

Wideband Multinode Full-Duplex Fading Channel Emulator

Efficiently test interoperability between multiple devices under realistic channel conditions

Key Features

- Full-duplex fading channel emulation of two nodes
- Wideband: 100 MHz bandwidth*
- Operational frequency range: 50 to 2500 MHz*
- Input signal level: -50dBm to 20dBm*
- Doppler frequency: 0 to 2000Hz in 0.01Hz steps
- Supports Rician small-scale frequency-flat fading and exponential path loss large-scale fading
- Can be configured for isotropic and non-isotropic scattering
- Optional support for accurate ray-tracing models

Functional Description

Ukalta's UEMU-N fading channel emulator is the first full-duplex emulator with a wide bandwidth of 100 MHz that emulates various radio channels over a wide range of frequencies independent of the wireless standards that devices operate under. Multiple devices under test (DUT) with a single antenna each are connected via programmable radio frequency (RF) interfaces to a compact and accurate fading channel emulator. The fading emulator can be rapidly configured to emulate a variety of scenarios, and faithfully emulates the radio propagation channels between all connected devices. In order to eliminate RF interference from other devices in an open-air laboratory setting, the DUTs are fully shielded.

Site-specific information of a particular environment can be used to configure the fully-parameterizable fading channel emulator through controller software with a graphical user interface (GUI) or scriptable interface running on a workstation. In addition, the emulator can be parameterized using the on-board keypad and LCD screen. With relatively small Doppler shifts, low data transmission rates, short range of communication, and absence of large delay spreads encountered in typical scenarios, the small-scale fading behaviour is best described by Rician frequency-flat fading. The fading channel emulator also supports large-scale fading and shadowing.

UEMU-N can be upgraded to support frequency bands above 2.5 GHz and additional small-scale and large-scale fading models. The UEMU-N platform is scalable and can be easily upgraded to support a greater number of wireless devices that operate in cooperation with other modules simultaneously.



Figure 1: Ukalta's 5-node full-duplex fading channel emulator

Applications

The multimode fading channel emulator is ideal for verification of wireless transceivers operating in shared spectrum. The multinode fading channel emulator enables rapid and repeatable performance measurements of a wireless system under a realistic channel conditions alongside interfering systems operating in the same frequency bands.

The multimode fading channel emulator is perfect for research and development activities, including:

- Transceiver QoS and sensitivity testing
- Signalling, power control, and media access controller design
- Link and network layer protocol evaluation

The UEMU-N is protocol agnostic and is compatible with numerous wireless standards:

- Wideband FSK transceivers
- Bluetooth and Zigbee modules
- General frequency-hopping and spread-spectrum systems
- WiFi, WiMax, GSM, WCDMA and CDMA2000 based systems

* Preliminary specifications subject to change without notice

Coexistence Testing

The coexistence of wireless devices that use shared spectrum simultaneously is prone to radio interference, which may degrade the performance of communication systems. Mutual radio frequency (RF) interference between wireless nodes can be severe as the number of interferers increases. It is especially critical in clinical settings where RF interference may affect medical equipment.

Ukalta's cost-effective UEMU-N test platform can not only be used for performance testing, but can also be used to validate the coexistence of diverse radio communication systems under arbitrary flat-fading channel conditions. The multimode fading channel emulator allows the designer to verify that the wireless product is versatile and robust in the presence of other wireless systems. Performance is tested in the presence of interference to prove that a system can reliably avoid interference from other radio systems. UEMU-N also provides system designers with repeatable emulation of wireless conditions, which simplifies testing and reduces time-to-market. To maintain a cost-effective testing solution, UEMU-N 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 and operate under digitally generated channel conditions. UEMU-N streamlines the development of wireless products and enhances coexistence capabilities and eliminates the need for custom-built testbeds.

Figure 3 shows the test setup for emulating the performance of wireless communication devices in the presence of other wireless devices operating over the same frequency band at the same time.

Related Products

Ukalta's wideband and full-duplex multi-node fading channel emulator also supports statistical channel models such as Rayleigh, Nakagami- m and Weibull to reproduce a variety of radio propagation models. Ukalta's flexible tester can be configured for large-scale fading models such as shadowing, lognormal, and user-defined models. Optional geometrical channel model support allows for spatial channel modeling. The fading channel emulator can also be upgraded to support both standard and user-defined power spectral densities (for antenna directivity).

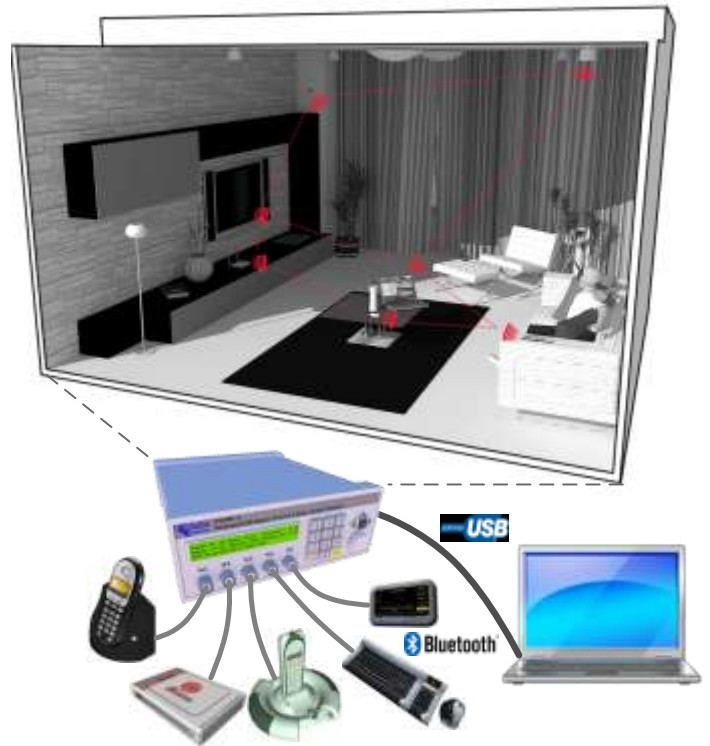


Figure 2: Performance evaluation of several wireless devices under various radio propagation channel scenarios

Ordering Information

For purchasing or to obtain more detailed information on this or any of our other products or services, please contact Ukalta Engineering and we will be pleased to discuss how we can address your special requirements.

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