RF LUMINATION 2019

# CLASS ABSTRACTS

## 5G mm-wave chipset characterization using on-wafer loadpull

Greg Bonaguide, National Application Engineer, R&S
Dr. Sajjad Ahmed, Business Development Manager, Focus Microwaves

As commercial wireless standards move to mmWave frequencies, on-wafer device characterization provides more and more challenges. The biggest hurdle for passive load pull at these higher frequencies is the loss between the tuner and the device under test. Since loss is proportional to electrical distance, these short wavelengths make it difficult to get usable tuning range in the 5G mmWave bands. A new innovative technique is now available to maximize tuning range for on-wafer device characterization, allowing for not only high VSWR tuning but harmonic tuning up to 110GHz.

## Advanced techniques for phase noise and jitter measurements

Greg Bonaguide, National Application Engineer, R&S

Phase noise can be a limiting parameter for many types of systems. As radar precision, data rates and modulation complexity increases, low phase noise oscillators and instrumentation to accurately generate and measure extremely low phase noise has never been more important. This workshop focuses on how to generate signals with low phase noise and how to perform accurate and fast measurements. We will contrast different techniques, such as the direct spectrum analyzer-, phase detector-, phase detector with cross correlation- and delay line discriminator method. Each has a different level of cost, complexity, measurement speed, and ability to attain a certain accuracy.

We will also introduce a new technique using direct down-conversion, analog I/Q mixers and baseband signal sampling that provides extremely high measurement sensitivity and speed. It allows to measure phase noise as low as -183 dBc/Hz with a 100 MHz carrier frequency and 10 kHz within two minutes. CW, Additive and Pulsed Phase Noise, Pulsed-Additive Phase Noise, and AM Noise measurements can be performed as easily and simultaneously.

## Automated RF component test for design engineers without programming

Martin Lim, National Applications Engineer

The complexity of RF designs is increasing while the pressure to hit market windows is ever increasing. Enabling the automation of repetitive tests like a power sweep over frequency can greatly help confirm if a new design is ready or further work needs to be done. Unfortunately, the downsides of programming are outside the normal responsibilities of most RF designers and include time consuming drawbacks like wading through long programmers manuals and debugging code. With innovative tools available from Rohde & Schwarz, learn how you don't need to be a programmer or even know how to program to quickly set up automated test routines. With the speed of test the newest instruments like the R&S®FSV3000 and SMBV, the throughput is excellent to complete a full characterization. This can help quickly validate designs by making repetitive tests over a wide range of conditions to better validate designs.

## Controlling Phased array antennas

Markus Lörner, Market Segment Manager / Business Development Manager
Tumay Kanar, Manager of mmWave IC Design Team, IDT

Beamforming using phased array antennas is a common technology in the aerospace & defense industry for radar, satellite communication and latest wireless technologies including 5G NR. This session will discuss an easy to use highly integrated beamforming solution to build up efficiently the beamforming front end from the leading industry partner IDT.

## Digital Doherty Power Amplifiers

Markus Lörner, Market Segment Manager / Business Development Manager

The Doherty Amplifier represents the benchmark for energy efficient, quasi-linear, power amplification. But for 5G, SatCom or any other application demanding high performance and reproducibility, the challenges remain the same: how can you be sure that you are getting the maximum possible performance from the design and how can you evaluate its sensitivities and variations for series production? During this session we will describe how, measuring the Doherty Amplifier as a dual-input device provides the designer with a hitherto unattainable visibility, enabling them to make the best design choices based on evidence, preparing for volume production with insight.

## MISO Transmitters (Multiple Input, Single Output)

Fabricio Dourado, Application Development

Energy Efficiency, Linearity, Output Power and Bandwidth are the four key technical parameters of the Tx RFFE. The latter three are regulated, but efficiency is the differentiator. As a result, Efficiency Enhancement and Linearization techniques have been the target of much R&D resource for a long time. This workshop begins with a review of linearization techniques, explores the physical limits and concludes with a classification. If perfect linearity could be achieved, it would not be worth having. MISO Transmitters represent an especially interesting type of Linearization. Measurements on three fundamental MISO Transmitters will be demonstrated, highlighting some intriguing features.

## Residual (Additive) phase noise measurements

David Tunkelrott, Business Development Manager

Additive phase noise measurements pose additional problems beyond the ones encountered in absolute phase noise measurements. In addition to the issues of diminishing the residual phase noise of the measurement device, 2-port device measurements require the reflection of how to remove (or sufficiently diminish) the impacts of the signal source used to drive the 2-port DUT.

## Simplifying wideband multi-antenna applications with advanced data converter integration

Barry Adkins, Application Engineer
Philip Pratt, Business Development, Texas Instruments

Data converters are essential in any RF system such as wideband communications or radar. In many cases, they define the overall system performance. During this session with leading industry partner Texas Instruments, we will review architecture tradeoffs of direct RF sampling vs traditional approaches, and get an update on the latest in integration, bandwidth and capability. We will have demonstrations of highly integrated AFEs (analog front ends) for wideband multi-antenna applications that cover up to 6-GHz of radio frequency and 1.2-GHz of information bandwidth.