URSI GASS 2021, Rome, Italy, 28 August - 4 September 2021

LTE-MIMO solutions checked in Reverberation Chamber

D. Micheli[(1)], M. Barazzetta[(2)], L. Bastianelli[(4)], R. Diamanti[(3)], C. Carlini[(1)], M. Colombo[(2)], F. Moglie[(4)], and V. Mariani Primiani[(4)]
(1) TIM S.p.A., Rome, Italy; davide.micheli@telecomitalia.it, camillo.carlini@telecomitalia.it
(2) Nokia Networks Italia,Vimercate, Italy; massimo.barazzetta@nokia.com, michele.colombo@nokia.com
(3) TIM S.p.A., Ancona, Italy; riccardo.diamanti@telecomitalia.it
(4) Università Politecnica delle Marche, DII, Ancona, Italy; l.bastianelli@pm.univpm.it; f.moglie@univpm.it; v.mariani@univpm.it

The reverberation chamber (RC) is, basically, an electrically large overmoded cavity. Within this shielded room, the electromagnetic field is statistically uniform, isotropic and without a preferable polarization. These statistical properties are ensured by a stirring process. Besides electromagnetic tests, this facility is also used for over-the-air (OTA) tests or for testing wireless devices. The RC is able to emulate real life scenarios, such as indoor and outdoor environments [1]. The environment is correctly reproduced by tuning the number and the position of absorbers within the RC until the root mean square time delay spread $\left(\tau_{RMS}\right)$agree with its value reported in the standards. Despite the use of a base station (BS) emulator, in our tests a commercial 4G-LTE BS feeds the chamber at different bands, i.e. band 3: 1800 MHz, band 7: 2600 MHz and band 20: 800 MHz. Figure 1 depicts the set-up [2] [3]. OTA tests have been carried out in order to compare the performance of MIMO configurations 2x2 vs 4x4. Performance can be evaluated by several key performance indicators (KPIs), Table I reports values of the throughput as function of the signal to interference plus noise ratio (SINR). The SINR values are referred to outdoor scenario, where the multipath is richer than an indoor environment. Maintaining the same power transmitted the MIMO 4x4 configuration improves the performance in terms of throughput w.r.t. MIMO 2x2. OTA tests results highlight benefit obtained by MIMO 4x4. These information are useful for the mobile operators may want to provide additional radio capacity in some specific locations, despite the efforts needed for its implementation.

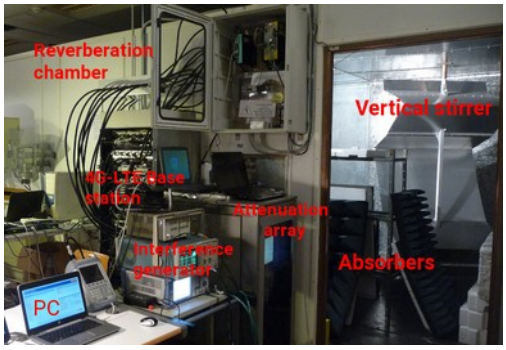

Figure 1: Overall view of the set-up.

Table I: Throughput values as function of SINR.

SINR (dB)	Throughput (Mbps)	
	2x2	4x4
-10	6.3	10.2
0	34.6	40.7
10	65.7	91.5
20	120	195.4

References

[1] P.-S. Kildal, C. Orlenius, and J. Carlsson, “OTA testing in multipath of antennas and wireless devices with MIMO and OFDM,” Proc. IEEE, no. 7, pp. 2145–2157, Jul. 2012.

[2] D. Micheli, M. Barazzetta, F. Moglie, and V. Mariani Primiani, “Power boosting and compensation during OTA testing of a real 4G LTE base station in reverberation chamber,” IEEE Trans. Electromagn. Compat., vol. 57, no. 4, pp. 623–634, Aug. 2015.

[3] D. Micheli, M. Barazzetta, C. Carlini, R. Diamanti, V. Mariani Primiani, and F. Moglie, “Testing of the carrier aggregation mode for a live LTE base station in reverberation chamber,” IEEE Trans. Veh. Technol., vol. 66, no. 4, pp. 3024–3033, Apr. 2017.