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Verification of Millimetre-Wave Wireless Channel Sounders

(invited paper)

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Successful characterization of a channel depends upon the trustworthiness of the measurements returned by the wireless channel sounder. Obtaining trustworthy measurements requires verification of the channel sounder's hardware and data post-processing performance, combined with accurate measurement best practices. In practice, various hardware and software defects may distort or impair the channel-measurement data generated by wireless channel sounders. These effects may be especially pronounced at millimetre-wave frequencies.

Users, developers and manufacturers of such instruments require standardized methods to identify and correct such defects or to give confidence that a set of channel measurement data produced by a given channel sounder is suitable for inclusion in a pooled database. A white paper recently published by NIST and the members of the 5G Millimeter-Wave Channel Model Alliance [1] and follow on work conducted by NIST and its research collaborators [2][3] shares many important insights but is not given in the form of recommended practices that can easily be adopted by developers, users or manufacturers.

We have recently embarked upon an effort to develop an IEEE standard that will present recommended practices for verification of millimetre-wave channel sounders. The standards development process has added value by providing a forum for other stakeholders to further contribute to the proposed millimetre-wave wireless channel sounder verification techniques.

The proposed standard presents methods for verifying millimetre-wave channel sounder performance by comparing processed channel measurement data to theory or to an artifact having known characteristics. Such measurement data may be collected in situ, under controlled conditions or by comparison to a reference measurement. Practices associated with: 1) instrument configuration and data dynamics (*i.e.,* the rate and amount of data generated, limitations imposed by buffer and storage media and bottlenecks in communications and processing), 2) instrument calibration, 3) verification based upon conducted measurements using connectorized test fixtures or artifacts, 4) verification based upon over-the-air testing, and 5) verification of high-resolution channel estimation software are considered.

The ultimate goal of the effort is to provide guidelines for producing verification results that may be used to: 1) identify and correct shortcomings in channel sounder performance and/or post-processing techniques and/or 2) give confidence that a given set of channel measurement data is suitable for inclusion in a pooled database.

References

[1] K. Remley *et al.,* "Verification Techniques for mmWave Channel Sounders." NIST, Boulder, CO, Apr. 2019.

[2] J. Quimby, D. G. Michelson, M. Bennai, K. A. Remley, J. Kast, and A. Weiss, "Interlaboratory Millimeter-Wave Channel Sounder Verification," in *Proc. EuCAP 2019* (Krakow, Poland), Apr. 2019, 5 pp.

[3] D. G. Michelson *et al.,* "System Distortion Model for the Cross-Validation of Millimeter-Wave Channel Sounders, in *Proc. EuCAP 2019* (Krakow, Poland), Apr. 2019, 5 pp.

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