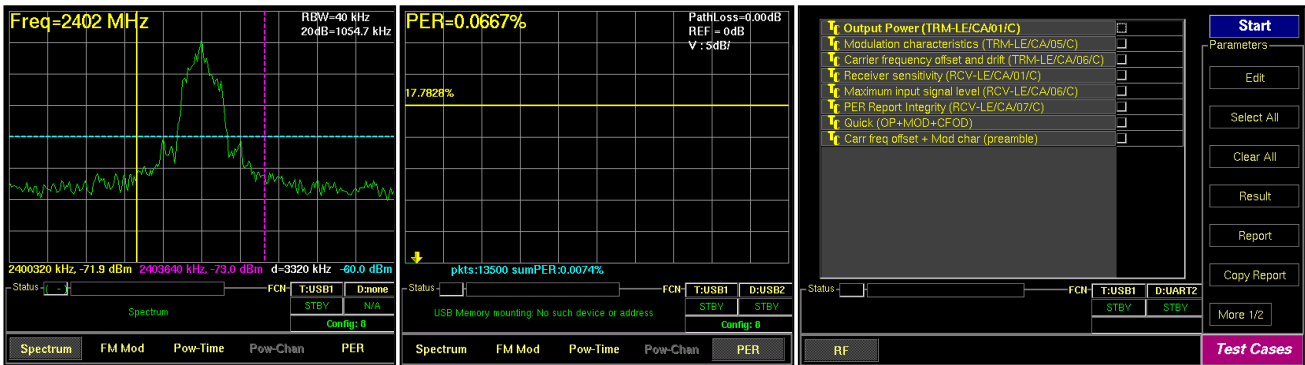

When measuring RF performance, the direct test mode must be supported on a DUT which can be connected through HCI (Host Controller Interface) or 2-wire UART Interface. Even though the direct test mode is not available on the DUT, TC-3000C can measure the RF performance through Non-signaling test mode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

Bluetooth Low energy v5.0

TC-3000C supports Bluetooth v5.0 through S/W upgrade without H/W changes. TC-3000C is capable of testing the following features introduced in the BLE (Bluetooth Low Energy) standard of the Bluetooth Core 5.0 specification.

> LE 1M PHY (1M uncoded) : Basic BLE v4.2
> LE 2M PHY (2M, uncoded) : Added 2 Mbps BLE PHY, supports high speed
> LE Coded PHY : Long range, 125 kbps(S=8) and 500 kbps(S=2)

31 RF Test Cases and BLE Measurement menu has been added for RF performance test of BLE v5.0
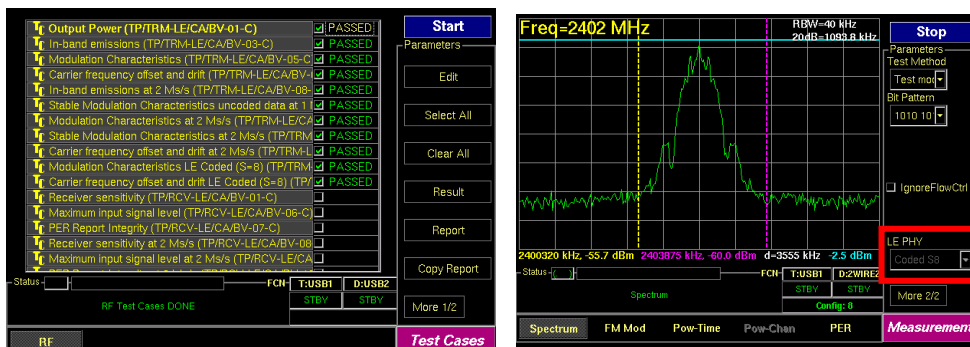

Adding Parameters
- LE PHY
* 1M uncoded
* 2M uncoded
* 1M coded S=2
* 1M coded S=8

Overall auto-measurement function

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.
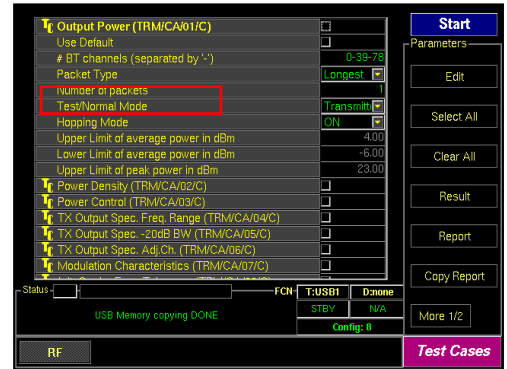

Measurement function

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 RFfunctions of the device.
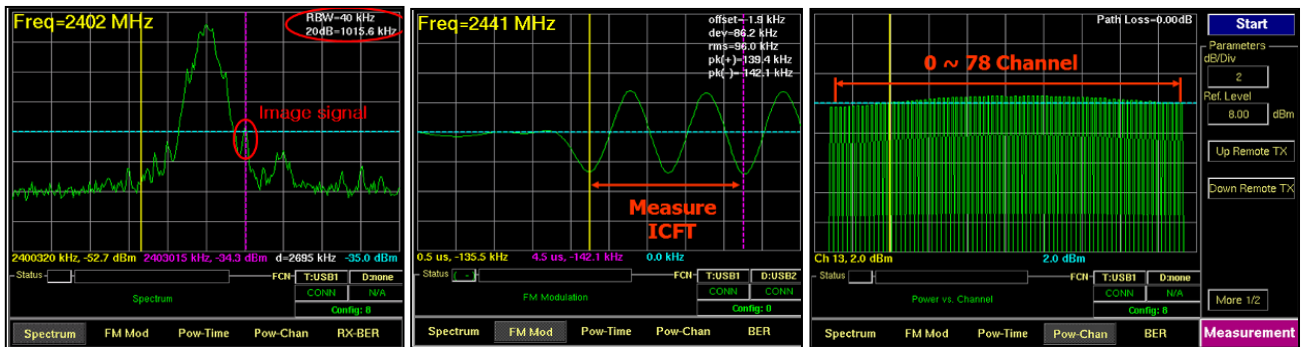
Audio Analyzer

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.
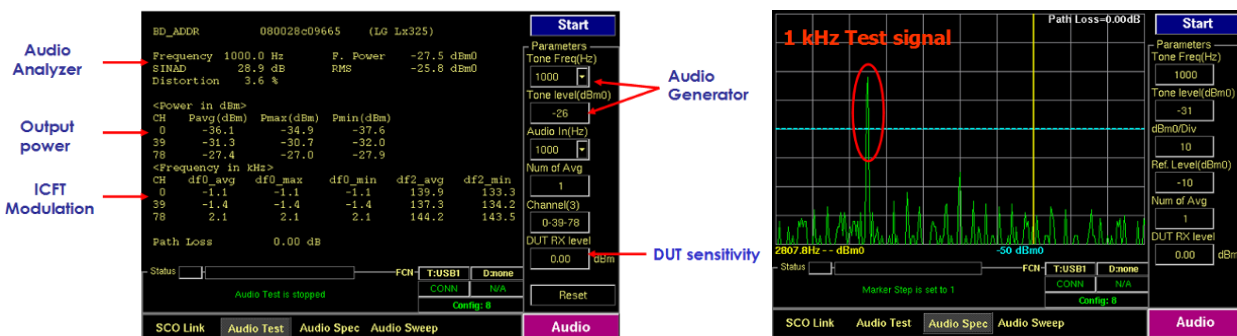
Ordering Information

Order No.	Name	Description
TC-3000C Bluetooth Tester		
3000-00[a]	Classic BT Basic	BR(Basic Rate) RF Test Case, Protocol Analyzer, General Signal Generator in the 2.4 GHz band
3000-10	Audio Analyzer Option	SCO Loopback Test, Audio Test, Audio Spectrum
3000-20	Measurement Option	Spectrum, FM Modulation, Power Channel, Power Time, RX-BER
3000-40	EDR Option (BT v2.1)	7 EDR RF Test Cases, EDR Measurement: (Constellation, DEVM, TX-PER)[b]
3000-50	BLE Option (BT v4.2)	7 BLE(v4.2) RF Test Cases, BLE Signal Generator, BLE Measurement (Spectrum, FM Modulation, Power Time, PER)[b]
3000-60[c]	BLE Option (BT v5.0)	31 BLE(v5.0) RF Test Cases, BLE Measurement v5.0[b]
TC-3000C LE Basic Model		
3000-50[a] **3000-20**[a]	BLE Basic (BT v4.2)	7 BLE(v4.2) RF Test Cases, BLE Signal Generator BLE Measurement (Spectrum, FM Modulation, Power Time, PER)
3000-60[c]	BLE Option (BT v5.0)	31 BLE(v5.0) RF Test Cases, BLE Measurement v5.0[b]

[a] : Mandatory option

[b] : Ordering 3000-20 options together is necessary to use the Measurement function

[c] : 3000-60(BT v5.0) requires 3000-50 BLE Option(BT v4.2)

Specification

■ RF SOURCE

➢ Output Frequency
- Range: 2400 MHz ~ 2500 MHz
- Accuracy: ±46 Hz + Frequency reference drift
- Resolution: 1 kHz
- Switching time : <160 us, ±75 kHz of the final frequency

➢ Output Level
- Range: 0 ~ -80 dBm
- Accuracy: ±1 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
- π/4DQPSK bit rate: 2 Mbps
- 8DPSK bit rate: 3 Mbps

- GPSK modulation at Low energy 1M PHY
- Data bit rate: 1 Mbps, B X T = 0.5
- 125kbps, LE Coded PHY when using S=8 coding
- 500kbps, LE Coded PHY when using S=2 coding
- Modulation index: 0.5
- Modulation index range: 0.45 ~ 0.55 (Frequency deviation range: 225 kHz ~ 275 kHz)
- Modulation index resolution: 0.01

- GPSK modulation at Low energy 2M PHY
- Data bit rate: 2 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: ±46 Hz + Frequency reference drift
- Resolution: 1 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 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 at 10 MHz Span.
- Averaging: 1 ~ 50

➢ FM MODULATION ANALYZER
- Modulation: FM, GFSK
- Frequency response: 1 MHz with channel filter selected
- Deviation range: 0 ~ 4 MHz
- Resolution: 1 kHz
- Frequency accuracy: ±1 kHz

➢ POWER-TIME
- Level accuracy: ±1 dB
- Resolution: 0.1 dB
- Trigger method: Access Code (BT), Power Level

- ➢ POWER-CHANNEL (BT Mode)
  - Level accuracy: ±1 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 (BT Mode)
  - DUT Mode: Requires EDR Transmitter Test Mode
  - Graph: Log Scale TX BER-Time and PER
  - Reading: %, Instantaneous, Cumulative
  - Parameters: Number of packet

- ➢ 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: ±1 ppm at 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, 2-Wire UART
- ➢ Remote programming interface: RS-232C

■ MISCELLANEOUS
- ➢ Operating temperature: 5 ~ 40℃
- ➢ Line voltage: 100 - 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 k

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

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