Statistical analysis of LTE base station performance in reverberation chambers

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Beside traditional electromagnetic compatibility (EMC) measurements, reverberation chambers (RC) demonstrated the ability to well replicate multipath propagation, so making them able to test wireless communication devices and systems. The introduction of an adequate absorbing material quantity allows to modulate the power delay profile of the chamber. In that way, it is possible to tune some interesting parameters for wireless testing such as the coherence bandwidth, the coherence time, the time delay spread, the Rician K-factor, and so on. A real fourth generation (4G) long term evolution (LTE) base station (BS) is installed in our RC to carry out complete over-the-air (OTA) tests. The BS is connected to the external mobile operator network so that during the OTA test it is possible to check a lot of BS parameters and traffic statistical counters to study the BS adaptation capability to the different multipath propagation conditions set inside the RC. Performance statistical indicators are observed during the chamber stirrer rotation varying the velocity and the loading conditions from an empty RC (very high Q factor, about 20000) to a highly loaded chamber (Q factor about 1000) at the BS operating frequencies (1800 MHz band). The BS transmitting antennas and a notebook, equipped by a LTE receiver data card, are both located in the RC and each test lasts 15 minutes to capture the statistical indicators of the external mobile network. As an example, fig. 1 shows the net throughput measured in the two conditions for a stirrer rotating speed of 30 deg/s. Fig. 2 reports the Channel quality indications (CQIs), a dimensionless measurement of air interface quality performed by UE and reported to BTS and used by the latter for link adaptation purposes. In the same figure, the most frequent Modulation and coding scheme (MCS) is indicated. The LTE base station decides how much a transport block transmission should be protected based on feedback received by the UE and BLER requirements. The higher is the protection of one transmitted block (TB), the more robust is the transmission, but the lower is the amount of information that could be sent on it. Other on going tests concern the analysis of the BS performance using the carrier aggregation function, combining both 1800 MHz and 800 MHz bands to improve the throughput up to 200 Mbps.

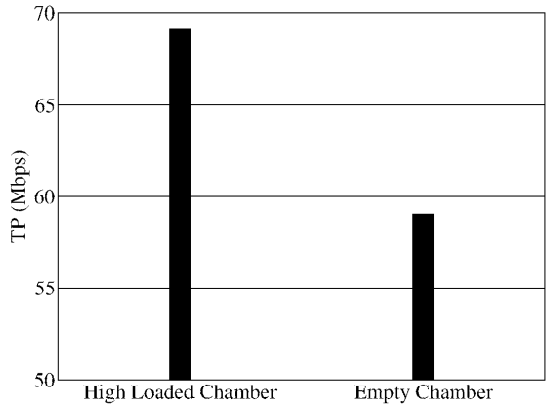

Fig. 1. Throughput data during the OTA test for two RC loading conditions.

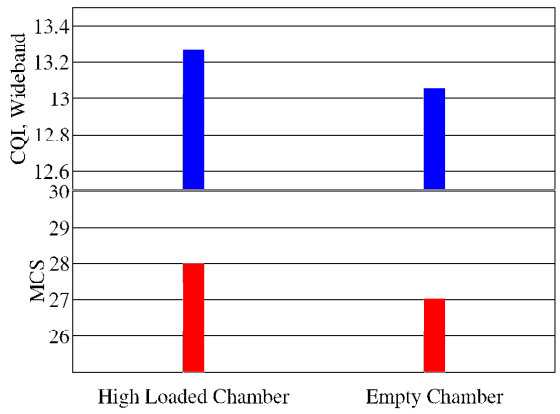

Fig. 2. CQI and MCS for two RC loading conditions.