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New White Paper: Navigating Compliance in the EU's Radio Equipment Directive (RED)

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By Yousseif Saeed, Firmware Engineer

Overview

While originally designed for low data-rate applications, Bluetooth Low Energy (BLE) has evolved to provide increasingly higher speeds. Since its introduction in 2010, incremental iterations of the spec have increased the maximum data packet length and added a new modulation scheme to enhance the practical data-rates. As a result, there is a significant impact on throughput allowing BLE devices to address the evolving expectations coming from IoT applications. The increase in throughput also improves power consumption for BLE devices. The radio is active for shorter periods of time to send a certain amount of data, therefore reducing the current consumption. Moreover, it can go into deep sleep for longer periods of time resulting in reduced average power consumption.

Bluetooth v4.2 LE Data Packet Length Extension

With the introduction of the v4.2 spec, the maximum data packet length increased from 27 to 251 bytes. With this near tenfold increase in data that can be sent per packet, the data-rate is significantly enhanced. Fragmentation is also improved as data that is larger than 27 bytes can now be sent in fewer packets. This is particularly important for the Internet of Things (IoT) market, as no fragmentation is needed for IPv6 data packets that would otherwise be split into 27 byte packets. Efficiency is also improved as less packet overhead is sent with larger amounts of data.

Bluetooth 5 LE 2M PHY

Prior to [Bluetooth 5](#), BLE only operated on 1Mbps modulation. Bluetooth 5 has added support for an optional 2Mbps modulation; this feature is known as LE 2M PHY. It allows data to transmit at the higher 2Mbps symbol rate, which should theoretically double the throughput. However, due to factors such as the packet format being slightly different, the practical impact is lower than the theoretical double. The LE 2M PHY feature is relatively new and might take some time before it is supported by silicon and stack vendors, although you can test it now using alpha firmware running on Laird's [BL652 module](#).

Conclusion

The growing demands of the IoT market and the huge array of BLE enabled applications have resulted in the addition of the LE Data Length Extension and LE 2M PHY features to the Bluetooth specification. A BLE radio can achieve the maximum possible data-rate when both features are implemented. However, there are other factors that can affect the measurement such as connection interval, attribute size, and bandwidth configuration.

Furthermore, since BLE throughput is calculated between two devices, the result will always be dependent on the capabilities and limitations of each device. Support of the optional features varies by OS, stack, and device, resulting in different calculations and adding to the complexity of the throughput measurements.

RSS



With devices connecting and sharing data wirelessly, increased security is also a growing demand. BT v4.2 was designed with the IoT in mind and includes major security upgrades that are also available in Bluetooth 5. AES-128, Diffie-Hellman pairing, and link layer privacy all provide enhanced security. Check out the [Leveraging Security Features of Bluetooth for Your IoT Applications](#) webinar for more information about these security features and more.

Please see Laird's [BL652 Bluetooth Module Series](#) for our production release FW image supporting LE Data Packet Length extensions in the "Software Download Tab". There you can also access a brand new ALPHA FW build that includes the new Bluetooth 5 feature "LE 2Mbps PHY" support. **Please note, this is an engineering firmware release to enable early access testing of this new Bluetooth 5 capability. As such, it has not yet been thoroughly optimized and validated for production use.**

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