Over-the-Air LTE Measurements in the Reverberation Chamber

Xiaoming Chen, Ahmed Hussain, and Per-Simon Kildal*

Department of Signals and Systems, Chalmers University of Technology, Gothenburg, Sweden
xiaoming.chen@chalmers.se, ahmed.hussain@chalmers.se, per-simon.kildal@chalmers.se

Abstract

The 3rd Generation Partnership Project (3GPP) has provided successful reports and specifications for Long Term Evolution (LTE). The LTE system is the so-called 4G system. A major difference between LTE and its 3G predecessor is that orthogonal frequency division multiplexing (OFDM) and multiple-input multiple-output (MIMO) techniques are employed in the LTE system, thanks to which a much higher throughput can be achieved in the LTE system. To evaluate LTE with end-user experience, over-the-air (OTA) testing of the performances of LTE devices is needed. Among the MIMO-OTA testing techniques, the reverberation chamber (RC) based OTA testing system [1, 2] seems the most promising candidate due to its fast and repeatable measurement. Despite the high efficiency of the RC-based OTA measurement, a theoretical model of the OTA measurement to complement measurement is desired. With throughput being the most interesting performance metric of LTE OTA testing, a throughput model based on the threshold receiver concept has been proposed in [3]. The throughput model is valid for both diversity and spatial multiplexing cases.

The reverberation chamber was first used for EMC measurements, i.e. measuring the effects of undesired radiation. Then, measurement uncertainty was not important. In this paper we describe how it is used for measuring the effects of desired radiation, in which case we would like to have measurement uncertainties smaller than 0.5 dB in order to distinguish good LTE devices from bad ones. This is possible with the latest RC developments [4].

Fig. 1 shows the modeled and measured LTE system under different channel coherence bandwidths. Note that the coherence bandwidth in the RC can be controlled by loading the chamber with different amounts of lossy objects [5], whereas, in the simulation, it is taken into account by generating independent OFDM subcarriers [3]. As can be seen, the throughput model well predicts the measurement. In the final presentation, we will present the throughput model in details. We will also present LTE throughput measurements and modeling for different LTE MIMO configurations, the relationship between Total Isotropic Sensitivity (TIS) and throughput, and the interpretation of throughput as a Probability of Detection (PoD).

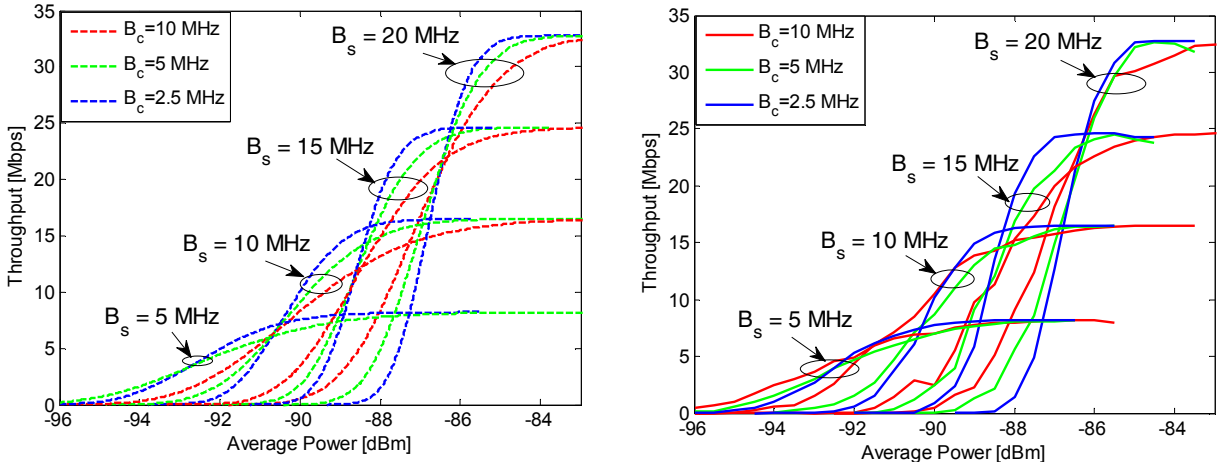

Figure 1. Modeled (left) and measured (right) relative throughput of a 2×2 MIMO LTE system in the transmit-diversity configuration.

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