EDI CON

2018

Electronic Design Innovation Conference

电子设计创新大会

B E I J I N G

March 20-22, 2018

China National Convention Center

Conference Guide

EDI CON 2018
Electronic Design Innovation Conference
电子设计创新大会

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Official Publications

Microwave Journal

Microwave JournalChina 微波杂志

Signal Integrity Journal

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EDI CON China Technical Advisory Committee

The EDI CON China 2018 Technical Advisory Committee is made up of leading experts in RF/microwave and high-speed digital design who are committed to the educational mission of EDI CON. They review and evaluate submitted abstracts to determine their quality and impact, and these committee members are essential to helping EDI CON reach the highest levels of quality and relevance.

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jlove@horizonhouse.com

EDICON

Tuesday, March 20, 2018

08:30 - 05:00	Registration On Site						
ROOM	**402 A/B**	**403**	**405**	**406**	**407**	**401**	**EXPO Hall**
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11:00 -12:00	**Lunch Break: Exhibition Floor**						
	Technical Sessions						**EXHIBIT HALL OPEN → 11:00 - 17:30**
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EDICON

Wednesday, March 21, 2018

08:00 - 05:00	Registration On Site						
ROOM	**402 A/B**	**403**	**405**	**406**	**407**	**401**	**EXPO Hall**
	Technical Sessions						EXHIBIT HALL OPEN → 10:00 - 17:00
	Radar & Defense	**RF & MW Design**	**Test & Measurement**	**EMC/EMI**	**Signal Integrity**	**ACB EMC Training for Chinese iNARTE Members** * Additional Registration Required	
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13:50 - 14:30	The Use of GaN/Si Commercial Process to Achieve mmW LNA and PA at Low Cost (168) Sichuan YiFeng	RF Test of 5G mmWave and Ultra-Wideband PA and Digital Pre-Distortion (DPD) Verification (38) Keysight	Advanced Front End Module Test Including Wide Band Impedance Control (70) Focus Microwaves	Get the Most Out of Your Data Converter Design (66) Rohde & Schwarz	Designing and Optimizing a High-Efficiency RF Front End with Digital Pre-Distortion (DPD) (120) Richardson RFPD Electronics		**Poster Session 14:00 - 15:00 (Exhibit Hall)**
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16:00 - 17:00	**Happy Hour: Exhibition Floor**						

Thursday, March 22, 2018

08:00 - 14:00	Registration On Site					
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	Technical Sessions & Panels					EXHIBIT HALL OPEN → 10:00 - 15:00
	5G	**Test & Measurement**	**RF & Microwave Design**	**Simulation & Modeling**	**Short Course**	
09:05 - 09:25	Developing Proof of Concept Systems for 5G (54) Fangze Tu, National Instruments	5G mmWave Massive MIMO Over-The-Air (OTA) Test: Technical Challenges and Prototype System (148) Wen Zhu, Keysight	Solid State RF Energy – Inroads to the Industrial Market, Panel Discussion, Klaus Werner kw tec b.v. & RF Energy Alliance	Automatic Design and Verification Flow of PA Modeling and Digital Pre-Distortion (156) Wu Jiarui, Keysight	Short Course: Essential Principles of Power Integrity Measurements Eric Bogatin, Teledyne LeCroy Runs from 9:05-11:50	
09:30 - 09:50	RF Technology for 5G mmwave Radio (79) Thomas Cameron, Analog Devices	Increasing Measurement Accuracy of VNAs in the THz Range (46) Thilo Bednorz, Rohde & Schwarz		Twisted Cable Fast Modeling and Simulation (44) Chenzing Zhao, Xpeedic Technology		
09:55 - 10:15	Overview of 5G UE OTA Test Challenges and Methods (151) Jing Ya, Keysight	Advanced Methods to Analyze Ultra Wide Automotive Radar Signals (94) Martin Schmähling, Rohde & Schwarz		Component - Level Via Modeling and Optimization Technology (34) Rui Wang, Xpeedic Technology		
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ACB Training Seminars

March 20, 2018: 4-hour Regulatory Training focused on basic knowledge of FCC/ISED/CE/MIC rule and current updates to the Regulations.

ACB provides professional and international regulatory training to our industry. This year's seminar will be extremely significant since there are important updates to the American FCC and European Radio Equipment Directive (RED).

March 21, 2018: 4-hour iNARTE EMC Training. The topic will provide EMC fundamentals and applications to help attendee prepare iNARTE EMC exam.

The iNARTE Certification covers EMC, ESD, EMC Design, Product Safety, RF and FCC. This year, iNARTE is creating membership programs to expand the service to Chinese engineers. Registered members will be able to gain free/low cost professional training and be guided to take the iNARTE exam. The goal of this training is to help engineers achieve iNARTE certification.

▼ Tuesday, March 20, 2018 ▪ 9:30 - 11:00 ▼

Plenary Keynote Talks

Room: Auditorium
IMT-2020 (5G) standardization process
Dr. Ying Peng, DaTang Telecommunication Technology & Industry Holding Co. Ltd (CATT)

EDICON
INVITED SPEAKER

Abstract

The scope of 5G is much broader than the previous generations of mobile broadband communication systems. We are talking here about not just an enhancement to the traditional mobile broadband scenarios, but extending the application of this technology to use cases involving ultra-reliable and low latency communications, and massive machine-type communications. The ITU's work in developing the standards for IMT-2020, in close collaboration with the whole range of 5G stakeholders, is now well underway, along with the associated spectrum management and spectrum identification aspects.

Biography

Dr. Ying Peng received her Ph.D degree from University of Bristol, U.K in 2006, and joined Datang Telecommunication in 2008. She has been working on ITU-R WP5D since the end of 2008 till now. She is now working as one of co-chair of SWG Evaluation in WP5D. Dr. Peng has also been regularly attending 3GPP TSG RAN1 meeting since 2008. Dr. Peng devoted herself to the whole working process of IMT-advanced ("4G") specification process including evaluation, submission and specification during 2008-2012 in ITU-R WP5D. Now Dr. Peng has been also working on a variety of topics/documents related to IMT-2020, including M.2320 for IMT future trends, M.2083 for IMT vision, M.2410 and M.2411 for IMT-2020("5G") technology requirements and submission templates, and she has also completed M.2412 for IMT-2020 evaluation guidance as the chair of SWG EVAL. She has a rich standardization experience and good knowledge of working method and process on ITU-R WP5D, and a thorough technical knowledge background on other external organizations, e.g. 3GPP. She has been engaged in 3GPP LTE/LTE-A/NR standardizations and now is serving as a rapporteur in 3GPP for technical topic of V2X.

Embracing Over The Air (OTA) Testing—A challenge or an opportunity for 5G
Giampaolo Tardioli, Keysight Technologies

EDICON
KEYNOTE SPEAKER

Abstract

This talk will discuss the challenges and opportunities involved with over the air testing as it relates to 5G.

Biography

Giampaolo Tardioli is vice president of the Keysight Technologies Network Access segment, part of the Communications Solutions Group. He is in charge of solutions serving the base station, front haul and backhaul markets. Prior to his current position, Dr. Tardioli was vice president of the Chipset and Components segment. He joined Hewlett-Packard in 1998 and served in a variety of senior management roles in planning, R&D, quality, operations and manufacturing both at the division and business unit levels. Dr. Tardioli holds an M.Sc, in Electrical Engineering from the Universita' Politecnica delle Marche, Italy, and a Ph.D. in Computational Electromagnetics from the University of Victoria, Canada.

T&M Challenges and Current Developments for 5G Testing in a Future Networked World

Christoph Pointner, Rohde & Schwarz

KEYNOTE SPEAKER

Abstract

With 3GPP Release 15, a complete set of specifications providing the set of features and functionality needed for deploying a commercially operational 5G system will be delivered, while an initial set for so-called non-standalone (NSA) operation in combination with 4G was finalized already in December 2017. With this 5G is now a reality. Whereas the fundamental requirements for eMBB, mIot/mMTC and URLLC have not changed, technical challenges need to be overcome. For example for the sub 6 GHz frequency range, testing the massive MIMO capabilities of base stations needs to be addressed. For UEs and base stations alike, the utilization of the cm and mm wave spectrum provides its own challenges from a testing perspective. Characterizing antennas in general but also transceiver performance characterization of DUTs (e.g. EVM measurements) needs to be performed in an over-the-air environment. Amongst others this approach poses additional requirements with respect to moving the reference plane in the overall measurement setup. This presentation shows available T&M capabilities as well as different approaches to overcome these challenges. It also provides an overview of measurement results for different DUTs, like a sub 6 GHz massive MIMO base station antenna, and a flexible design of an antenna array that can be used across different applications including UEs.

Biography

Christoph Pointner has joined Rohde & Schwarz in 2005. Since then he has held several managerial positions within the Secure Communications Division before joining the systems group of the Test & Measurement Division in 2014. Until 2017 he served as Senior Director of EMC, Antenna and A&D Test Systems and, alongside this assignment, from January to June 2017 as General Manager of the System Support Center at Rohde & Schwarz USA, Inc. In July 2017 he took over the responsibility as Vice President for Signal Generators, Audio Analyzers and Power Meters.

A Platform based Approach to 5G: Design, Prototyping and Test

Luke Schreier, National Instruments

KEYNOTE SPEAKER

Abstract

For many, 5G represents that next major standard for cellular connectivity, but 5G is significant beyond just the next cell phone standard. It will have huge implications for connectivity that will take use beyond the smart phone to vehicles, hospitals, medical devices, factories, and smart cities. In the case of vehicle design, systems that used to operate independently are increasingly designed such that mechanical and electrical systems operate within a holistic system of an autonomous vehicle. Highlights of this presentation will include:

- The challenges of testing new devices and systems, and how this could be a major bottleneck for organizations
- How every standard follows a progression that starts with research and prototyping, and then moves to the design and development of the enabling semiconductor technology
- The test challenges that lie ahead and the architectural requirements needed
- How we will look to the past and apply systems thinking to a connected world from beam steering, synchronization to lowering the cost of millimeter wave measurement within the industries highlighted

Biography

Luke Schreier was an applications engineer before transitioning to product management in 2003. His focus areas have spanned the entire portfolio of modular instrumentation and PXI platform products as well as aerospace/defense and semiconductor application spaces. He has been heavily involved in the company's automated test product and go-to-market strategies for more than a decade. As the leader of NI's product management and product marketing teams in automated test, Luke focuses on growth strategies for modular instrumentation, continuing to advance the PXI industry ecosystem, and furthering cross-industry exploration of best practices for automated test engineering and management. He holds a bachelor's degree in mechanical engineering from the University of Nebraska-Lincoln.

▼ Tuesday, March 20, 2018 ▪ 12:05 - 12:25 ▼

Technical Sessions

5G and Advanced Communications
Room: 402 A/B
5G Track Featured Keynote: Mobile Radio Transformation in the Age of 5G: A Perspective on Technologies and Solutions
Peter Rabbeni, GLOBALFOUNDRIES

With the deployment of networks and devices for sub-6GHz in the next 12-24 months, 5G promises to be as disruptive to wireless communications as data was to voice. 5G will spark new applications and use cases which will leverage the large BW, high capacity and low latency the standard promises to deliver. Challenges however remain with regards to how the RF front end will be architected to not only support 5G communications but also coexist with existing LTE networks while continuing to drive lower cost year to year. This talk will present some of the operational challenges for 5G-capable RF FEMs, some of the architectural solutions being considered and the technologies best positioned to help deliver the required performance.

Test and Measurement
Room: 403
Measurement of Beamforming Antenna in Transmit Mode
Thilo Bednorz, Rohde & Schwarz

Rapid and accurate verification of beamforming weights is required, for example, for codebook generation or beam forming algorithm development or verification. Diverse VNA models are equipped with multiple independent sources, whose relative amplitude and phase may be arbitrarily controlled ("defined coherence mode). These sources are connected to individual elements of a multi-element antenna to derive and verify transmit (Tx) mode beam steering and beam forming operation. This paper makes use of several coherent sources of VNAs and shows the possibility to cascade the several VNAs to increase the number of phase and amplitude controlled sources. Amplitude and phase relation is established by means of a system error calibration.

Signal Integrity
Room: 405
Using 3D EM Simulation Tool to Help Pre & Post-layout Simulation for Improving the Signal Integrity in High Speed SERDES Lane
Kris Liu, Analog Devices

Using 3D EM simulation tools helps to build up the two models for these options. Comparing the models leads to several suggestions. Of course, no via on the lanes is the best choice. If a via to another layer is needed, plated through via (top to bottom) is the next best choice. If via to internal layer and back is needed, then a dip on the TDR trace is unavoidable and this unfortunately cannot be removed by optimization due to the stub that remains after back-drilling, although back-drill could help to decrease the mismatch.

Simulation and Modeling
Room: 406
Simulation of BER, EVM and ACPR Performance under Proposed 5G Modulation Waveforms
Milton Lien, National Instruments

The upcoming 5G communications standards will require more spectrum, more and smaller cells, better power efficiency, higher data throughput, and lower latency. New modulation schemes are being developed and high directivity antennas will be required. Ideal 5G waveforms will be capable of supporting high data rate/wide bandwidth communications, low latency for long and short burst transmission modes, fast switching between uplink and downlink, and energy efficient operation. This presentation showcases new simulation capabilities in commercial design software for 5G communications devices. The new 5G spatial channel model will be demonstrated, as will new VSS test benches for narrow-band internet-of-things (NB-IoT) and Verizon's LTE carrier aggregation. The new radio (NR) 5G specifications will be discussed.

RF and Microwave Design
Room: 407
RF-Connectivity Concepts Addressing the Requirements of Future RF-Energy Applications
Hannes Grubinger, HUBER + SUHNER AG

Solid-state RF-sources and power-amplifiers allow for controllability of amplitude, phase and frequency. In comparison to magnetron, which are used in many today's applications, complete new features can be realized in the respective applications. Applications range from warming, and heating, to motor-ignition, medical- and industrial applications. Employing solid-state amplifiers has also a significant impact to the RF-connectivity. Magnetrons are optimized for coupling into a rectangular waveguide. Power amplifiers, however, will be realized on printed circuit boards, calling for different concepts. Connectors and cables as used in the communication industry are often not the perfect solution, since losses, and cost of coaxial assemblies in many applications may appear as not appropriate.

▼ Tuesday, March 20, 2018 · 12:30 - 12:50 ▼

5G and Advanced Communications
Room: 402 A/B
Components for 5G – What's New?
Markus Loerner, Rohde & Schwarz

Everyone is talking about 5G enabling enhanced throughput by using higher signal bandwidth and microwave frequencies. Many field trials are being conducted to understand the new environment. But what does all this mean for people in the component industry? They are the ones who need to supply the right building blocks to enable everything. This paper provides an overview of the relevant changes on the way to 5G and various trends to address them. The technology trends and direction will be discussed. Also we will discuss about test and measurement technology as regards of 5G.

Test and Measurement
Room: 403
Tricks for Antenna Gain Measurements
Andrew Yuk Choi Ko, Keysight Technologies

Most RF and microwave engineers know how to select antennas with the best and lowest return loss for best matching. In practical applications, selecting antennas with the highest gain, which is size and structural dependent, does play an important part in the design of the electronic circuit for transmitting and receiving signals. Making the antenna gain measurement with a vector network analyzer can be an expensive task, as it involves a broadband transmitting antenna, reference receiving antenna with known gain for calibration, and even building the anechoic chamber with RF and microwave absorbers to provide an non-reflective environment. This paper introduces an inexpensive and effective method for estimating the antenna gain from a pair of antennas of the same batch directly. The method is further extended with conjugate match for estimating the antenna gain for differential antennas with complex impedance.

Signal Integrity
Room: 405
Master Your 400G, Characterization and Simplifies PAM4 Testing
Steve Sekel, Keysight Technologies

400G interconnects in data centers will have to meet extremely tight signal quality requirements. Higher-order modulation formats and higher symbol rates mean that channel loss and higher signal-to-noise ratios (SNR) have to be considered to achieve the required bit error ratio (BER).You will get the insight, into the 400G standard and get ready for the total solution for 400G design and testing in this presentation.

Simulation and Modeling
Room: 406
Status of Current Reliability Modeling Solutions
Long Ma, Keysight Technologies

Semiconductor reliability models have been well established and used successfully to predict the lifetime of integrated circuits (ICs) throughout the steady progression of advances in semiconductor process technology. People face more challenges now in creating an accurate reliability model when the transistor geometry continues to shrink and the adoption of new materials. In this paper, we introduce the physics and characterization of hot carrier injection (HCI) and bias temperature instability (BTI) effects. The reliability simulation flow will be briefed. Then the various modeling approaches will be discussed, as well as the standardization efforts in the industry.

Test and Measurement
Room: 407
Symmetric and Reciprocal Two-Port 3x Through: Theory and Application
Joshua Wan, Xpeedic Technology, Inc.

De-embedding a two-port device under test (DUT) in a fixtured setup has been always an important topic in radio-frequency (RF) /microwave measurement. Short, open, load, through (SOLT) calibration standards can be used to de-embed a DUT but the standards must be perfect. Thru-reflect-line (TRL) is an exact de-embedding technique as reflect is just a reflecting termination like an imperfect short or open. Recent advances led to time-domain gating based techniques like through-only de-embedding (TOD) and automatic fixture removal (AFR). Both TOD and AFR depends on halving a 2x through as a fixture. They can be used to halve a full-length cable or transmission line measurement to obtain scattering parameters of a half-length one. This presentation provides examples of meaurements.

▼ Tuesday, March 20, 2018 · 12:55 - 13:15 ▼

5G and Advanced Communications
Room: 402 A/B
Wideband mm-Wave 5G Antenna Solution for Mobile Device
Bin Yu, Speed Wireless Technology Co., Ltd

The design of mmWave band beam-steering phased array antenna for future fifth generation (5G) mobile device applications is presented. First, we review the development of a mmWave 5G antenna for mobile devices and discuss several mmWave 5G antenna solutions that have been published. Then, we propose a wideband AoB array antenna which has 8 ME dipole elements that are implemented via PCB board of the mobile device. In addition, we propose a wideband AiP array antenna that uses 4 metasurface elements that are implemented via InFO-WLP process. Finally, we propose a mm Wave array antenna implemented using a metallic frame or casing of a mobile device, and the impacts of user's hand effects are also investigated.

Test and Measurement
Room: 403
Precise And Fast Noise Figure Measurement Of Multiport Devices
Volker Herrmann, Rohde & Schwarz

Noise figure is a key figure of merit for low noise amplifiersin frontend modules for mobile communications. Noise figure results are utilized along with S-parameters and compression characteristics during all phases of design, verification test, and product production to enable optimal engineering decisions focused on performance vs. cost vs. yield. There is a desire to make all of these measurements available also for the device under test (DUT) which are used in mobile communication devices during production even if the DUT has multiple ports to support available frequency bands. This talk will present methods to measure noise figure using a multi-port VNA using standard built-in measurement receivers. This method does not rely on external noise sources.

Signal Integrity
Room: 405
Via Simulation and Research in High Speed Circuit
Xiuguo Jiang, Keysight Technologies

As the signal rate increases, any factor in the design of a high-speed circuit is a factor in the success of the entire design. Vias are one of the key elements. This paper will study the structure of vias, various structures and designs of vias, and compare the vias with ADDS and MEMS to study the effect of vias on high-speed serial signals.

Simulation and Modeling
Room: 406
Accurate GaN Modeling for RF Power Amplifier Design Enablement
Amit Dikshit, Ampleon Netherlands BV

The intrinsic material properties of GaN, such as high breakdown voltage and carrier mobility, result in higher power density compared to Si-based LDMOS devices. In addition, the lower output capacitance of GaN offers the possibility of designing optimum termination at harmonic frequencies, thus boosting the efficiency of PAs. GaN technology with its higher power density and efficiency, is widely applied in RF power amplifier (RFPA) designs in base stations, radar, and solid-state energy applications. Accurate RF modeling of the active devices, including the effect of harmonic termination on the PA performance is critical to avoid multiple design passes. In this paper, we present the results achieved with Ampleon's internal model developed for a commercial mass-production ready GaN process.

RF and Microwave Design
Room: 407
The Future of IoT Wireless Technology: Smarter Testing from Characterization to Production
Fangze Tu, National Instruments

For the past decade, video and music streaming have been a bigger driver of Wi-Fi and mobile technology than the IoT. In 2016, this is no longer the case as wireless technology is being increasingly shaped by the need to connect "things" rather than people. Wireless streaming rates and bandwidth remain critically important. Analysts predict that within the next decade the number of connected devices will outnumber people by 10 to 1. In the new IoT era, wireless requirements – and hence wireless standards – continue to evolve. In fact, technical requirements ranging from reduced latency to lower power consumption to better reliability are ultimately driving the roadmap of tomorrow's wireless technology. In this presentation, we will investigate the design and test implications of the hottest emerging wireless technologies for IoT, mobile, and infrastructure including ZigBee, Z-Wave, Bluetooth Low Energy, NB-IoT, and more. By attending this session, you will become more equipped to evolve your organization for the future of wireless design and test.

▼ Tuesday, March 20, 2018 ▪ 13:20 - 13:40 ▼

5G and Advanced Communications
Room: 402 A/B
5G 3GPP NR Signal Generation and Analysis
Martin Schmähling, Rohde & Schwarz

5G new radio (NR) is going to be the standard that enables the next generation of mobile networks. While 2G provided cellular voice, 3G WCDMA/UMTS and 4G LTE addressed the need of wireless internet access, 5G will provide connectivity among users, cars, wearables, sensors and more.This paper describes the differences between the 3GPP LTE and the NR air interface. It compares the setup of the waveform in terms of channels, signals and CP-OFDM parameters. It then descibes how to generate 5G NR signals according to 3GPP 38.xxx and how to analyze and perform conformance tests.

Test and Measurement
Room: 403
Development and Testing of High Accuracy Reference Antennas for Millimeter Wave On-Chip Antenna Measurements
Lars Jacob Foged, Microwave Vision Group MVG

Recent growth of WiGig standard alliance to achieve gigabit data rates has increased the development activity of on-chip antennas at millimeter wave frequencies. In particular, on-chip antennas based on silicon technologies at 60GHz. The measurement of such antennas require a coplanar micro-probe to ensure the connection to the antenna under test (AUT). The micro-probe is attached to a probe positioner that is maneuverer into position to land it, on the chip, to ensure connection during test. The actual testing is performed by standard antenna measurement techniques. Spherical near field (SNF) techniques are generally preferred as particularly well-suited for accurate determination of the on-chip radiation. The accurate determination of antenna gain requires a reference antenna with a known gain to high accuracy preferable with the same interface as the unknown AUT. This paper discusses the development of reference antennas for on-chip antenna testing at millimeter-wave frequencies.

Signal Integrity
Room: 405
PCIe Gen4 / Gen5 – How to Measure the Real Jitter Performance of an SSC Clock
Martin Stumpf, Rohde & Schwarz

With increasing data rates, system jitter budgets get tighter and tighter. This calls for even lower jitter limits for key components like clock sources. Traditional scope-based measurements get to their limits, as clock jitter performance gets more and more masked by the inherent jitter of the instrument. We will look at modern ways to analyze the real jitter performance of clocks, even when the clock runs in spread spectrum clocking (SSC) mode.

Simulation and Modeling
Room: 406
Using Automatic De-Embedding Technology to Complete the Accurate Extraction of Simulation Model
Xu Yue, Keysight Technologies

This paper introduces automatic de-embedding technology for accurate extraction of simulation models. The article simulates and verifies the correctness of the technical theory through simulation and actual measurement. The same test piece is selected by measurement, and the result of de-embedding of the automatic fixture is compared with the de-embedding result of the TRL calibration piece. The two are in good agreement. This demonstrates the ease-of-use and accuracy of automatic de-embedding techniques that allow engineers to perform accurate and rapid model extraction.

RF and Microwave Design
Room: 407
Millimeter Wave Challenges and Calibration
Stewart Forsyth, Keysight Technologies

Industry is moving more towards higher frequencies, whether in wireless for the move to 5G, high capacity secure links in A/D or in the automotive industry for the radar involved in advanced driver assistance systems (ADAS). At these millimeter wave frequencies, the test challenges include identifying test equipment with the required performance and ensuring we have calibration and traceability for the complete solution. In many of these applications, this has resulted in the need for changing the test methodology. This can range from choosing the correct level of test equipment, ensuring the correct cables and connectors are used through to over the air testing when cabling is not possible. This presentation focuses on the test challenges for the generation and analysis of wide bandwidth signals at these millimeter wave frequencies and how to improve the measurements for optimum performance across the available link budget. It also looks at how we calibrate the test setup including the instrumentation, test fixtures and cabling and ensure this calibration is traceable and how it can be optimized to reduce the uncertainty and increase the yield within your test process.

▼ Tuesday, March 20, 2018 ▪ 14:15- 14:55 ▼

Panel

5G and Advanced Communications
Room: 402 A/B
5G Massive MIMO Panel
Pat Hindle, Microwave Journal

Sponsored By: Microwave Journal

The first deployments of 5G for mobile applications will likely encompass wider bandwidths, high order of carrier aggregation, and massive MIMO to increase data rates. However, massive MIMO greatly increases size power and cost of systems. This panel will discuss and debate various approaches and methods to overcome these challenges from a design and test perspective.

Panelists:
Ribo Tang, Business Development Manager, Rohde & Schwarz
Peter Rabenni, Sr. Director RF BU Business Development, GLOBALFOUNDRIES
Blair Lee, Master Application Engineer, Keysight
Manuel Uhm, Director of Marketing at Ettus Research, a National Instruments Company
Anthony Fischetti , VP and Chief Architect for the Lightwave Antenna Business Unit, MACOM
Guizhen Wang, Radio Hardware Group Leader, China Mobile

▼ Tuesday, March 20, 2018 ▪ 14:15- 14:55 ▼

Workshops

5G and Advanced Communications
Room: 403
Rapid Design Method for GaN HEMT Asymmetric Doherty PA
Zhancang Wang, NI/AWR

Sponsored By: NATIONAL INSTRUMENTS

With the 5G NR era fast approaching, the Doherty Amplifier is still the workhorse of the cellular infrastructure market. In 5G NR, the situation of frequency fragments may not be fundamentally solved. It is important to master powerful EDA tools to accelerate the design and verification process to shorten the time to market for so many frequency variants of PAs. In this workshop, NI/AWR v13 is used with the author's featured design method to speed up Doherty PA design from load pull measurement results, EM simulation to Geber file generation. In addition to the insights from GaN HEMT Doherty PA design with EDA tools, a practical 3.5 GHz asymmetric Doherty PA design based on a Wolfspeed GaN HEMT device will be demonstrated using their large signal models.

Test and Measurement
Room: 405
Channel Emulation and Testing Based on SDR Platform
Sample Technology (Shanghai) Co., Ltd

Sponsored By:

Fifth Generation (5G) technology will bring higher data rate, greater user density, and therefore, new technologies such as massive MIMO which leads to many differences in characteristics of channel model that be will put into effect. It puts forward higher requirements on the channel simulator. This presentation introduces the difficulties which 5G test will face and discuss equipment of 5G channel emulation base on SDR platform. Then we introduce the architecture and ability of the equipment, focus on challenges in channel emulation of adopting massive MIMO and give new channel models and test solutions for 5G channel emulation.

Sponsored By:

Test and Measurement
Room: 406
Mastering IoT Testing Challenges: Protocol Choices and OTA Test Solutions to Successfully Implement Wireless Connectivity in IoT Devices
Aleksis Anterow, Microwave Vision MVG

Right now, we are at the start of a huge transformation – shifting Internet from the screens of smartphones and laptops into the physical world. IoT has an impact on all industries and markets, across the world, such as wearables, transportation, homes, cities, healthcare and manufacturing. In the future, any device that could become connected will be connected. From a wireless connectivity technology perspective, the requirements are different compared to traditional smartphone based connectivity solutions. There are new protocols specifically optimized for IoT, such as NB-IoT, LoRa, Sigfox, LTE-M, as well as 5G. Typically, wireless connectivity modem platforms, even available as plug and play modules, can be efficiently integrated in IoT devices. However, even though the modem hardware and software can be tested and certified on platform level as standard parts with proven performance, the antenna solutions cannot. An identical antenna, implemented in a different product, will generally not perform the same. For IoT devices, it is often critical to ensure that the wireless connectivity performs as expected, where the antenna performance is a major contributor that needs to be optimized and controlled. This in order to achieve the expected user experiences, as well as business cases for the IoT product and solution provider. In this workshop, MVG will explain protocol choices for IoT, and introduce how to efficiently test IoT devices with the right tools and test methods. Test solutions for different IoT protocols and product categories as well as product lifecycle phases will be covered.

Sponsored By: Dynax 能讯半导体

RF and Microwave Design
Room: 407
DYNAX GaN Technical advantage and recommended applications
Jianfeng Gao, Dynax Semiconductor Inc.

DYNAX is an IDM-mode company committed to the design and manufacture of GaN RF power devices. Products are applied to wireless communicaton, including GaN epitaxial materials,power amplifier dies and packages devices. DYNAX owns advanced technology on reliability oriented GaN design,processing,packaging,with neariy 200 domestic and foreign patents. In this workshop, DYNAX will highlight the technical advantages in GaN RF power amplifier and present applications in wireless infrastructure market.

▼ Tuesday, March 20, 2018 ▪ 15:00- 15:40 ▼

5G and Advanced Communications
Room: 402 A/B
All-Silicon Active Antennas for High Performance 5G Terminals
Ian Gresham, Anokiwave

Sponsored By: Anokiwave mmW Solutions. Enabling a new world

Active millimeter-wave antennas are expected to be rolled out in unprecedented volumes over the next few years fueled by the rapidly emerging 5G telecommunications infrastructure, consumer premises equipment (CPE) and handheld unser equipment (UE) markets. Millimeter-wave spectrum is attractive for these new high capacity systems due to the availability of large bands of contiguous spectrum. Using active antennas allows highly directive antenna beams to be formed by physically small apertures which helps offset the higher path loss associated with these high frequencies. Additionally, the highly directive beams allow spectral re-use through spatial diversity. These planar antennas offer fast steerable beams,

low size and weight, and can be cost effectively produced in high volumes. Active antennas also provide excellent reliability since there are no moving parts and the failure of a few elements in the array has little effect on the overall antenna performance.

5G and Advanced Communications
Room: 403
Smart Partitioning of Signal Chain for Massive MIMO Systems
Thomas Cameron, Analog Devices

Sponsored By: ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE™

5G is the next proposed step in the evolution of wireless networks, providing an order of magnitude improvement in bandwidth delivered to the user device and enabling new vertical businesses for mobile operators. Massive MIMO is one of the pillar technologies for 5G providing a large improvement in spectral efficiency. Massive MIMO is enabled by the large number of radio channels in the active antenna, but this in turn put large pressure on the size, weight and power consumption of the system. In this workshop we will discuss how smart partitioning of the signal chain leads to overall optimization of the system. We will provide an overview of massive MIMO requirements and system architectures. We will then provide an overview of Analog Devices highly integrated radio transceivers and how this technology has enabled the massive MIMO form factor. Finally we will discuss the overall partitioning of the system between RF and digital and how the right partition provides the optimum solution.

Radar and Defense
Room: 405
Using Vector Agile Frequency Technique to Improve the Fidelity of Radar Signal Simulation
Qin Zhang, Keysight Technologies

Sponsored By: KEYSIGHT TECHNOLOGIES

With the development of electronic warfare technology, the anti-interference characteristics of radar in complex electromagnetic environment are receiving more attention. How to evaluate the operating characteristics of a radar in a quantitative and controlled environment has become a hot topic as well as a challenge. Over the past few years, the construction of complex electromagnetic environment has experienced rapid development from analog signal sources to wideband vector signal sources, but many difficult technical problems still exist. This workshop introduces a new radar signal simulation system based on DDS agile frequency technology combined with wideband vector modulation and how to use the system to improve the duration, dynamic range and fidelity of radar signal simulation.

RF and Microwave Design
Room: 406
Mixed Signal Non-Linear Network System for Arbitrary Impedance Application
Mauro Marchetti, Maury Microwave Corp.

Sponsored By: Maury Microwave Your Calibration, Measurement & Modeling Solutions Partner!

This workshop presents MT2000, a highly integrated measurement system not only for high performance small S parameter measurement, it is also a comprehensive system which includes spectrum analyzer, oscilloscope, multi-tone broadband signal sources and electronic tuner for arbitrary impedance tuning.

Test and Measurement
Room: 407
Vector Network Analysis Multiport Testing: Challenges and Solutions
Tanja Menzel, Rohde & Schwarz

Sponsored By: ROHDE&SCHWARZ 罗德与施瓦茨公司

The constant advancement of mobile communication systems, e.g. for 5G, and monitoring systems for military and civilian use cause permanently growing demands on the measurement systems. One crucial demand is the growing number of measurement ports. This needs to be combined with the requirements for increased RF performance, higher frequencies, up to the microwave range, and shortened test times. Current solutions are often based on network analyzers that are extended with switch matrixes. These solutions often do not meet the needed RF performance, or cause an undesired increase of the measurement time. This workshop covers the background and the pros and cons of multiport network analyzer measurement systems with switch matrixes compared to “True multiport network analyzers” with integrated measurement ports.

▼ Tuesday, March 20, 2018 ▪ 15:45 - 16:25 ▼

5G and Advanced Communications
Room: 402 A/B
An Overview of 5G New Radio - From Prototyping to Test
Manuel Uhm, National Instruments

Sponsored By: NATIONAL INSTRUMENTS

The term 5G seems to refer to all kinds of different wireless technologies. But what is 5G actually? The 3GPP standards body has been meeting regularly to define this next-generation standard. Learn what 3GPP organizational partners have already approved for 5G and what technologies they are considering. The 5G standard combines many new ideas on communication theory and it is only recently that a segment of the wireless industry has focused on developing new tools and technologies needed to enable researchers to quickly prototype their ideas. This has been made possible by the advancement in software defined radio (SDR) platforms, new hardware/software interfacing tools and hardware abstraction languages. Additionally, programming of devices such as field programmable gate arrays (FPGA) and general purpose processors (GPP) has become significantly simpler for wireless researchers due to the abstraction provided by higher level languages. These new tools and technologies are redefining the design flow for building PoC systems and have now become an integral component of 5G research. Design of prototyping platforms has a very different set of requirements than the actual wireless devices. This is because prototyping platforms need to accommodate many different variants of 5G concepts with “flexibility and ease.” Enabling “flexibility and ease” impacts the choice of RF front ends, data converters, data management and distribution, DSP algorithms and architectures, software architecture for real time operation, platform connectivity to network, and choice of hardware abstraction language.

RF and Microwave Design
Room: 403
Evaluation of Key RF FEM Design Blocks with Cutting-edge SOI Technology
Liangying(Katie) Zeng, GLOBALFOUNDRIES

Sponsored By: GLOBALFOUNDRIES

The China market has emerged as a rapidly growing consumer and developer of mobile RF devices. The development of FEM solutions for these devices requires the optimization of various metrics including gain, NF, insertion loss and linearity to name a few. The pressures of time to market, however, present challenges in getting from concept to design to product in a short amount of time. The usage of reference designs and reference flows makes this process easier and more straightforward. In this talk, we present a validated reference flow for two key FEM device elements: RF switch and LNA. Provided are detailed schematic/layout and PEX tips along with measurement results to give the designer confidence in the chosen approach.

Test and Measurement
Room: 405
Noise Parameter Characterization Techniques for mmWave Applications
Yuexing Li, Maury Microwave Corp.

Sponsored By: Maury Microwave — Your Calibration, Measurement & Modeling Solutions Partner!

Noise figure is the most commonly used measure of device-added noise. The variations due to source impedance can be characterized and represented in terms of noise parameters. It is essential to understand the noise parameters of your devices, especially when designing low-noise amplifiers using mismatched transistors. Maury will introduce the history of non 50 Ohm device noise figure measurement and share the real noise figure performance characterization on the device with the state of art fabrication process.

RF and Microwave Design
Room: 406
Innovative LTCC Product Design & Development
Wei Ping Zheng, Mini-Circuits

Sponsored By: Mini-Circuits®

Low temperature co-fired ceramic (LTCC) technology is a multi-layer ceramic process that can be used to realize a wide range of RF & microwave components with low cost and high performance. This technology is of critical importance for new products to achieve a core design philosophy “design ahead of market need with consistent repeatable manufacturing.” An overview of the LTCC fabrication process, its strength and weakness, and a case study are presented. Focus resides on LTCC filter design details, 3D EM simulation workflow, production, and validation. Review of circuit topologies include lumped elements, distributed, and Substrate Integrated Waveguide(SIW). An accurate characterization of dispersive and anisotropic dielectric materials, a LTCC design challenge, will be covered.

RF and Microwave Design Sponsored By: TELEDYNE e2v Everywhereyoulook™

Room: 407

Direct Conversion with High-Speed Data Converters and K-band Application

Marc Stackler, Teledyne e2v

The super-heterodyne architecture for receiver and transmitter was invented in the beginning of the 20th century. Consisting in intermediate frequency stages (called up- or down-conversion stages) based on mixers and local frequencies generation, it allows interfacing the high analog frequency on the side of the antenna to the data conversion and digital processing side. It has, since its discovery, been used in many transmission systems as the solution to reach higher frequencies. This architecture relaxes some of the constraints on the data converters and transfers them to the intermediate frequency stage. This was necessary until the last decade because data converters where not capable of reaching high frequencies directly.

▼ Tuesday, March 20, 2018 ▪ 16:30 - 17:10 ▼

5G and Advanced Communications Sponsored By: win SEMICONDUCTORS | RF and mm-wave Solutions

Room: 402 A/B

Crucial Points of Device Models for 5G Semiconductor/MMIC Design Consideration

Win Semiconductors Corp.

Considering the coming 5G market, the designers have to well consider the suitable semiconductor technologies for both sub-6 GHz and mm-wave MMIC design. And, the accurate models selection for 5G MMIC design is becoming a critical point. This workshop is intended to give the MMIC designers a broad view of novel device models for 5G product design.

Test and Measurement Sponsored By: KEYSIGHT TECHNOLOGIES

Room:403

5G PA and FEM Test Workshop

Xiang Feng, Keysight Technologies

For 5G, the requirements for high data rate implies wide bandwidth (e.g, >=100MHz) of the signal, and high spectrum efficiency, which can be achieved by high-order QAM with OFDM. So the signal would have high peak-to-average power ratio (PAPR) and is sensitive to non-linear distortion. Also, mm-Wave technology will play a role in 5G due to wide bandwidth requirements and scarcity of spectrum at frequency for sub-6GHz. And according frequency planning, multiple bands will be assigned for 5G use and noncontiguous spectrally-agile transmission is the key feature of 5G systems for increasing data rates and spectral allocation flexibility, and carrier aggregation (CA) requires that modulated signals be provided at various frequencies at the maximum bandwidth, which would require the wideband PA or one or multiple multi-band PA. However, the PA nonlinearities impose even more severe challenges in such noncontiguous transmission scenarios due to the resulting spurious intermodulation emissions that can easily violate the emission limits.

Amplifier Design Sponsored By: MACOM™ *Partners from RF to Light*

Room: 405

On the AM/PM distortion of GaN HEMT

Mengsu Yang, MACOM

In this workshop, the generation of AM/PM distortion for Gallium Nitride (GaN) high electron mobility transistor (HEMT) is studied from a theoretical perspective, and validated through both simulation and experiments. It is illustrated that input impedance variation, which largely results from the feedback capacitance Cgd through the Miller Effect, is the dominant contributor of AM/PM distortion, revealing the internal relationship between AM/AM and AM/PM distortion. By manipulating the input impedance presented to the device, as well as the quiescent bias condition, the AM/PM distortion of a single-ended power amplifier (PA) is mitigated experimentally. Additionally, in a practical Doherty PA, similar experiment is conducted to verity the effectiveness.

5G and Advanced Communications Sponsored By: Mini-Circuits®

Room: 406

Low Cost Solutions for (5G) Wireless and Massive MIMO Testing

Chi Man Shum, Mini Circuits

Mini-Circuits has been developing a series of automated signal control and routing systems to support telecom industries in Massive MIMO deployments and 5G development. Our solutions are highly scalable with a straight forward and flexible

software API, facilitating rapid and cost-effective test system developments. Customizable solid-state switch assemblies and high order switch matrices have been developed for high volume and fast throughput test environments. Our high reliability mechanical switch systems now support operation up to 40 GHz in preparation for the anticipate spectrum of 5G devices. Programmable attenuator systems provide precise signal level control for simulation of transmission loss or fading effects in a production environment, with models operating up to 30 GHz. Mini-Circuits' novel multi-channel approach allows systems to be configured with over 100 independent attenuator channels, controlled through a single software interface (Ethernet or USB) and API. Our mesh network systems are an extension of this technology, allowing multiple devices to be interconnected in a simulated environment, with transmission loss / simulated distance independently variable between any pair of nodes or devices on the network.

Sponsored By: ANSYS

Radar and Defense
Room: 407
Autonomous Vehicle Radar Simulation: From Antenna Design to Dynamic Road Scene Testing
Yong Yuan, ANSYS

As the world draws near to the reality of fully autonomous automobiles and transport vehicles, radio frequency ranging sensors (radar) are employed at millimeter-wave frequencies for long-range object and obstacle detection, as well as for tracking the velocity and direction of the various actors in the environment around the vehicle. Whether the challenge is designing the radar sensor module, studying its installed performance on the vehicle, or gaining insight into what the radar reports for moving and stationary targets on a full, dynamic road scene, ANSYS can help.

▼ Wednesday, March 21, 2018 ▪ 9:00 - 9:20 ▼

Technical Sessions

Radar and Defense
Room: 402 A/B
Radar Technology for IoT Applications
Henry Lau, Lexiwave Technology, Inc.

Radar technology has been traditionally used in military or remote sensing applications. Due to the proliferation of IoT, smart city and smart home applications, the demand for radar technology continues to grow as it can enhance the product features and increase a product's competitiveness. Such features may include occupancy detection, gesture detection and motion & speed detection, etc for smart home applications. This presentation introduces different radar technologies i.e. pulse, FMCW, and MIMO radar for consumer and IoT applications. The pros and cons of using different radar technologies and operating frequencies will also be addressed. System and antenna design strategies are also presented so that participants can incorporate and adopt the right radar technology into their products for optimum performance.

RF and Microwave Design
Room: 403
The Taiji Theory of Direct-Conversation and Super-Heterodyne Architectures in RF Design
Wei Lin, National Instrumetns

For many years, the super-heterodyne receiver has enjoyed a wide range of popularity to RF designers due to its enormous benefits such as easier filtering at single frequency and better gain selectivity for linearity and so on. However, most components of super-heterodyne design are expensive and not small, it also has disadvantage of LO sensitivity in temperature and extra IF filters requirement. Another option, direct-conversion has benefits of lower cost and less number of filtering and gain stage which can take place at DC. But, it has obvious problems of third-order distortion products (IP3) and LO-RF leakage. This presentation talks about how to consider both architectures with Taiji theory to make their own benefits coexist in a single design.

Test and Measurement
Room: 405
Phased Array Antenna Control Components
Markus Loerner, Rohde & Schwarz

Phased arrays antennas are a common technique in the aerospace and defense world for radar applications. With the enhancements in mobile wireless for 5G as well as for satellite communications, phased array antenna systems become a much wider use. The paper discusses different techniques of implementing phased array antennas and has a look at

important parameters. To verify the performance, we will also have a look at different design parameters and how to test them. Also introduce the difficult and challenge in the test technology and how to deal with them. Discuss the advantage of new test technology and how to select the solution which focus on phased array antenna control components.

EMC/EMI
Room: 406
Research of an EMC Test Method for the High-power and Integral Antenna Equipment with Multi-Antenna and Multi-Channel
Li Ge, ZTE Corporation

Along with the development and application of 5G massive MIMO technology, the integral antenna equipment with high-power,multi-antenna and multichannel are more common,and will become the main form of 5G radio equipment. There are some challenges for EMC testing of these kind of equipment,including the over-power saturated amplifier of the measurement system and the over-loaded receiver causing by the intermodulation of the multi-carrier. According to the standards and the present situation, this presentation put forward a proposal that the 5G radio equipment should adopt a separated antenna design. When the radio equipment is in EMC testing, this method disassembles the antenna from the equipment and uses the tooling device to replace the antenna. In order to prevent the leakage of the radio signal and reduce the high-power radiation harm to human body, the matched loads should be connect to the antenna ports.

Signal Integrity
Room: 407
New Test Vehicle Design for High-Performance Laminate Materials
Eric Bogatin, Teledyne LeCroy

We present a new, simple design for a stripline transmission line test vehicle to show off and evaluate the performance of any laminate material system. The structure is a 20 inches long, meandering differential stripline with surface pads compatible with the Molex 2.9 mm surface mount connector. There are three key features that make this a universal test structure design. First is the use of an adjacent 2x thru which can be used with a impedance corrected de-embedding tool to remove the fixture effects and extract a measured, behavioral model of just the uniform transmission line. The second feature is a stack up design so the residual via stub at the launch is of minimal length and it has little impact up to 40 GHz. The third and most important feature is the placement of the two test structures on a business card sized board which can literally be used as a business card. When a measurement is required, the surface mount connectors can be attached and the measurement performed. This new design was implemented with the Rogers RO1200 laminate material using rolled copper foil layers. The performance of this test structure is nearly the same as predicted by a simple model of smooth copper and nearly lossless dielectric.

▼ Wednesday, March 21, 2018 ▪ 9:30 - 10:30

Plenary Session ▼

Room: 402 A/B
Innovation and Entrepreneurship in the Wireless Communication Industry
Dr. Gordon GC Liang, Pivotone

INVITED SPEAKER

Abstract

The wireless industry has experienced a rapid growth phase, and the Internet of Things(IoT) system now covers the world with a smart sensor network, connecting people in the rapid sleepless digital world. 5G has brought about breakthroughs in features and functions for mobile systems. And high-speed, point-to-point communication systems connect them together seamlessly. 5th generation wireless provides over one million wireless connections within one square kilometer. And, the anytime and anywhere data rate is 100 MBPS, and the demanded speed is over 1 to 2 GBPS. Today's engineers face extensive innovation challenges. The active and passive components, devices, dielectric material, and the miniature circuits all must be considered and integrated together to satisfy the demands of today's consumers. In this invited plenary keynote talk, Dr. Liang (Gordon GC Liang) will share his observations on technology advancement, and how to meet the challenges and the opportunities that result. He will also share how entrepreneurship can help build companies in this dynamic world of wireless technology and business challenges.

Biography

Since his early career, Dr. Liang (Gordon GC Liang) has started several companies that specialize in wireless technology, from Silicon Valley California to dynamic Chinese rapidly growing areas. His companies have contributed not only technology but also support the wireless industry. With the core values of vision, professionalism, and integrity, Dr. Liang and his organization, Pivotone, have made significant contributions to the wireless industry. At EDI CON CHINA 2018, Dr. Liang is going to share his experiences as an entrepreneur. With the grasp of technology in one hand and business in other, his unique perspective combined with his practical approach, open minded mentality, and unselfishness to the industry enable him to be able to lead and to train strong research and development teams, working with universities and R&D organizations, colleagues, and the collaborators to contribute to the wireless world.

Solid State RF Energy is the Smart Technology Solution for 2018
Dr. Klaus Werner, RF Energy Alliance

INVITED SPEAKER

Abstract

Cooking applications are just the beginning; as the benefits of solid-state RF energy (SSRFR) technology are being realized in other industries such as lighting, medical and automotive. These new markets present ultra-high volume opportunities for businesses operating directly and peripherally in the RF technology industry. They also present alternative revenue potential to that of currently maturing markets such as cellular infrastructure.The RF Energy Alliance (RFEA) is leading the necessary cross-industry collaboration needed to facilitate even more market momentum through the establishment of technical workshops, roadmaps and standards. This keynote will address the emerging technology trends that will shape the SSRFE market in 2018.

Biography

Dr. Klaus Werner is the owner of kw tec b.v., a company active in the fields of metrology, automation, and consultancy. Currently, he focuses on RF Energy market development as the RF Energy Alliance executive director. Dr. Werner was previously with NXP Semiconductors as the solid state RF Energy markets business development manager. He studied physics at the RWTH Aachen University, Germany, and holds a Ph.D. in Semiconductor Device Technology from Delft University of Technology, Netherlands. Dr. Werner started his professional career as a process engineer at Philips Semiconductors. Prior to his assignment in the RF power device business, he worked in several engineering and operational management functions.

The Advantages of Using Multiple Satellite Navigation Systems
Rainer Horn, SpaceTec Partners

INVITED SPEAKER

Abstract

The last 15 years saw an enormous increase in the use of Global Navigation Satellite Systems (GNSS). Satellite Navigation, originally designed for defense purposes, has become the backbone of a growing multi-billion dollar industry. There are more than 3 billion single frequency receivers in use worldwide (about 2/3 of these are installed in smart-phones and tablets). Besides the mass market, GNSS also serves a growing number of professional applications – from network synchronisation to surveying - all the way to safety-of-life services.Currently, there are four global Satellite Navigation systems deployed: GPS, GLONASS, BEIDOU and GALILEO. While only 15 years ago, a hybrid receiver, able to receive and process the signals of more than one system was a large, heavy and expensive unit, nowadays GNSS chip manufacturers are starting to have 3 - 4 GNSS enabled while maintaining low cost, low mass and low power consumption. In this presentation we will address the advantages and disadvantages of multiple GNSS operating in the same frequency bands. It should be noted that UN ICG and several other organizations have been pushing for interoperability of the different systems. GPS and GALILEO actually signed an agreement on this subject and the other systems have also chosen signal coding and modulation schemes for minimizing the interference between systems. Of course each system creates some noise to the other systems which, with current receiver designs, reduces the signal to noise ratio of the wanted signals. It is expected, that next-generation receivers using vector processing or other novel concepts, will be less affected by this problem.

Biography

Rainer has nearly 20 years experience in consulting and finance. He has consulted private and institutional clients in aerospace, automotive, transportation and telecoms - on strategy, market analysis, organizational and finance matters. As accredited coach for leading seed funds he works with several start-ups and SME. At Booz Allen Hamilton he led the Space Services and Telematics Practice and managed European Business Operations as Finance Director. Rainer obtained an MBA from INSEAD and a dual-degree from ESB Reutlingen/London in European Business. He is a member of the European Commission's Galileo Advisory Board (MEAG), shaping the future of satellite navigation in Europe. Rainer is an avid skier and enjoys playing squash.

▼ Wednesday, March 21, 2018 ▪ 10:55 - 11:15

Radar and Defense
Room: 402 A/B
Electronic System-Level (ESL) Automotive Radar Design and Optimization
Jin Zhang, Keysight Technologies

Electronic system-level (ESL) design and optimization is a prerequisite for product business success in most modern R&D processes, and automotive radar design is no exception. With ESL techniques, electronic systems such as communication or radar terminal-to-terminal design and quantitative performance evaluations for baseband, digital IF, RFuW TRx and antenna array with propagation modeling are much simpler than traditional methods.

Amplifier Design
Room: 403
Harmonic Injection and Elimination (HIE) GaN HEMT Doherty Power Amplifiers Design for High Efficiency
Zhancang Wang, Ericsson

A conventional Doherty PA comprises traditional amplifier units or cells that exhibit limited efficiency characteristics which define the upper limit of the achievable efficiency of a Doherty PA. Various theories of operation of high efficiency amplifiers have been developed over the years. There is a need for achieving high efficiency in amplifiers of Doherty PAs. The traditional solution had maximum drain efficiencies exceeding 70%. Low losses are particularly critical in the high power circuits where the dissipated power not only drains the power source but often substantially increases the junction temperature of the device. High operational temperatures thereby lead to lower performance and lower reliability of the Doherty PAs. Harmonic injection method is a valid approach to boost amplifier cell peak power efficiency and that around the peak power. However, the existing arts have some shortcomings. One of them is the high cost and complexity of circuitry by using active harmonic injection method. Also the power dissipation in harmonic generation circuitry degrades the overall efficiency to a certain extent. The high complexity of circuits also causes bulky equipment which may become an obstacle of for product miniaturization. A new concept of harmonic injection and elimination (HIE) was firstly proposed by the author to boost amplifier cell efficiency greatly.

Test and Measurement
Room: 405
Overcome the Challenges in Low-IF Mixer/Converter Measurements
Ning Cheng, Keysight Technologies

Making accurate conversion phase and group delay measurements is critical in testing satellite system devices like mixers and converters. Some measurement instrument manufacturers have provided an easy way to measure the group delay of mixers/converters based on a phase reference calibration using a comb generator, but because the minimum frequency of the comb generator is limited to 55 MHz, an unknown mixer still needs to be used to extrapolate the phase reference calibration below 55 MHz. In such a case, making a good and stable low-IF converter group delay measurement down to 10 MHz can be challenging, and different measurement settings and factors such as the number of points, group delay aperture, phase noise and higher order mixing products can severely impact the group delay measurement accuracy. This presentation discusses the theory of the phase reference calibration and the best practices in making a good phase reference calibration, and a good and stable low-IF converter group delay measurement.

Simulation and Modeling
Room: 406
MIMO Antenna Synthesis
Lars Van Der Klooster, National Instruments

Multiple-in-multiple-out (MIMO) antenna systems are able to carry more data and reduce signal fading than single-trans-

ceiver systems because they use multiple independent RF channels. Creating compact antenna arrays that are MIMO-capable is challenging because, along with standard frequency performance, isolation between antenna ports is critical for obtaining good MIMO performance, especially when device size limitations require ports to be placed very close to one another. This presentation highlights the use of commercial antenna design and synthesis tool, to create dual-band WiFi MIMO arrays for an example compact internet-of-things (IoT) device. These antennas were created automatically by entering specifications for antenna and coupling performance, along with various geometric configurations and limitations. Attendees will learn how to create and optimize the resulting antennas to meet these specifications using advanced optimization algorithms and full 3D simulation. The final antennas have machine-designed features such as multiband choke structures to reduce coupling and excellent wideband performance. It is demonstrated that this technology is able to create high-performance designs in a fraction of the time and effort required by standard design techniques.

Power Integrity
Room: 407
Comprehensive Signal and Power Co-Investigation on DDR4 Simulation and Measurement
Nick Huang, ASUSTek COMPUTER INC.

As the technology continues to scale down and the data rate is increasing dramatically, PCB design has become more challenging than ever. Keeping track of signal and power integrity becomes a requirement for PCB designers in order to meet the product development time and reduce the overall cost. Memory is always the first component to check in a system, thus it is important to make full use of circuit and EM simulators to solve all its potential problems at the initial design stage instead of late troubleshoot. In this manner, the investigation on the DDR is studied to determine its prospective issues by SI/PI simulation. Not only the frequency domain simulation is performed to check its power integrity impedance, but the transient simulation is also applied to analyze how power integrity issue may lead to a potential signal quality failure. Simulation and measurement results are performed for verification.

▼ Wednesday, March 21, 2018 ▪ 11:20 - 11:40 ▼

Radar and Defense
Room: 402 A/B
Automotive Radar's Signal Generation and Analysis
Hui Wu, Keysight Technologies

This paper presents the methods to generate and analyze the automotive radar signal. Two automotive radar technologies: FMCW and MFSK are discussed. And the vector and analog method of generation signal are introduced. 24GHz and 77GHz radar signals are generated and analyzed in the spectrum analyzer and oscilloscope as the example.

Test and Measurement
Room: 403
Measurement and Behavioral Modeling of Power Amplifiers Under Mismatched Loads
Tong Li, Keysight Technologies

Power amplifier (PA) is the key component in wireless communication system. It plays an important role in system linearity and efficiency. Measurement and circuit-level or behavioral-level modeling has been the focus of studies. Up to now, almost all the solutions on the market are aimed at PA with matched load. However, in 5G system, PA and antenna will be integrated as a subsystem, and there are no isolators between PAs and antennas anymore. As a result, the PA will not always work under matched load conditions. There has been some research work on the PA performance under load mismatch using network analyzer and passive load-pull. But it cannot describe the PA behavior under modulated signal. This paper presents a measurement solution for load impedance mismatched PAs under a modulated signals. Two-port four-channel oscilloscope-based PA active load-pull measurement platform is built and calibrated. The injected and reflected waves at PA input and output ports can be captured simultaneously. Digital predistortion (DPD) is implemented on this platform and ACLR shows degradation under different mismatched loads. It means that the load condition impacts DPD performance. Load-mismatched PA behavior is measured by using active load-pull and double-input Volterra series behavioral model is developed. Compared with single-input model, over 10dB improvement of normalized mean squared error (NMSE) is obtained.

RF and Microwave Design
Room: 405
Evaluating High-Performance Direct RF Sampling Data Converters
Markus Loerner, Rohde & Schwarz

This paper briefly outlines the technology trends driving the move to direct RF sampling for 5G and similar applications and explains why these functions will be increasingly integrated in advanced CMOS SoCs in the future. These wireless appli-

cations are driving very high levels of data converter performance which are outlined along with how this is achieved in advanced CMOS technology. Another topic is the challenge of testing high performance in a highly integrated solution, and the evaluation and testing platform is presented. The test technology will focus on the difficult and Challenge on ADC/DAC test. Also introduces the real test case in the ADC.DAC design process.

Simulation and Modeling
Room: 406
Multiharmonic and Bilateral Transistor's Behavioral Models for RF & MW PA Design
Zacharia Ouardirhi, AMCAD Engineering

When designing a high performance RF or MW power amplifier, different commercial simulators can be used to predict the circuit performances, as a function of the biasing and matching circuit designs. Indeed, these circuit simulators can provide easy-to-use simulation templates that can highlight the main figures of merits commonly used in industry for targeted applications (Pout, PAE, Gain, IMD, EVM, ACPR). A circuit simulator can be seen as a tool box. If these figures of merit have to be realistic, the transistor model used in the design must be also reliable also, and accurate to predict the component performances versus different parameters, such as power levels, loading impedance, basing conditions. If so, this means that the designer toolbox must be filled and equipped with reliable tools, which are the component models. Conventionally, compact models are used because of their ability to describe the behavior of the transistor along different power ranges for different load variations, as for different biasing conditions.This presentation will go from the model needs presentation, through the modeling process of a packaged GaN available on the shelf, up to the model use in a circuit simulator for a complete PA design.

Power Integrity
Room: 407
PDN Challenges in High Speed PCB Design
Lu Xian, ZTE Corporation

Power distribution network (PDN) is the main challenge in system design at present. With new materials being used in the miniaturization and packaging of the system, this challenge is growing. As the density of the device increases and power voltage lowers, the corresponding power and current will be increased. Signals are transmitted by package and circuit boards, So it is important to provide a clean power supply for the transistor circuit. This paper describes the influence of power noise on PCB, power design challenges and power optimization method. Then it puts forward and studies a new subject——Power Merge Method. Power merge method can not only simplifies the power supply, lower stack numbers, save power module and R&C quantity, but also can reduce PCB design workload,greatly improve work efficiency, so this method has profound significance.

▼ Wednesday, March 21, 2018 ▪ 11:45 - 12:05 ▼

Radar and Defense
Room: 402 A/B
State-of-the-art Automotive Radar Measurement Techniques
Hieng Ling Tie, Keysight Technologies

Automotive radar systems have been widely used In passenger and commercial vehicles recently, enabling advanced features such as adaptive cruise control, collision warning system, blind spot monitoring, etc. Automotive radar narrowband frequency ranges in the 24GHz and 76GHz bands at the present is unable to distinguish more clearly between objects on the road. This has led the automotive industry to the use of continuous 4GHz bandwidth in the frequency range of 77-81GHz for automotive radar. Increased use of frequency bands and more bandwidth has become more challenging for the designers to verify the performance of radar. This presentation will share an automotive radar measurement technique/method that helps to address the above test challenges. Testing automotive radar systems and their components at high frequency bands requires both the generation and analysis of either pulsed signal or frequency-modulated continuous wave (FMCW). This is to test the radar receiver sensitivity and transmitter efficiency. For the automotive radar signal generation, the method is to use arbitrary waveform generator, upconverter mixer and signal generator. This measurement setup is able to generate radar signal across 60GHz-90GHz frequency range with wide IF bandwidth and > 5GHz RF bandwidth for automotive radar transceiver testing. On the other hand, the automotive radar signal analysis measurement setup is using high performance spectrum analyzer, oscilloscope and downconverter mixer. Some of the essential measurements include system-level tests such as transmit and receive frequencies, bandwidth, power levels, modulation, radar system measurement distance, resolution and antenna beamwidth will be discussed. There are several automotive radar signal analysis setup configurations ranging from high performance wideband solutions to economical ones. Each configuration has its pros and cons that allow users to determine what is the best solution to meet their test requirements and budget.

Test and Measurement
Room: 403
Testing Power Amplifiers for 802.11ax, Power Amplifiers EVM Testing Impairments and Digital Pre-Distortion (DPD) Technology
Middle Wen, LitePoint

The first Wi-Fi standards were used primarily to provide low data rate wireless connectivity for web browsing and email. Over time, new 802.11 wireless protocols offered higher data rates for new applications such as wireless networked computing and video streaming. The upcoming 802.11ax standard takes Wi-Fi another step forward by enhancing wireless connectivity for more consistent and reliable high throughput Wi-Fi in dense user environments. A familiar target application for 802.11ax is the crowded hot-spot in a busy airport or stadium where an overloaded access point delivers terrible user experience. 802.11ax promises to support 10X more users over the same unlicensed spectrum, increase average throughput per user by 4X, and improve outdoor and multi-path signal robustness.

Test and Measurement
Room: 405
Vehicle Networking Simulation Test Solution
Yu Xian, Keysight Technologies

Millimeter-wave radar is a core technology for V2X car networking. The millimeter-wave radar has strong anti-environmental interference ability, high stability and is not influenced by external lighting, and has a wide range of application scenarios. These features make millimeter-wave radar the key sensing technology for driverless and active safety systems. How to ensure the stable operation of the millimeter-wave radar system is a key to whether the car networking can be achieved. This topic introduces a millimeter-wave automotive radar target simulation test platform, the platform can be completed target simulation (such as single-lane scenario multi-target movement, target micro-Doppler characteristic modeling, pedestrian target simulation), environmental simulation (for example Ambient noise settings) and scene settings (preset a variety of automotive radar typical work scenes, including ACC, EBA, PCS, etc.)

Simulation and Modeling
Room: 406
The Theory and Challenges for Robot Automatic Tuning (RAT) of Microwave Filtering Networks
KeLi Wu, The Chinese University of Hong Kong, Department of Electronic Engineering

The microwave filter is a compulsory component that provides high band pass selectivity and rejection for signals in the wireless communication system. It has been estimated today that there is a 15 Billion RMB market for the microwave filter industry but the manufacturing does still heavily rely on human tuning and especially by experienced technicians. The robotic automatic tuning (RAT) technology is based on more than ten years researches on computer aided tuning (CAT) of microwave filters. The objective is to replace the expensive human tuning by RAT that will develop a new production method for the future 5G RF/ microwave filters. This paper will introduce and describe this innovative methodology for robotic automatic tuning of RF and microwave filter network.

Signal Integrity
Room: 407
Update on the IEEE P370 Standards Committee on a Draft Spec for Electrical Characterization of Interconnects to 50 GHz
Eric Bogatin, Teledyne LeCroy

The IEEE P370 group has drafted a spec that describes how a de-embed process should be implemented to remove fixture effects when Characterizing any interconnect structure used in high speed digital applications. This includes recommended fixture design, verification of the process and consistency tests to check the results and quality metrics of the resulting S-parameters. As part of this program, we have designed and implemented a series of boards that can be used to verify a measurement and de-embed process. In addition, we recently held a “plug-fest” where multiple end users brought their board structures and fixture reference structures to an open forum to test out some of these recommendations. In this presentation, I will review the structure of the spec, the plug and play test boards and what we learned from the plug fest.

▼ Wednesday, March 21, 2018 ▪ 13:05 - 13:45

Panel ▼

RF and Microwave Design
Room: 402 A/B
Panel: GaN Goes Global
Gary Lerude, Microwave Journal

Sponsored By: Microwave Journal

For the past several years, this panel session at EDI CON China has been tracking the technical maturity and commercialization of GaN, and the 2018 conference will provide another update. GaN, which was initially developed as a power amplifier technology for defense applications, seems to have proven its competitiveness for wireless infrastructure power amplifiers and is now aiming for RF energy applications. We're also seeing it used at millimeter wave frequencies and used for switches, mixers and low noise amplifiers. Among the topics this year's panel will discuss: Has GaN overtaken LDMOS for wireless infrastructure? Have the advantages of GaN on Si moved from PowerPoint to reality? Is GaN challenging GaAs and silicon at millimeter wave frequencies? What performance advantages does GaN offer for switches, mixers and low noise amplifiers? Have Chinese companies established a competitive technology and production capability?

Panelists: Ampleon, Dynax Semiconductors, MACOM, OMMIC, Xiamen Sanan Integrated Circuit Co., WIN Semiconductors, and Zhancang Wang, of Ericsson, will co-moderate the panel.

▼ Wednesday, March 21, 2018 ▪ 13:05 - 13:45

Workshops ▼

Simulation and Modeling
Room: 403
Advanced Modeling Tools for RF and Microwave System Simulation
Zacharia Ouardirhi, AMCAD Engineering

Sponsored By: FOCUS MICROWAVES GROUP

The growing telecommunications industry urges the researcher to always look for new methods and techniques that can help supply the rising demand of present and future transmitter systems. In this aspect, behavioral modeling is not different and is going through the same progression. The increasing bandwidth and power requirements and methods of smart transmissions have increased the demands on fast and accurate simulation capabilities for analyzing, optimizing and designing microwave systems.Circuit level simulation techniques and look-up tables often are unsuitable for subsystem and complete system analysis. The RF performances as well as the baseband characteristics must be taken into consideration for system evaluation to validate the RF system specifications. Therefore, to assess the system performance by simulation or to develop compensation techniques to linearize its behavior, it is very important to have accurate behavioral models (black box model).

5G and Advanced Communications
Room: 405
How to Use Wideband High Resolution Phase & Amplitude Controlled Matrix to Help the R&D and Test Related to 5G
Wei Liu, Mitron

Sponsored By: Mitron 伟博电讯

5G is the hot topic today! To design good 5G system is a really long challenge. Are there any tools that can help 5G development? How do you prove the accuracy of beam forming algorithm? How do you test and evaluate 5G antenna array? How do you build up the test system with lower investment? How do you simulate the signal environment of 5G application? How do you meet the future possible higher specification requirements by 5G? This workshop gives the author's thinking based on the application of 2~6GHz, 24~43GHz high resolution phase and amplitude controlled matrix.

Test and Measurement
Room: 406
New mm-Wave Test & Measurement Solution for More Accurate, Compact and Affordable Designs
Tomasz Waliwander, Farran Technology

Sponsored By: Farran Technology

Farran Technology, combined with one of globally recognized innovators, has partnered to create CobaltFx; a new mm-Wave frequency solution. ColbaltFx is the first mm-Wave frequency solution that utilizes a 9GHz VNA. ColbaltFx's high dynamic

range and directivity allow for highly accurate and stable mm-Wave S-parameter measurements in three dedicated waveguide bands 50-75GHz, 60-90GHz, and 75-110GHz. CobaltFx offers an unparalleled combination of price, performance, flexibility and size the VNA, used in this system, features fast sweep speeds down to 10 microseconds per point and a dynamic range if up to 160 dB, all comprised in a compact, USB form factor. Moreover, it works seamlessly with Farran Technology's mm-Wave FEV frequency extenders. The extenders are packaged in a small and versatile enclosures, that allow for flexible port arrangements with respect to the waveguide. Waveguide ports are manufactured in accordance to the new IEEE 1785 standard and ensure industry best alignment and repeatability of the connection, allowing for long interval times between calibration. The system comes with a precision calibration kit, containing a flush short, offset piece and broadband load and allows for full 12-term port calibration.

Radar and Defense
Room: 407
What to Consider When Selecting PCB Materials for Optimum Performance at 77 GHz
Evan Yuan, Rogers Corporation

Sponsored By: ROGERS CORPORATION

There has been a rapid increase in the development of 77 GHz automotive radar sensors and it appears this trend will only increase over the next several years. There have already been many lessons learned on how to design and implement 77 GHz radar sensors using printed circuit board (PCB) technology. This presentation will give an overview of the major obstacles and how to overcome them for PCB based technology used for 77 GHz automotive radar sensor applications. Initially, six critical circuit material properties which impact millimeter-wave radar performance will be discussed. Following will be supporting data that will validate the influences of these key material properties on radar performance. Additionally, several PCB fabrication influences will be outlined and data shown to better understand the potential variations that can occur for RF performance at millimeter-wave frequencies.

▼ Wednesday, March 21, 2018 ▪ 13:50 - 14:30 ▼

5G Advanced Communications
Room: 402 A/B
The Use of GaN/Si Commercial Process to Achieve mmW LNA and PA at Low Cost
Fabien Robert, OMMIC/Sichuan YiFeng

Sponsored By: YFEN 益丰电子

Until today, 3G and 4G infrastructure networks have been deployed in frequency bands below 4GHz. The targeted high speed data rate of future 5G networks requires the development of new products at higher frequencies, such as 27 GHz or 37-40 GHz in USA, 24-27 GHz, 31-33 GHz or 40-43 GHz in Europe, 37-43 GHz in China. At these frequencies, the currently used silicon/LDMOS technologies can no longer meet the technical requirements of future 5G networks. Above Ka band, the GaN technologies commonly proposed with gate length of 500, 250 or 150 nm are also close to their limits. The cost of such technologies is also quite high since using SiC substrates. We will demonstrate here that we can target 5G or other mmW application specs using GaN/Si. We have thus investigated a GaN technology dedicated to microwave and millimeter wave circuits, using a 12V 100 nm gate length and a 100 GHz cutoff frequency, with a 40 GHz power amplifier targeting a 10 W output power and a 26-34GHz 5W Pout /2.7dB noise single chip TR chip.

5G Advanced Communications
Room: 403
RF Test of 5G mmWave and Ultra-wideband PA and Digital Pre-Distortion(DPD) Verification
Feng Li, Keysight Technologies

Sponsored By: KEYSIGHT TECHNOLOGIES

5G mmWave and ultra-wideband modulation is the best way to achieve ultra-high data communication throughput, so it has been recognized as the key technology of next generation wireless communication standard. The major operators and NEMs have invested in this area actively and began developing commercial products. The most challenging thing to enable the technology is the mmWave component, especially power amplifier, because traditional CMOS PA does not have enough output power, so GaAs and GaN PA are under development. Since the frequency band and modulation bandwidth are quite different than current 2G/3G/4G, there is no mature DPD product and PA test specification, so the industry has high demand for mmWave PA test platform and DPD verification solution. This paper is focused on RF test of 5G mmWave and wideband PA and Digital Pre-Distortion(DPD) verification. Compared with traditional PA component parameters test, I will put emphasis on the wireless system level test aspects. The workshop will discuss the major requirement and test specification from operator, NEM and PA company, and then the major mmWave PA EVM/ALCR test method and platform will discussed. I will also give the important methods to improve the accuracy and dynamic range on EVM and ACLR testing, and key technology to implement DPD verication for ultra-wideband PA.

5G and Advanced Communications
Room: 405
Advanced Front End Module Test Including Wide Band Impedance Control
Xianfu Sun, Focus Microwaves

Sponsored By: FOCUS MICROWAVES GROUP

With the ever increasing complexity and wide band nature of new modulation schemes employed in communications systems it is more important than ever to fully understand the performance of a front end module under realistic operating conditions. Traditionally the effect of non 50 Ohm impedance presented by, for example an antenna has been emulated using passive tuners, however these structures based on narrow band tuning stubs cannot accurately emulate the effect of changes in impedance particularly as the modulation bandwidth increases. The novel patented measurement technique presented allows the user to measure key parameters such as ACP, EVM, power and efficiency while accurately emulating the wide-band impedance of the antenna. This is achieved using a digitally controlled loop load-pull where any impedance profile can be emulated over a 100MHz bandwidth.

Test and Measurement
Room: 406
Get the Most Out of Your Data Converter Design
Markus Loerner, Rohde & Schwarz

Sponsored By: ROHDE&SCHWARZ 罗德与施瓦茨公司

Data converters are today an essential part in any RF data transmission from mobile wireless systems like the upcoming 5G, in satellite communications and in radar applications for automotive or aerospace and defense. In many cases, they define the overall system performance with their characteristics. It is essential to make sure the design-in enables getting the best performance. In this workshop, we will discuss why it is important to have an eye on power integrity in the supply line as well as signal integrity for the clock signal. The required test solutions addressing these points will be demonstrated and how the performance of the converter is effected.

Sponsored By: RichardsonRFPD An Arrow Company

5G and Advanced Communications
Room: 407
Designing and Optimizing a Small Cell RF Front End with RF Transceiver and Digital Pre-Distortion (DPD)
Mark Vitellaro, Richardson RFPD Electronics

The exponential growth in mobile data usage has driven the network operators (MNOs) to increase infrastructure investment for improving coverage and quality of service (QoS). Small Cells have garnered significant attention as a potential solution to enable both coverage and QoS improvements in densely populated urban areas. The original equipment manufacturers (OEMs) that serve the MNOs must offer small cells that not only balance the technical requirements with the operating and capital expense limitations, but also provide flexibility to deploy quickly for multiple bands, configurations, and protocols. A small cell system consists of three basic components; the SoC (base band), RF transceiver IC, and RF front end. Developing a platform to seamlessly integrate these components can be achieved, but multiple aspects need to be considered to achieve system flexibility. This workshop will account for these factors and demonstrate the development of a small cell system "platform" that can be reused for multiple bands and configurations. Specifically, we will delve into five separate sections; RF transceiver use and selection, RF front end component selection, utilizing modeling software, interfacing with RF transceivers, and optimizing the design.

▼ Wednesday, March 21, 2018 ▪ 13:05 - 13:45

Low-Power RF and IoT
Room: 402 A/B
Testing and Optimization to Enhance NB-IoT Product Life Time
Kent Rao, Keysight Technologies

Sponsored By: KEYSIGHT TECHNOLOGIES

For intelligent IoT devices in the application process you need to minimize power consumption and delay battery life. Many products, such as smart meter reading, intelligent traffic sensors, etc., put forward the requirements of up to 10 years of battery life! This not only requires low power consumption, but also the performance of the battery itself needs to withstand the test of prolonged and complicated working environment. In this project, we start with an accurate analysis and optimization of the power consumption of a work scenario, focusing on battery characterization and screening, as well as closer approaches to accelerated life-time validation with the job scene.

RF and Microwave Design
Room: 403
Effect of Balun Amplitude and Phase Imbalance on RF System Performance
Larry Zhao, Integrated Device Technology IDT

Sponsored By: IDT

Balun is generally used in RF systems, which can act as the single end to differential end transformer in Rx or differential end to single end transformer in Tx. There are many analysis related to balun, mostly focused on the effect of amplitude and phase imbalance on ADC performance, which can be expressed with SFDR. Some analysis focused on the effect to circuit design and expressed with CMRR. The analysis in past just focused on specified part in the Rx/Tx path and less systematic analysis on the whole RF system, in this workshop, we try to analze the effect of balun amplitude and phase imbalance on RF system performance. The effect of Balun amplitude and phase imbalance on the RF system can be quantized and more clearly with special cases, which raise from the 3GPP technical standards. The analysis shows the balun's amplitude and phase imbalance has a direct effect on the RF system performance, especially on the Rx blocking test case, the worst case is in-band modulated interferer. Given the simulation results, assumption and considering the RF link budget and key component performance, the SNR degrades only about 0.2dB with phase imbalance about 9°for the in-band blocking case, which is more strictly than the 3GPP technical requirement and be used as criteria of main wireless infrastructure system vendors. To describe the analysis more clearly, we will use F1128 as an example which integrates the high linearly broadband RF amplifier and balun with IPD, the F1128 features low power high linearity and broadband balun with low amplitude and phase imbalance.

Amplifier Design
Room: 405
Application of Power Amplifier in Radar and Electronic Countermeasures
Edward Davis, Beijing Xutec Technology

Sponsored By: XUTEC

This workshop discusses how power amplifiers can be used in radar and electronic countermeasures.

Test and Measurement
Room: 406
Applications for 110GHz Load Pull and Noise Parameter Extraction
Xianfu Sun, Focus Microwaves

Sponsored By: FOCUS MICROWAVES GROUP

This workshop describes how RF designers use load pull and noise parameter extraction tools to design for millimetre wave applications. The 5G standard has yet to be finalized, yet device and power amplifier designers are tasked with testing these high frequency linear and non linear devices. Load Pull and noise parameter extraction make it possible to know how an active device will behave under different source and/or load condition. As spectrum above 30GHz is being allocated for new commercial applications the need for extremely Wideband/High Frequency non 50 ohms system will require new innovative solution to address this new emerging markets.

RF Microwave and Design
Room: 407
SAIC Foundry Service For RF Application
Xiamen Sanan

Sponsored By: 厦门市三安集成电路有限公司 Xiamen San'an Integrated Circuit Co., Ltd.

This workshop explains the capabilities of the SAIC foundry service for various RF applications.

▼ Wednesday, March 21, 2018 ▪ 15:20 - 16:00 ▼

5G and Advanced Communications
Room: 402 A/B
Design Considerations for 5G mm-wave Products
Win Semiconductors Corporation

Sponsored By: win SEMICONDUCTORS | RF and mm-wave Solutions

How to quickly design a high performance and cost effective mm-wave FEM is the key successful factor to win in the 5G market. It's important to consider all the elements of product design, including semiconductor technologies, package solution and test platform etc. This workshop aims to shed the light on a total design consideration for the 5G mm-wave FEM product.

Test and Measurement
Room: 403
Test Technology Development and Challenges in THz Engineering Application
Dr. Deng Jianqin, CETC41

Sponsored By: Ceyear 思仪

This workshop focuses on THz in defense, homeland security, astronomy, medical, computer, communication and other applications in the field of science, mainly around the THz technology in recent years. Topics include those in the field of national defense terahertz radar sensors, military communications (tactics, space-based communication system, etc.), civilian areas mainly involves human security, industrial nondestructive testing, the provision of THz products and test system from a practical angle.

5G and Advanced Communications
Room: 405
Material Selection for High Frequency PCB in the 5G Era
Luan Yi, Shengyi Technology

Sponsored By: 生益科技 SYTECH

This workshop introduces technical requirements regarding antenna-used PCBs in various niche applications for 5G communication and recommend suitable base materials.

RF and Microwave Design
Room: 406
GaN/SiC HEMT Process in the Mainland China
Wei Zhang, Chengdu HiWafer Semiconductor

Sponsored By: HiWAFER 海威华芯

HiWafer has fabricated the first 6 inch GaN/SiC HEMT wafer in the mainland China with 0.25μm gate length on its own production line in August, 2017. Featuring 0.25μm optical T-gate, TaN thin film resistor, SiN MIM capacitance, spiral inductor, high opration voltage (up to 40V) and high output power (>5W/mm) with high PAE (>50%) at 10GHz, this technology provides suitable solution for power amplifier applications from DC to 18GHz. This workshop provides the details on this development.

RF Microwave and Design
Room: 407
GaN RF Devices for Next-Generation Wireless Communication
Xiamen Sanan

Sponsored By: 厦门市三安集成电路有限公司 Xiamen San'an Integrated Circuit Co., Ltd.

Wide band-gap GaN-based high electron mobility transistors (HEMTs) have been extensively explored as promising candidates for high frequency, high power density, and high efficiency power amplifier applications, due primarily to its material properties such as high electron mobility, high breakdown electric field, and high temperature, superior to those for Si and GaAs. Meanwhile, the higher power density translates into smaller devices that are easier to fabricate and to match due to its higher impedance. GaN devices can better meet the needs of high frequency and high output power for base stations powering 5G communication. In addition, the bandwidth characteristics of GaN devices can effectively reduce the number of PA power amplifiers.In order to meet the market needs of the next generation of wireless communications, a 6-inch GaN fab was established by Xiamen Sanan Integrated Circuit Co., Ltd. (SAIC), aiming at offering 0.45, 0.25 and 0.15 μm GaN RF technology to customers, thus realizing large-scale production of GaN RF devices.

▼ Thursday, March 22, 2018 ▪ 9:05 - 9:25▼

Technical Sessions

5G and Advanced Communications
Room: 402 A/B
Developing Proof of Concept Systems for 5G
Fangze Tu, National Instruments

The increasing number of data hungry applications, explosion in the number of machine to machine communications, and support for mission critical operations have posed a unique set of challenges on current day wireless communications systems. In most cases, current day 4G systems are not scalable to meet growing demands. The need to deliver reliable communication services with guaranteed quality of service requirements to meet these increasing demands has fueled the development of the 5th generation wireless systems (5G). While theoretical research and simulation provides the

foundation for the enabling 5G technologies, it's the development of proof of concept (PoCs) systems that truly enable the researchers to understand the challenges of these new wireless systems.

Test and Measurement
Room: 403
5G mmWave Massive MIMO Over-The-Air (OTA) Test: Technical Challenges and Prototype System
Wen Zhu, Keysight Technologies

Massive MIMO, as one of the key enabling technologies for 5G, has various of technical challenges, among which the OTA (over-the-air) test is one of the most challenging technical issues. In this paper, the major technical challenges for 5G mmWave massive MIMO OTA test are analyzed. What's more, the pros and cons of the commonly used OTA systems (far-field OTA, CATR and near-field OTA) are discussed from the mmWave massive MIMO OTA perspective. Based on the discussion, a compact size near-field OTA test solution was proposed for the 5G mmWave massive MIMO OTA test. A prototype system has been built, and some OTA test results are shown to demonstrate the effectiveness and accuracy of the proposed OTA solution.

Simulation and Modeling
Room: 406
Automatic Design and Verification Flow of PA Modeling and Digital Pre-Distortion
Wu Jiarui, Keysight Technologies

With the departure of 5G, the demand for broadband high-efficiency amplifiers has also made digital pre-distortion performance improvements necessary. Designing and optimizing the DPD algorithm requires the cooperation of the PA. The traditional method is to describe the PA with an ideal mathematical model before the PA design is completed. After the PA design is completed, the connected hardware is repeatedly used to test the data before and after the PA is processed at different power points Pattern to optimize the algorithm. The design process is more complicated. This paper describes how to extract PA fast circuit envelope models that include memory effects and two algorithm models based on Voterra series and memory polynomials to help algorithm developers improve DPD design and optimize efficiency. It provides two kinds of broadband DPD verification procedures for circuit-level PA and hardware PA respectively. CFR compression peak-to-average ratio and DPD compensate each other to increase the maximum linear range of PA.

▼ Thursday, March 22, 2018 ▪ 9:05 - 10:40▼

Panel

RF and Microwave Design
Room: 405
Solid State RF Energy – Inroads to the Industrial Market
Klaus Werner, RF Energy Alliance

An ever-increasing performance/price ratio coupled with unprecedented, precise radio frequency (RF) signal control expands the practical use cases for SSRFE technology to include heating and power delivery scenarios. As a result, the technology is making inroads into industrial application fields that were previously considered impossible for RF tube based systems or dominated by cost-effective magnetrons. This panel will discuss technical developments and opportunities in the industrial markets. The panel will also define the broad range of potential applications, the go-to-market strategies and the cross-industry collaboration needed to swiftly penetrate the industrial market.

Panelists:
Coen Centen, RF Power Senior Director, R&D, Ampleon
Mark Murphy, Senior Director Marketing and Business Development for RF Power, MACOM
Hannes Grubiner, Market Manger, RF Energy, Huber + Suhner
Dan Viza, Global Marketing Manager, RF Cooking, NXP
Art Aguayo, Senior Business Development Manager, Rogers Corporation

▼ Thursday, March 22, 2018 ▪ 9:05 - 11:30▼

Short Course

Power Integrity
Room: 407
Essential Principles of Power Integrity Measurements
Eric Bogatin, Teledyne LeCroy

Power integrity design is expanding in many directions at the same time. Some systems, like mixed signal, have lower acceptable noise levels. Some systems, like high performance processors have higher current requirements. And some systems, like IoT have lower energy consumption requirements. All of these challenges make measurements to characterize and debug the power rails more difficult. In this short course, we will look at the five most important measurement challenges, related to low noise in the presence of a large DC level, high bandwidth, low current loading and immune to RF pick up and how to overcome each of them. We will then apply these techniques to look at how we extract the important figures of merit for any power rail, both under nominal conditions and under stimulated transient loading. We will look at on-die measurements and on-board measurements and illustrate how to measure ground bounce. All of these examples will be demonstrated with real test boards and high definition oscilloscopes (HDO). We will present a practical approach to very difficult measurement problems.

▼ Thursday, March 22, 2018 ▪ 9:30 - 9:50 ▼

Technical Sessions

5G and Advanced Communications
Room: 402 A/B
RF Technology for 5G mmwave Radio
Thomas Cameron, Analog Devices

While the prospect of harnessing mmwave spectrum for broadband mobile communications will enable ultra high speed data communications, there are many challenges to overcome to bring these systems to reality. It is generally agreed that beamforming techniques will mitigate the large propagation losses at the mmwave frequencies. In this session we will discuss the most promising approaches to design mmwave beamforming systems and the RF technology requirements for these systems. We will compare which technologies are most suitable for the various architectures (GaAs, GaN, SiGe BiCMOS, CMOS) and how the choice of technologies influences the antenna array size.

Test and Measurement
Room: 403
Increasing Measurement Accuracy of VNAs in the THz Range
Thilo Bednorz, Rohde & Schwarz

A challenge in characterizing mm-wave components and systems is to perform precise S-parameter measurements using VNAs together with frequency converters. The accuracy is affected by the movement of test cables together with frequency converter modules between calibration and measurement, in particular for multiport DUTs. The impact especially to the phase of measured S-parameters cannot be compensated by calibration so far. This paper focuses on fundamental methods to reduce these effects by choosing a special calibration technique and measurement solution for frequencies at 110 GHz and beyond. The impact of the chosen parameter description of the calibration standards will also be shown.

Simulation and Modeling
Room: 406
Twisted Cable Fast Modeling and Simulation
Chenxing Zhao, Xpeedic Technology

In this paper we will give a solution to build up twisted cable very quickly and run a simulation with 3D simulation. And the correlation between simulation and measurement indicates that this method is more efficienct for cable modeling and simulation. More twisted cables were used in the 5G application such as MIPI. before we use the cable, we may need to make some feasibility studies. Through the simulation, we could get the performance of cable in advance. This presentation includes a flow to build up a parameterized twisted cable model very quickly and get the simulation result. It's very important to building a reliable twisted cable model is to determine the material properties and the geometry.

▼ Thursday, March 22, 2018 ▪ 9:55 - 10:15 ▼

5G and Advanced Communications
Room: 402 A/B
Overview of 5G UE OTA Test Challenges and Methods
Jing Ya, Keysight Technologies

As 5G is coming to UE, OTA (over the air) test will face more challenges. A lot of previous cable-conducted tests will be replaced by radiated tests because of no available connector provided by UE working in the mmWave frequency range. Because of adopting the beamforming techniques, some measurement metrices had to be measured in radiated way, for example: beamforming gain, beam tracking ability, EVM on the beam center. To solve 5G UE OTA test problems, a lot of proposals have been proposed to 3GPP New Radio access technology discussion team covering the topics on measurement metrics, test fields, test methodologies and measurement uncertainty analysis. For different measurement metrics, different test fields and methodologies have their own unique advantages and limitations. For the basic metrics, such as radiated transmit power and receiver sensitivity performance some baseline setup has been proposed. While for some other measurement metrics there are still a lot of open questions. For example for mm Wave NR UE demodulation test, some fundamental questions still have no answers: What channel models to use for 5G UE demodulation test? Whether the antenna property should be included in demodulation test? Whether the active antenna beam steering capability and the baseband tracking ability of the adaptive channel should be tested in Rel-15? What's MIMO order? 2x2 MIMO implementation with polarization diversity/pattern diversity or larger scale? Now different test methods including IF testing, applying RTS method with baseband emulation of Multi-AoA, SS-MPAC method with direct spatial channel emulation are all under investigated. The answers for the open issues will have a large impact on the choice of test system. This paper will overview 5G UE OTA test challenges, analyze the limitations and advantages of different solutions and proposes possible solutions to the open issues.

Test and Measurement
Room: 403
Advanced Methods to Analyze Ultra Wide Automotive Radar Signals
Martin Schmähling, Rohde & Schwarz

Automotive FMCW radars operate typically between 76 and 77 GHz. The frequency range between 77 and 81 GHz has become available in some countries for automotive radar applications. The distance resolution of a FMCW radar is proportional to its signal bandwidth. Therefore automotive radar manufacturers are already developing FMCW radars with wider bandwidths to get the most out of the available frequency range. In addition to signal frequency and bandwidth, the signal linearity and chirp duration determine the radar performance. Therefore it is important to analyze the automotive radar signal parameters such as chirp length, chirp rate, frequency deviation, etc. This paper will review different methods to overcome the challenges of RF measurements in the E band for ultra wide signals. It will then show the demodulation and analysis of a wideband automotive radar signal and discuss the results and main performance parameters.

Simulation and Modeling
Room: 406
Component - Level Via Modeling and Optimization Technology
Rui Wang, Xpeedic Technology

This paper focuses on an innovative through hole modeling and simulation technology designed to improve the efficiency of modeling and simulation engineers. The traditional method of modeling and simulation is to model the via of each structure individually and then call the simulator to solve the problem so as to optimize the structure of the via. We propose a new modeling and simulation optimization technique that uses a variety of via templates to create a large number of 3D models that cover a wide range of physical parameters as much as possible are used to solve the problem in a centralized manner. Generating device project library files can be invoked directly from library files without a separate simulation when the next engineer makes a via design. We want to make this kind of structure via such structures as discrete devices like capacitors, resistors, inductors and so on. Engineers call them directly from the device library without having to design via.

▼ Thursday, March 22, 2018 ▪ 10:20 - 10:40 ▼

5G and Advanced Communications
Room: 402 A/B
Creating Far-field Condition at a Tenth of Far-field Distance: An Innovative Technique for 5G OTA measurement
Benoît Derat, Rohde & Schwarz

Basestation antenna systems in 5G present two significant challenges for antenna measurement: up to 256 antennas and

integrated transceiver with antenna, resulting in an elimination of traditional RF port interfaces and large DUTs (device under test). Several transceiver performance metrics are typically measured in far-field type conditions, including Error Vector Magnitude (EVM), Adjacent Channel Leakage Power (ACLR), and Spectral Emissions Mask (SEM). Due to the basestation size in the 5G sub 6GHz frequency bands, this requires a far-field chamber with 10 to 50 meters of range length. This paper proposes a method using a variant of a hardware based Fourier transform located in the near-field of the DUT antenna in order to create far-field conditions–a plane wave converter (PWC). A phased antenna array of 156 elements is placed within 1.5 meters of a high gain basestation antenna of dimensions 60x60 cm. There is excellent agreement between the gain measurement results of the PWC with measurement results from a certified chamber. The measurement system is bidirectional and able to directly measure both traditional antenna metrics of gain as well as transceiver metrics of EVM, ACLR, SEM, and receiver sensitivity.

Test and Measurement
Room: 403
5G massive MIMO Measurement Challenges and Test Solutions
Kong Hongwei, Keysight Technologies

Massive MIMO technology is the key technology being adopted by 5G to achieve high spectrum efficiency, high power efficiency and lower multi-user interference etc. For mmWave band, the massive MIMO technology is critical to address the coverage challenges in high frequency due to the high propagation loss. Devices using massive MIMO technology are much more complicated in terms of the baseband algorithm, RF transceiver design,nd antenna array design. The device performance is now the combination of the baseband, RF and the antenna array. To completely characterize the device performance, the test solutions need to be able to test the device with the baseband, RF and also antenna array impact included. With that, the massive MIMO devices need measurement solutions covering the different aspects: 1) the design and prototyping solution for massive MIMO system. 2) the channel measurement, modeling and emulation. 3) the multi-channel calibration, RF parametric measurement and spatial performance measurement solution over the air 4) the beam dynamics measurement solutions to cover the device beamforming functionality and beam match, tracking performance etc. 5) the end to end performance test solutions to evaluate the system performance with multiple user or links, etc. Those test solutions pose significant technical challenges in terms of test measurement. In this presentation, we will highlight the different massive MIMO test and measurement needs and also the challenges to realize the corresponding test solutions. We will also provide brief overview on the state of the art test and measurement solutions to address some of the challenges.

Simulation and Modeling
Room: 406
Entire Equivalent Model and Design Method for RF Testing System Signal Integration
Lung Shu Huang, Jthink Technology, Ltd

The development trend for RF integrated circuits is towards higher frequency and greater speed. Hence, in an RF testing system, the parasitic effects from the socket and the load board become increasingly significant. Although the socket and the load board can each meet the criteria for high frequency when are combined as a test system, the overall system may not retain these qualities. This paper analyzes the signal discontinuity effect to construct an equivalent circuit model for the an RF testing system. Based on this equivalent model, compensation mechanisms for the whole testing system are established. In the applications, given the modes of the socket and the load board, a user can implement these findings to rapidly find identify the appropriate equivalent circuit model for the an RF testing system.

▼ Thursday, March 22, 2018 ▪ 11:05 - 11:25 ▼

5G and Advanced Communications
Room: 402 A/B
5G mmWave OTA Testing
Aleksis Anterow, Microwave Vision MVG

Advances in 5G connectivity, Internet of Things (IoT) and WiGig are connecting new industries, enabling new services, and empowering new user experiences. These exiting technical developments significantly influence the design, development, and testing of wireless devices equipped with phased antenna arrays. While standardization bodies such as 3GPP are making good progress in devising recommendations for test of wireless devices at millimetre frequencies in both near-field and far-field configurations, the progress on standardizing propagation environments is still lacking. Today, propagation environments usable for link level simulations are available, but how to implement these in a controlled environment such as an anechoic chamber is still unclear. The response from the measurement industry to this void in standardization is to investigate versatile measurement solutions in tight collaboration with customers that can be adapted to include testing in defined propagation environments in the future. In this presentation, we give a brief overview of the advanced millimetre-wave testing options using both NF and FF techniques and comment on possible ways forward for further advances in OTA testing of such devices.

Test and Measurement
Room: 403
Medical Wireless Coexistence Between Medical and IoT Devices
Chris Kelly, Keysight Technologies

RF coexistence measurement is a new technique to determine the ability of a RF device to tolerate interference and still deliver satisfactory operation. Coexistence addresses interference on the same frequencies as the device under test, unlike other “adjacent channel” or “out-of-band” receiver tests. Coexistence test may be performed for any of several reasons. In some cases, it may be performed due to complaints of failure in a certain environment. In others, it may be to measure the tolerance of a new product to expected interference levels. The purpose of the testing will determine the methods of test and reports required. This paper describes the coexistence topic and how one might go about making such measurements.

Signal Integrity
Room: 405
DDR4 Design and Simulation DDR4
Jun Wu, EDADOC

How about the effect of signal integrity problems in DDR4 Design? This paper talks about the topological structure, termination, length match, impedance, crosstalk, ISI, SSN etc. We use both simulation and test methods to verify the design quality of DDR4. We will talk about the design rules, details and experience. We provide a detailed case study of DDR4 by on board design. We look at placement and routing, as well as the timing requirement, and how to finish the length matching. And we will also talk about capacitive load and how we deal with it.

Test and Measurement
Room: 406
Trends in mmWave Devices, ICs and Packaging for Electronics Test and Measurement
Di Liu, Keysight Technologies

With the rise of various hot-point applications such as 5G, automotive collision avoidance radar and millimeter wave imaging, millimeter-wave technology has been increasingly valued by the industry and gradually applied. In the electronic measurement industry, what are the characteristics, limitations and possible future trends of millimeter wave devices, chips and packaging technologies? This presentation introduces and shares mainstream millimeter wave devices, chips and packaging technologies in the electronic measurement industry.

▼ Thursday, March 22, 2018 ▪ 11:30 - 11:50 ▼

5G and Advanced Communications
Room: 402 A/B
Far-field Distance and OTA Characterization of 5G Mobile Devices using mmW Antenna Arrays
Benoît Derat, Rohde & Schwarz

Far-field is generally considered to start at a distance of d_ff=2D≤/L, where L is the wavelength and D is taken as the maximum dimension of the radiator. This criterion may, however, be overly conservative when the antenna occupies a very small portion of the complete volume of the considered equipment. This case will exactly happen with mobile devices operating 5G NR at frequencies around 28 and 40 GHz. Indeed, for future 5G handsets, chipset and mobile phone manufacturers are looking at arrays of patches or dipoles integrated into small modules, which are typically not much larger than 2 cm. For a 2cm-sized antenna array, the above mentioned d_ff formula gives a far-field distance of ca. 8 cm at 28 GHz. For a 15cm-long mobile device, applying D=15 cm results in a far-field distance of 4.2 m. As the whole length of the device is not completely covered with antenna arrays and the 2-cm arrays are made to essentially operate as standalone radiating structures, the far-field behaviour must start in space at a much shorter distance than 4.2 m. The question of where then becomes crucial as the cost and complexity involved for over-the-air (OTA) measurement systems increases dramatically with the testing distance.

Test and Measurement
Room: 403
Sub-6GHz 5G Device Requirement in GTI
Yang Huaizhi, Keysight Technologies

In the face of 5G services and market trends, there are many key capabilities and performance indicators for 5G network, base station and device. And there are also many challenges for 5G device design and implementation, so here some contribution exported from GTI as related to 5G devices to define the technical requirements, and to direct the research and analysis on key points.

Signal Integrity
Room: 405
Correlation between Measurement and 3D EM Simulation for 25Gbps and Beyond Backplane Passive Channel Characterization
Lei Yue, Keysight Technologies

Design and characterization of passive channels at the data rates of 25Gbps and beyond are very challenging, especially when PCB layout uses stack-up with dozens of layers, traces with tens of inches length, and back-drilled holes, the traditional 3D EM simulation techniques are hard to quickly characterize the performance of these passive structures. Advanced modeling, analysis, and accurate measurement techniques are required over broad frequency ranges. In this study, a new 3D EM simulation approach with short simulation time and less memory occupied is used to show good agreement with the results from measurement in the fabricated backplane. The proposed approach was performed on 5-inch strip-line differential pair of backplane PCB layout with 24-layer stack-up and back drilling.

Test and Measurement
Room: 406
Techniques for Measuring 5G New Radio Components
Sheri DeTomasi, Keysight Technologies

The 5G 3GPP new radio specification roll out in Dec 2017 and summer 2018 will introduce many new challenges for designers. One of the biggest challenges will be designing and testing components and modules to operate at cm and mmwave spectrum. It may seem like a small step from 4G, but in reality, there are major differences that will greatly impact the quality of your designs. There are many new considerations including path loss at the higher frequencies, connections to the device under test, signal quality and interference to name a few. This paper will identify the key contributors to poor measurements and provide tips and techniques for making measurements for 5G New Radio.

▼ Thursday, March 22, 2018 ▪ 11:55 - 12:40 ▼

Panel

Sponsored By: Microwave Journal

Test and Measurement
Room: 402 A/B
5G mmWave OTA Testing Workshop and Panel
Pat Hindle, Microwave Journal

Building on past years' successful MIMO OTA workshops and panels, the 5G mmWave OTA Testing workshop and panel will address how industry must solve this big challenge quickly. With 5G applications being deployed soon in the 28 GHz and above frequency range with bandwidths up to 1 GHz and using massive MIMO arrays, how will the industry measure the 3D narrow beam propagation environment? Leading measurement and test chamber experts will present data on possible methods and test setups discussing and debating the merits of each.

Panelists:
Fabricio Dourado, Test and Measurement Solutions, Rohde & Schwarz
Aleksis Anterow –5G Project, Managing Director of MVG-ORBIT/FR Europe Microwave Vision (MVG)
Dr. Kong Hongwei, Manager of Germany Science and Technology Laboratory in China, Keysight
Manuel Uhm, Director of Marketing at Ettus Research, a National Instruments Company
Kai Yan, Senior Researcher for 5G System Platforms, China Mobile

▼ Thursday, March 22, 2018 ▪ 11:55 - 12:40 ▼

Workshop

Sponsored By: YFEN 益丰电子

Simulation & Modeling
Room: 406
Advanced III/V MMIC Process and Product Roadmaps for Terahertz Applications
Marc Rocchi, OMMIC/Sichuan YiFeng

In the near future, defence, space, instrumentation, security, automotive and telecommunication systems are planning to use higher frequencies up to 600GHz. In this context, advanced III/V MMIC processes and products will be shown to be an indispensable complementary solution to Si(Ge) solutions for all RF applications. In particular, the metamorphic HEMT process

roadmap is focused on the right scaling rules enabling to minimize parasitic capacitances and to reach ft and fmax of 1THz while preserving the reliability levels required for demanding applications such as space-borne systems. The perfomance of OMMIC's 70 and 40nm MHEMT processes will be reviewed with examples of receiver products including ultra low noise LNAs and tunnel diodes used as zero bias detectors for security scanners.

▼ Thursday, March 22, 2018 ▪ 11:55 - 12:15 ▼

Technical Sessions

5G and Advanced Communications
Room: 403
Performance Differentiated Transmit (Tx) Radio Frequency Frontends (RFFE)
Gareth Lloyd, Rohde & Schwarz

The four key technical metrics of transmitter (Tx) RFFE (radio frequency front ends) in communication systems are output power, signal quality, bandwidth and energy efficiency. The first three of these are generally governed by regulatory or performance requirements. The last, energy efficiency, is a market differentiator. Historically, three critical innovations in TxRFFE have been made whose combination of performance and simplicity have stood the test of time (two are almost 100 years young). These innovative architectures offer an interesting solution set, especially for the 5G RFFE; a counterpoint to the commodity quasi-linear solution. This presentation describes how these TxRFFE innovations actually achieve their goal and demonstrates how they can easily be measured. These architectures exhibit some potentially advantageous side-effects or features. For example: the demonstration of ER, driving a mixer with AM and PM signals (rather than IF and CW), gives an image-free output. This potentially relaxes (eliminates?) the need for additional, intentional, filtering. ER also provides for direct, efficient, control of amplitude and phase, potentially advantageous for beamforming applications, such as required by 5G. And, both LINC and ER use constant envelope signal(s) in the RF/IF path(s), despite eventually generating a high PAPR signal.n.

Signal Integrity
Room: 405
High-Speed Digital Bus Standard Test Technology Updates, from PCIE4.0 to Type-C Interface
Huang Teng, Keysight Technologies

PCIExpress is the most important and popular high-speed serial bus in data centers and servers. As PCIE4.0 spec was announced, there will be a boom in 2018. Type-C will be the dominant interface on consumer products in near future. With Alt Mode, Type-C interface can be configured as USB3.x/TBT/DP. But compliance test for it is more complicated because of swappable and too many test items on different standards. This presentation shows an example of how a fully automated test solution can save more time and efforts.

▼ Thursday, March 22, 2018 ▪ 12:20 - 12:40 ▼

RF and Microwave Design
Room: 403
Design and Optimization of Biasing Networks for Wideband High Power Amplifiers
Osman Ceylan, Ampleon

The demand for very high data rate 5G systems requires the use of wider spectrum bandwidths and phased array systems to increase the network capacity. Although the individual power level of each RF amplifier decreases due to the array factor, in the sub-6GHz bands it is still high enough to place significant challenges on its development, to fulfill the increasing performance requirements. The RF bandwidth requirement of 200 to 600 MHz, associated with the high back-off efficiency and linearity needed by the use of wideband modulated signals, leads to even more complex architectures. One of the consequences is the design and optimization of the bias networks that becomes a challenging issue as it needs to consider even more parameters, such as low-frequency stability, video bandwidth, power handling capability, linearity, and reliability. All of these parameters have a direct influence one the performance of the PAs.

Signal Integrity
Room: 405
Using Eye Contours in Scopes to Analysis High-Speed Serial Digital Signals
Qiujie Lu, Keysight Technologies

Higher data rates in high-speed digital interfaces have introduced more analysis and debug challenges. Eye diagram and mask test is a general test item on such interfaces. But due to memory/oscilloscope limitations and general lab time, a

direct measurement of, say, 1 trillion transitions cannot be made directly. Eye contours provide a statistical method for determining what an eye may be after a certain number of signal transitions, which can take 1 million or 10 million transitions and do a statistical analysis of the signal to create what the eye is expected to look like at 100 billion or 1 trillion transitions, or more. Construction of precise eye contours requires comprehensive and precisely decomposition of deterministic, random and bounded uncorrelated terms on both the traditional jitter axis as well as the vertical noise domain. Attendees will learn eye contours' basic and construction, and more inportant, how to interprete the eye contours to debug and optimise their products.

▼ EXHIBITOR LIST ▼

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▼ FLOOR PLAN ▼

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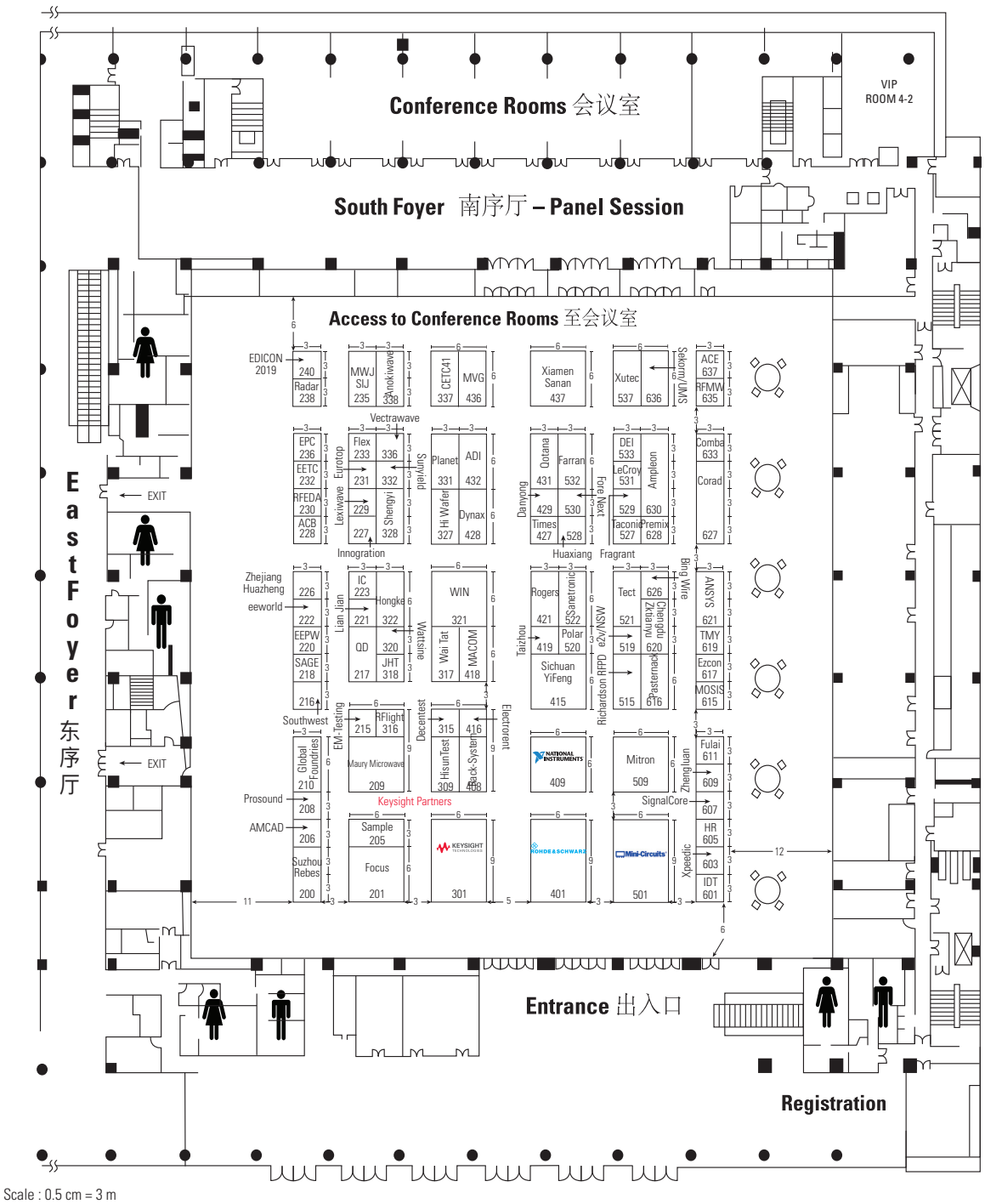

Scale : 0.5 cm = 3 m

These booth numbers are complete as of February 23, 2018.

▼ NOTES ▼