Testing Telecommunications Devices in Reverberation Chambers using Broadband Signals

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As new devices are developed and manufactured, they may be tested to examine their immunity to and/or emissions of RF energy. The most common standard for this type of testing is IEC 61000-4-3 which takes place inside an anechoic chamber, at a limited number of device orientations and field polarizations. In cases where RF susceptibility is of interest, the standard calls for radiating the device with a 1 kHz sine wave, 80 % AM modulated signal at a 80 MHz – 1 GHz at user defined intervals. This may be an easy signal to generate, but it may not accurately reflect signals impinging on a device in today's modern wireless environments. The now ubiquitous 4G/LTE signals can have a bandwidth much larger than 1 kHz, reaching up to 20 MHz for a single user channel. LTE signals also feature QAM modulation schemes, which differ significantly from the amplitude modulation specified in the standard.

With the difference between the test signal and the real-world signal, can we expect to see a significant difference in a device's performance? This question was recently posed by a consortium of cable television multiple-system operators (MSOs). MSOs typically use the band from 50 MHz to 1 GHz for their downstream (MSO to end user) communications. There have been recent reports that outline an interference problem in the range of 500-850 MHz allegedly caused by 4G/LTE communications. As a result, MSOs are interested in quantifying any potential interference between wireless 4G systems that overlap with their conducted communications at the same frequencies.

In this context, we explore methods for testing telecommunications equipment (e.g. set top boxes, modems) in an attempt to quantify their susceptibility to broadband, 4G/LTE signals while simultaneously exchanging conducted communications at the same frequency. We show that several difficulties arise when testing with broadband signals, particularly when measuring the incident electric field. We also examine how different device configurations (i.e., cabling and/or the use of splitters) can induce a significant change in device performance.

Both the measurement of the incident electric field and the device's configuration during testing are important factors in the testing of any telecommunications device and need to be well understood before any changes are proposed to current standards.