A Sample Uncertainty Budget for a Conducted Coexistence Test

N. Chris Hess*(1,2), and Jason B. Coder (2)
(1) University of Colorado Denver, Denver, CO USA
(2) National Institute of Standards and Technology, Boulder, CO USA

The need and desire for coexistence testing is rapidly increasing. Wireless devices from the medical, consumer, and industrial sectors all need to perform in crowded RF environments. Coexistence testing can help determine how such devices will perform in their intended operating environment. Coexistence testing is generally technology agnostic; interactions between LTE, Wi-Fi, and Bluetooth (for example) can be all be examined.

The ANSI C63.27-2017 standard provides four test methods for measuring a device's ability to coexist [1]. Though thorough, the standard does leave some areas for additional exploration. One such area is the determination of measurement uncertainty. C63.27 gives some basic guidance on the measurement uncertainty, but users are left to develop their own uncertainty budgets.

Further complicating matters is the use of "Evaluation uncertainty" and "Measurement uncertainty." The former is the ability to estimate the in-field performance from laboratory results. The latter is an expression of the ability to measure a given quantity (e.g., power, frequency, etc.) in a coexistence test. Measurement uncertainty also takes into account the variances between outcomes of same test but different iterations.

Evaluation uncertainty includes the impact of the test method. For example, using a conducted test, we can lower the measurement uncertainty, but at the cost of having a higher evaluation uncertainty. The higher evaluation uncertainty is a result of the fact that neither the Wi-Fi nor BLE links are conducted when used in operation. In addition, a conducted test has the benefit of lower susceptibility to spurious interference associated with radiated tests.

In this presentation we will show a sample uncertainty budget for a conducted coexistence test and describe the resulting evaluation uncertainty. To demonstrate this, we will design a test comprised of two separate links, one between two Wi-Fi development boards and one between two Bluetooth Low Energy (BLE) development boards. The tests will be monitored by use of a vector signal analyzer. Three separate coexistence tests will focus on throughput, signal interference ratio (SIR), and frequency.

Practical examples will be used to help illustrate key points related to coexistence, measurement setup, and the prediction of in-field performance.

[1] American National Standard for the Evaluation of Wireless Coexistence, ANSI C63.27, 2017.