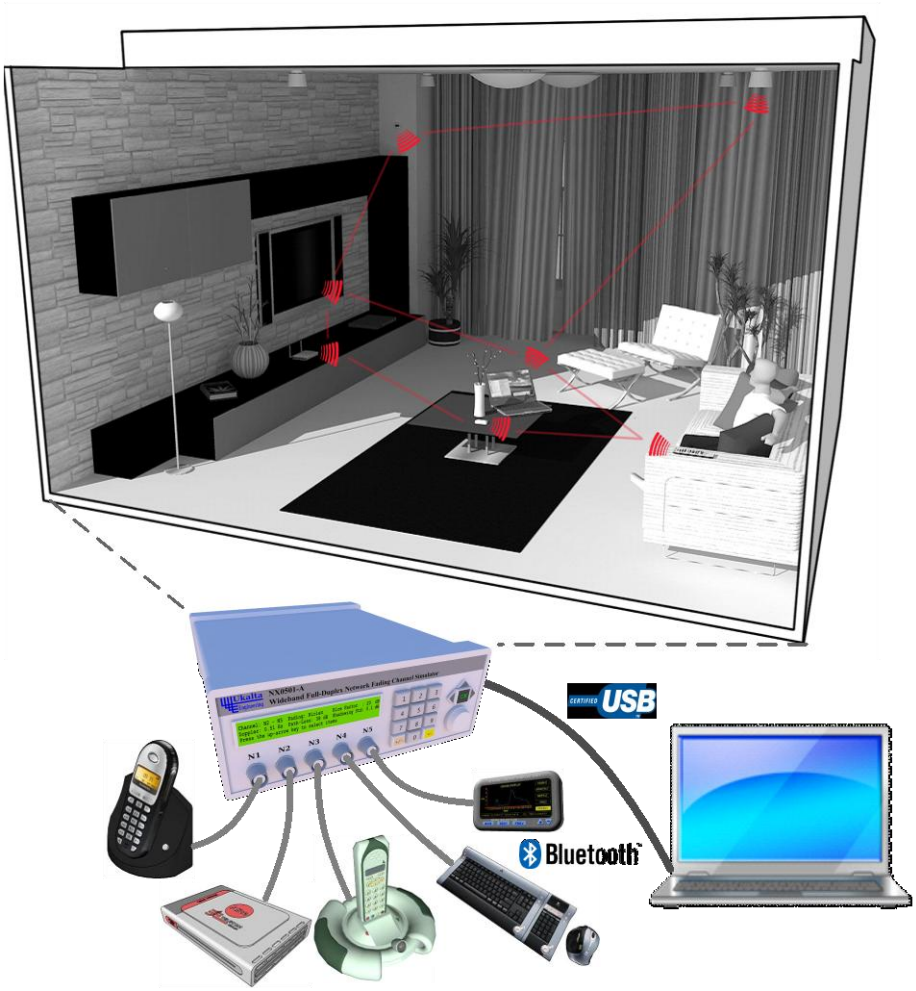
With the proliferation of emerging wireless devices and applications that use a shared electro-magnetic spectrum, the number of wireless protocols and standards that support these devices is also growing rapidly. For example, emerging wireless sensor networks and different wireless personal, local, and metropolitan area network standards, such as Bluetooth (IEEE 802.15.1), ZigBee (IEEE 802.15.4), IEEE 802.11 *b*, *g*, *n*, Wi-Fi, WiMax (IEEE 802.16. *d*, *e*), operate over the ISM (industrial, scientific and medical) radio bands. Many of these wireless devices, which possibly adhere to different standards, may operate in close proximity and at the same time. For example, a future home networking will likely include pervasive deployment of wireless devices, such as wireless sensor nodes (e.g., implantable or wearable medical devices) and interactive multimedia systems. Although the use of unlicensed bands facilitates spectrum sharing and allows for open access to the wireless medium, it also raises serious challenges. The coexistence of wireless devices that use a shared spectrum simultaneously is prone to radio interference, which may degrade the performance of communication systems. Mutual radio frequency (RF) interference between wireless solutions could be severe as the number of interferers increases and could be especially critical in clinical settings where RF interference may affect medical equipment. As the interference tolerance of wireless devices become increasingly important to technology developers, test methods and solutions are required to verify that the communication device under development tolerates any interference from other available devices. The key limitation of the commercially-available testing solutions is that they were developed for a particular standard and network topology and are not applicable across other standards and network configurations. In other words, they are "standard-focused" rather than "system-focused". For example, a test platform can provide complete conformance testing solution to emulate WLAN client devices (such as laptops or handhelds) or access points; however, it is unable to evaluate the real-world performance of wireless networks in presence of the broad variety of other available devices that operate under different standards and over the same radio frequency band at the same time.

Coexistence testing verifies that the wireless product is versatile and robust in presence of other wireless systems. Currently, there are no generally accepted test methods or metrics for evaluating the performance of wireless devices suffering from interference in shared spectrum bands. This issue has led network designers, chipset manufacturers, and equipment developers to rely primarily on custom-built testing solutions. They develop their own benchmarks and adopt the traditional over-the-air site testing. Because of the differences in each vendor's methodology and metrics, the new wireless devices from different manufacturers may not operate consistently. Moreover, using site measurements, only a limited number of scenarios can be tested. It is almost impossible to verify the performance of wireless devices under the prohibitively large number of propagation scenarios and wide range of other available radio systems. In addition, testing in open environments where devices under test (DUTs) cannot be isolated from random RF emissions lack accuracy and repeatability.



Performance evaluation of several wireless devices under various radio propagation channel scenarios

The Ukalta Co-existence Tester (UCOT) is different than point-to-point testing systems that verify only single devices and standards. Our cost-effective test platform can not only can be used for performance testing, but also can be used to validate the coexistence of diverse radio systems in arbitrary indoor channel conditions. Performance is tested in the presence of interference to prove that a system can reliably avoid interference from other radio systems. UCOT also provides system designers with repeatable emulation of wireless conditions, which reduces time-to-market. To maintain a cost-effective testing solution, UCOT can be easily scaled to support a large number of wireless devices. Moreover, consistent test outcomes can be obtained as the DUTs are isolated from RF interference. UCOT allows development of wireless products with greater coexistence capabilities and eliminates the need for custom-build testbeds.

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