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Building testability into mmWave 5G

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Abstract — For most of the history of cellular radio we have relied on conducted measurements of base stations and user devices where the impact of the antenna is discounted. This has been sufficient during the period when antenna performance has been reliable enough to extrapolate end-user experience in real networks. The introduction of smaller less efficient integral antennas in devices motivated the move towards over the air (OTA) testing to ensure antennas were of sufficient quality. SISO OTA test methods have been around since 2003 and will soon be augmented with MIMO OTA test methods. For the base station, SISO OTA is soon to be introduced for antenna arrays supporting elevation beamforming (full-dimension MIMO). With the plan to develop a new air interface for 5G at mmWave frequencies, almost all base station and all device testing will need to be carried out OTA since cabled connections at mmWave frequencies involving antennas with multiple elements are not viable. This move to OTA represents an unprecedented step function in the complexity of testing cellular systems and will require the development of a variety of new test methods that provide a range of spatial and non-spatial test capability at different complexity/cost levels. Part of the development of viable OTA test methods will be the identification of base station and device special conformance test functions that enable control over the DUT in order to simplify or speed up the process of device testing. Due to the timescales of 5G, viable cost-effective test solutions need to be found very quickly as there is no cabled fallback like in earlier generations. The work to identify test methods and possible conformance test functions has started in 3GPP and this paper describes some early ideas with a view to motivating further timely contributions from industry and academia.

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