



## Linearity Measurements of Wireless Communication Systems: Past and Future

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### 1 Extended Abstract

Linearity measurements and wireless communication systems evolved harmoniously. Initially systems were static. CW measurements were sufficient to predict performance [1]. With broader bandwidths nonlinear dynamics became relevant. Swept 2-tone measurements were developed to quantify 3rd-order nonlinear dynamics [2]. Since bandwidths and signal modulation complexity continued to increase, higher nonlinear dynamic orders became relevant. Unequally spaced multi-tone techniques were developed to observe them independently [3]. However, due to scalability issues the field geared towards linearity measurements performed using communication signals. To understand linearity in this context, we have explained how to use static nonlinear reference profiles to measure nonlinear dynamics using such signals [4], and how linearity metrics change with the communication signal [5]. But many challenges remain unaddressed. In our opinion, we must address how to bridge the gap between simulated and measured performance by fostering first-pass design techniques based on communication signals. Right now, systems are designed with tools that do not contemplate the nonlinear dynamics present in real operation. The device models used in CAD design are not based on communication signals. It is hard to balance the model/simulation accuracy-complexity trade-off when using real signals. This gap grows as the trend towards larger bandwidths and more complex signals continues. In fact, in [6] the Pareto optimality has been used to show that the load that provides the best efficiency-output power trade-off in real communication differs from the optimal load in CW. In [7], we have shown it is possible to design systems from a wireless communication signal standpoint by using wideband active load-pull measurement systems to design the matching networks while simultaneously applying real signals to the system input and assessing EVM, ACPR, NPR, and power at the system output. But work is required to develop novel systematic methods of using this measurement approach to reach optimal design performance, and to translate the gained knowledge into simple models that lead to practical simulations that can be used in CAD designs whose performance meets the system-level validation. At the conference venue we aim to show, for the first time, how the performance of a PA design based on wideband active load-pull measurements compares with the performance of a PA design following classical techniques.

### References

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