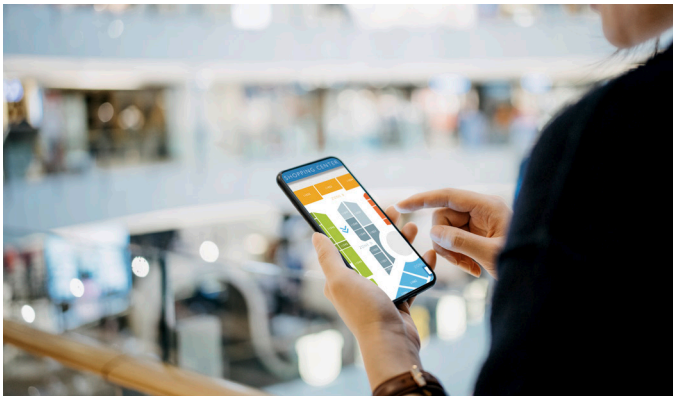
ENSURE ACCURATE BLUETOOTH® 5.1 DIRECTION FINDING

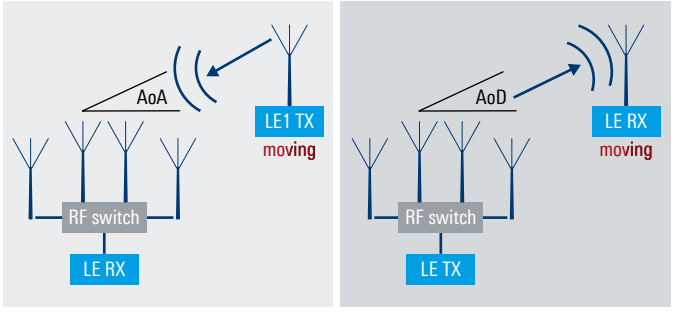
An automated test solution based on the R&S®CMW wideband radio communication tester fully supports the new test cases for real-time submeter positioning.



Your task

New applications and services increasingly require accurate positioning. To meet this need, the Bluetooth Special Interest Group (SIG) added direction finding (DF) as a location service to the Bluetooth® LE Release 5.1 standard from 2019. Conventional Bluetooth® location services estimate locations using received signal strength indicator (RSSI) measurements and trilateration. However, Bluetooth® 5.1 defines two direction finding methods that use antenna array techniques: angle of arrival (AoA) and angle of departure (AoD).

AoA (left) and AoD (right) techniques enable accurate location services



AoA and AoD operating principle

In AoA, the incoming direction of a Bluetooth® direction finding signal with constant tone extension (CTE) such as a Bluetooth® beacon signal can be determined by a locator with an antenna array. AoA is used for real-time location services (RTLS) or proximity services where tracked items transmit Bluetooth® beacons and are mostly used for asset tracking in warehouses. Whereas for AoD, the Bluetooth® beacon signals are transmitted over the antenna array. The receiver is typically a mobile device that receives the beacons and calculates the relative angle to the transmitter. AoD is used for indoor positioning systems (IPS), such as way finding in underground facilities.

Using AoA and AoD for advanced direction finding enables the delivery of precise positioning information down to the centimeter and significantly enhances Bluetooth® location service performance, improving user experience.

The new direction finding feature in Bluetooth® 5.1 requires a total of 23 AoA and AoD transmitter and receiver test cases that are integrated in a mix of RF and I/Q tests. All of these direction finding conformance tests are done in direct test mode (DTM).

Rohde&Schwarz solution

The R&S®CMW platform can generate and analyze all the required direction finding packets in a single box. The one-box solution can manually or automatically perform all 23 test cases and can be controlled via UART and the host controller interface (HCI). All TX/RX measurements and I/Q tests are easily performed with 1 µs and 2 µs slot sizes. All I/Q reports via the HCI can be simply logged in a text file for further analysis.

Application Card | Version 01.00

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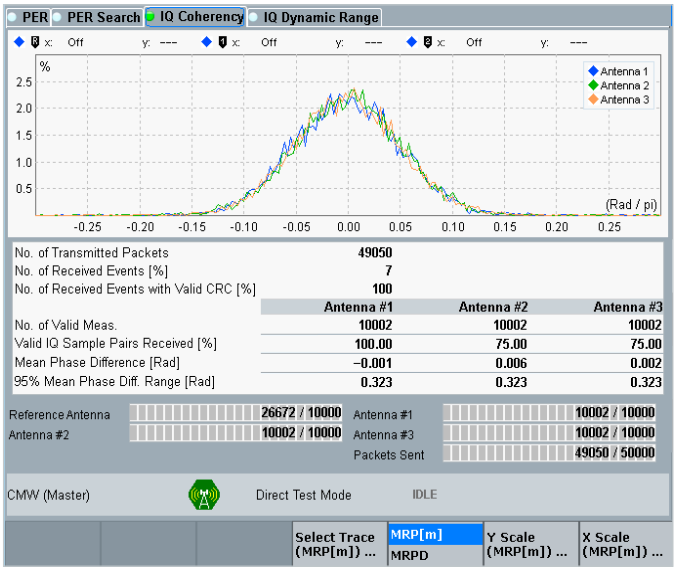
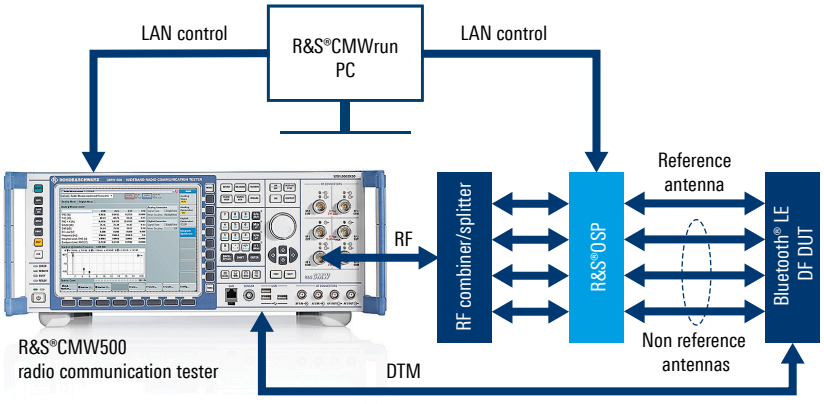


R&S®CMW one-box tester clearly displays measurement results

An off-the-shelf test case plan with full coverage of all Bluetooth® DF preconformance test cases is available with the R&S®CMWrun sequencer software tool. It can run test cases separately or with full preconformance testing including a test report. R&S®CMWrun also maintains log files after each test run to make regression and preconformance testing easier than ever.

The R&S®OSP open switch and control platform eliminates the need for tedious manual switching of RF connectors. The fully automated test solution is ideal for antenna switching integrity test cases that require multiple RF connections and disconnections.

Application



Bluetooth® 5.1 direction finding physical layer verification setup with R&S®CMW and R&S®CMWrun

A fully automated Bluetooth® 5.1 DF test setup is illustrated below. Both the R&S®CMW wideband radio communication tester and the R&S®OSP open switch and control platform are controlled by the R&S®CMWrun sequencer software tool (installed on a separate control PC) via LAN connections. R&S®CMWrun supports all Bluetooth® 5.1 direction finding test cases.

Transmitter tests

- Output power with constant tone extension (CTE)
- Carrier frequency offset and drift with CTE
- TX power stability, AoD transmitter
- Antenna switching integrity, AoD transmitter

Receiver tests

- I/Q samples coherency, AoA receiver
- I/Q samples dynamic range, AoA receiver
- I/Q samples coherency, AoD receiver
- I/Q samples dynamic range, AoD receiver

Summary

The Bluetooth® LE 5.1 direction finding test and measurement solution from Rohde&Schwarz is based on the R&S®CMW platform and covers all verification needs in the product design phase, including functional tests, RF parametric measurements and production requirements. Together with R&S®CMWrun, an off-the-shelf test plan can ensure efficient regression and preconformance testing.

See also

www.rohde-schwarz.com/bluetooth

Designation	Type	Order No.
Wireless connectivity tester	R&S®CMW270	1201.0002K75
Bluetooth® LE Release 5.1 DF DTM and RX measurements	R&S®CMW-KS722	1211.4000.02

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PD 5216.2553.92 | Version 01.00 | June 2022 (jr)
Ensure accurate Bluetooth® 5.1 direction finding
Data without tolerance limits is not binding | Subject to change

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