Bluetooth is a very common short-range wireless communication technology. Its "core specification" for interoperability is defined and maintained by the Bluetooth Special Interest Group (SIG). The first version was published in 1999, and the most recent version, Bluetooth 5.0, was released in June of 2016. Unlike some revisions, Bluetooth 5 may require devices to have new integrated circuits (ICs). In general, Bluetooth 5 is superior to, but incompatible with, previous Bluetooth versions.

Improved Speed and Distance

From the end user’s perspective, the enhancements contained in BT 5.0 are mainly aimed to improve the suitability of Bluetooth for connectionless IoT applications. Compared to Bluetooth 4.2 LE, Bluetooth 5 has up to four times the range (over 1000 feet or 300 meters, depending on the hardware) and twice the speed (up to 2 Mbps).

Location Aware and Mesh Network Capable

Bluetooth 5 is also more location-aware than Bluetooth 4.2 LE, meaning that it has navigation features that talk with other location-aware devices. This enables guided shopping in a very large store, or intelligent visitor experience management in a museum or amusement park.

Bluetooth 5 includes mesh network capabilities, which means some Bluetooth 5 devices can relay messages for others. This enables expansion capabilities far beyond those of the typical star topology. This makes Bluetooth attractive for many Internet of Things (IoT) applications, especially in the industrial IoT. For data integrity purposes, it also includes adaptive frequency hopping, a 24-bit cyclic redundancy check (CRC), and a 32-bit message integrity check.

Improvements for IoT device developers

From the device developer’s perspective Bluetooth 5 includes various improvements that yield better performance and interoperability while requiring less power than Bluetooth 4.2 LE. Like Bluetooth 4.2 LE, Bluetooth 5 is a low energy (BLE) specification with several advantages over classic Bluetooth:

- Non-Link test mode is pre-defined and mandatory. This is an advantage to developers because developers know that the other devices that their devices will encounter have passed this test.
- Bluetooth 5 includes a simplified test case using predefined non-ideal (“dirty”) packets. This allows device developers to validate the robustness of their devices in dealing with imperfect data transmissions.
- Some RF physical specifications, such as blocking resolution, are relaxed.
- The Bluetooth SIG has defined specific test packets, so every manufacturer’s test packet follows the same guidelines, which enhances interoperability.
Test and Measurement Solutions

Keysight covers multiple product validation measurements with the N9081C Bluetooth application (Figure 1). The application runs inside a Keysight X-series signal analyzer, covering multiple product validation measurements, and you can use the application to measure Bluetooth RF transmitter performance, compliant to Bluetooth RF test specifications 2.1+EDR/3.0/3.0+HS and Low Energy (RF-PHY.TS/4.0/4.2/5). These are all test specifications associated with different versions of Bluetooth. You can run the application either via its multi-touch graphical interface or the SCPI programming language.

The application has one-button pass/fail tests and can perform transmit analysis measurement, adjacent channel power and output spectrum measurements, enhanced data rate in-band spurious emissions measurements, low energy in-band spurious emission measurements, and spectrum monitoring.

The in-band emissions test is frequently performed to verify that the level of unwanted signals is within limits on both EDR and LE transmitters.

Figure 2, below, shows you the commonly used transmitter test summary report. There are various measurements that you can use to test your Bluetooth device, including RF envelope, demodulated waveform, and other result metrics.

Figure 2. Transmitter test summary report

For EDR transmitters, there should be no emissions exceeding 26 dB below the maximum transmitted power and beyond 500 kHz away from the carrier. For LE transmitters, there should be no emission greater than -20 dBm at frequency offset of 2 MHz and no emission greater than -30 dBm at frequency offset of 3 MHz.

Conclusion

Bluetooth 5 is a substantial leap forward in Bluetooth technology. Its increased speed and distance and its location awareness and mesh networking capabilities make it suitable for a large variety of applications, including IoT and industrial IoT applications. Testing Bluetooth devices remains critically important, and Keysight has test and measurement solutions to help you succeed with Bluetooth 5.

For More Information

Application Note: Bluetooth 5 Fundamentals and Critical Test Parameters

Keysight Bluetooth test solutions
www.keysight.com/find/bluetooth