iQxel-M

BROCHURE

IQxel-M™ Bluetooth Low Energy Test Solutions

LITEPOINT

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A wireless device requires thorough RF testing in engineering to ensure the performance is meeting requirements. In manufacturing, these same devices require a limited subset of testing to validate that the production process was performed properly and to ensure critical component values are within specification.

Traditionally, Bluetooth Low Energy (BLE) devices were tested using a method called Direct Test Mode (DTM). This is an excellent solution for engineering or board level test, but it is sometimes not well suited for manufacturing test for fully assembled BLE devices. To address this, LitePoint developed a new measurement method for Over-the-Air (OTA) testing known as Bluetooth Advanced. This new method can be used with any BLE device that advertises and can perform rapid transmitter and receiver testing, without any special firmware or physical connections to the device being testing. LitePoint offers both DTM and Bluetooth Advanced solutions with the IQxel-M test hardware.

Two measurement methods, one powerful IQxel-M hardware platform

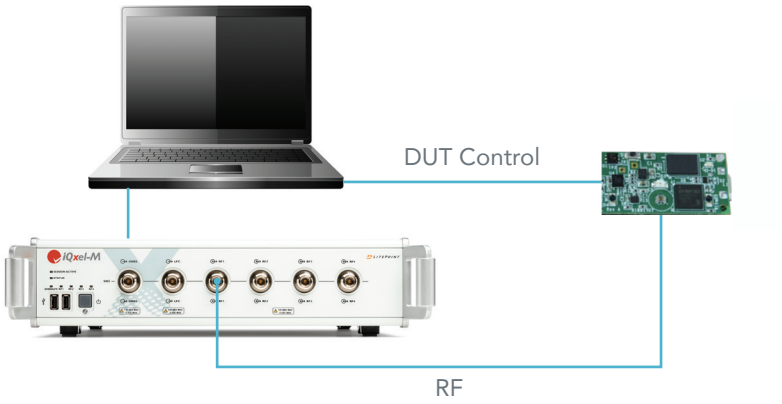
For Bluetooth Low Energy, LitePoint® IQxel-M™ provides two distinctly different methods for RF testing. Shown in the drawings below are the traditional DTM method for BLE testing as well as LitePoint Bluetooth Advanced, for OTA RF testing. Both methods are designed to work with any chipsets and any device that follows Bluetooth Special Interest Group (SIG) defined specifications. For DTM, the device needs to have a COM port and support either Host Controller Interface (hci) or "2-byte" binary test commands defined by Bluetooth SIG. For OTA test, the device simply needs to advertise using standard BLE advertising packets.

Both of these test methods use the IQxel-M hardware platform. Each test setup uses different application software and on-tester licenses, but the hardware is identical and switching between different methods simply requires running a different software application.

Direct Test Mode Measurement Methodology

Bluetooth SIG has defined DTM testing to ensure devices meet a specific level of RF performance. This method generally requires a device to be loaded with special DTM test firmware and the device needs a COM port to allow control of the transmitter and receiver functions. These control methods and control messages are defined by Bluetooth SIG. For DTM testing, LitePoint provides IQfact+ application which runs on a PC and controls both the DUT and the RF tester. This IQfact+ software application provides an easy method to setup test flows, check pass/fail limits, and log measurement data in convenient .txt and .csv files. The LitePoint BLE test application, IQfact_Generic_BLE, works with any BLE device which follows the Bluetooth SIG recommendation. The test methodology closely follows the test methods defined in the Bluetooth SIG specification and allows users to configure their own pass/fail limits. This software application has been tested and is deployed in both engineering and manufacturing applications for most major BLE chipsets. For devices or chipsets that do not follow Bluetooth SIG, LitePoint can provide chipset-specific or custom IQfact+ solutions to control and test your device.

Direct Test Mode Measurement Method



Bluetooth Advanced Measurement Methodology

Bluetooth low energy devices use dedicated advertising channels to transmit beacon signals to establish a connection with a controller. These three advertising channels are distributed across the 2.4 GHz band, providing a convenient method to characterize a device at multiple frequencies. The IQxel-M Bluetooth Advanced measurement solution uses these advertising channels to perform transmitter and receiver measurements, providing excellent coverage and confidence in the parametric performance of the device. The device is tested using its native commercial firmware, not test firmware. In many cases, the Bluetooth Advanced OTA method is easier to implement, and because it uses standard firmware, it provides high confidence that the results are correlated with actual performance of real devices. The Bluetooth Advanced solution comes with the automated IQfact+ test manager. This provides an easy method to build test flows, perform pass/fail testing, and it logs the measurement data in standard .txt and .csv files. An additional brochure is available from LitePoint which provides more details on Bluetooth Advanced capabilities and methods.

Two methods, same measurement results

Direct Test Mode and Bluetooth Advanced use very different measurement methods and the measurement results will reflect some minimal differences between them. For instance, with DTM, the device is configured to transmit very specific data patterns to measure frequency drift, frequency offset, and FM deviation. With Bluetooth Advanced, the device will be transmitting its normal advertising data and the test system will approximate these same measurements based on the data pattern that was received. The table below shows Bluetooth SIG test items and the measurements which are performed. For Bluetooth Advanced, these measurements are performed on the advertising channels (37, 38, and 39) and for DTM, these measurements can be performed on any channel.

Bluetooth SIG Test Item	Measurements Performed DTM and Bluetooth Advanced
TRM-LE/CA/01&02/C (Output Power)	TX Power. Min/Max/Avg
TRM-LE/CA/03&04/C (In-band emissions)	Adjacent Channel Power
TRM-LE/CA/05/C (Modulation characteristics)	Delta F1, Delta F2 (FM deviation)
TRM-LE/CA/06&07/C (Carrier frequency offset and drift)	Frequency Offset, Frequency Drift
RCV-LE/CA/01&02/C (Receiver Sensitivity)	Packet Error Rate (PER), Receiver Sensitivity

In engineering or manufacturing, transmitter power, transmitter quality, and receiver sensitivity are important measurements to perform and IQxel-M with LitePoint application software performs these quickly, with high accuracy and repeatability. Both DTM and Bluetooth Advanced methods have unique benefits and with the LitePoint solution, both are based on identical hardware, giving you the flexibility to choose exactly what you need through simple software licenses and applications.

IQxel-M and IQfact+: A flexible platform for future wireless testing

IQxel-M is a full-featured hardware platform with frequency coverage in unlicensed bands from 860 MHz to 6 GHz. This platform is widely used today in manufacturing and engineering applications for Wi-Fi, Bluetooth, ZigBee, Z-Wave, and Navigation. These additional wireless capabilities can be added to any test system through simple software licenses. As technologies evolve, you can be confident that your measurement system can grow with you. IQfact+ is full-featured turnkey test manager solution and it provides functionality beyond the minimum requirements defined by Bluetooth SIG. This same application framework is used across all wireless technologies and provides an easy method to build test flows, check pass/fail limits, and log test results in .txt and .csv formats.

Convenient Ordering Bundles and Easy Upgrades

Contact your LitePoint sales representative for updated or latest configurations for BLE testing. Below are a sample of more common configurations for BLE test.

Ordering and Configuration

Description	Part Number	Includes
Bluetooth DTM Bundle IQxel-M bundle for BLE Direct Test Mode measurements	0100-IXLM-019	• IQxel-M with 2 ports active for ping-pong testing • Bluetooth measurements License • IQfact+_Generic_BLE. Includes DUT control for BLE devices that follow Bluetooth SIG DTM specifications
Bluetooth Advanced Bundle IQxel-M bundle for BLE OTA measurements	0100-IXLM-020	• IQxel-M with 2 ports active for ping-pong testing • Bluetooth measurements License • Bluetooth Advanced License (enables Over-the-Air testing) • IQfact+ Bluetooth Advanced application software
IQfact+ for DTM Adds application test software for DTM testing with any IQxel-M which has a Bluetooth license	0300-PLUS-105	• IQfact+_Generic_BLE software application for one tester. Includes DUT control for BLE devices that follow Bluetooth SIG DTM specifications * Requires IQxel-M with Bluetooth measurements license
Bluetooth Advanced License and software application Adds Bluetooth Advanced to any existing IQxel-M with a Bluetooth license	0300-IXLM-061 0300-IXLM-062 (field upgrade)	• Bluetooth Advanced License • IQfact+ for OTA testing of Advertising Channels * Requires IQxel-M with Bluetooth measurements license

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