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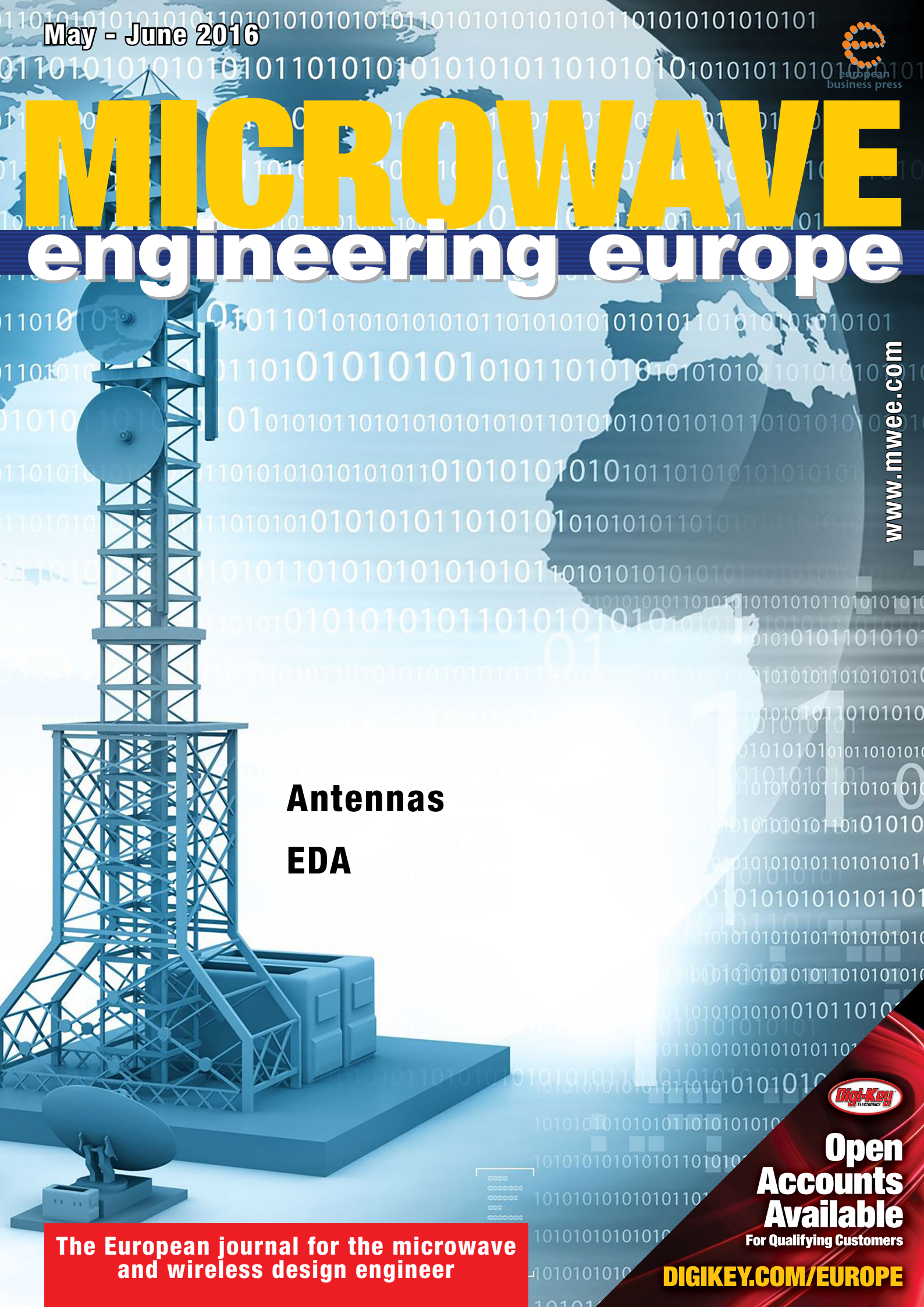
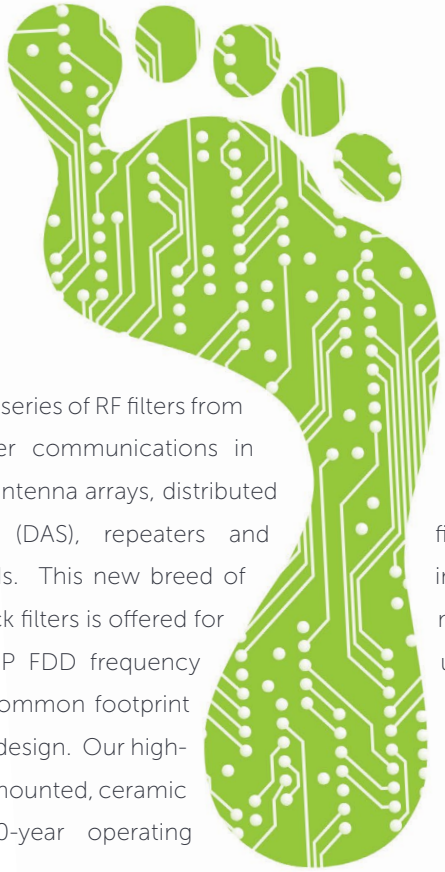


Antennas

EDA

The European journal for the microwave and wireless design engineer

Universal Footprint RF Duplexers



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Tx Band Isolation	74dB	66dB	57dB
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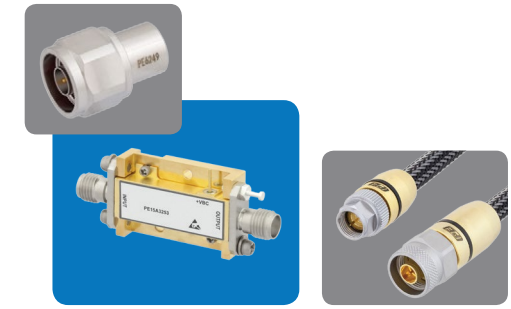

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Managing IoT data is the challenge of the decade

The IoT is a hot topic at the moment, but it is also one of those technologies that is hard to pin down covering a huge variety of applications and requirements. The connected car is considered an element within the IoT, as could an intelligent microwave that knows how to cook the food put into it by identifying the product from the package RFID tag or barcode. The IoT encompasses industrial applications, smart cities, M2M, smart homes, intelligent consumer devices, vehicles, and even healthcare, amongst others.

This year, market research firm Analysys Mason expects the market for Internet of Things (IoT) and M2M systems to mature markedly, as some of the key questions facing operators around technology, use cases and opportunities will be resolved. On the IoT network front, the analysts predict that the contest for worldwide dominance in LPWA networking technology will be confined to NarrowBand IoT (NB-IoT) and LoRa1.

The data crunch however is not that easy to address. Besides, various connectivity requirements generated by IoT devices from low data rate, high latency such as metering through to high data rate, low latency and even mission critical such as in automotive and medicine, the amount of data that will be generated by the IoT is already on an upward path that is predicted to dwarf even the smartphone era. The main issue here is that the IoT promises to connect over 50 billion devices by 2020 according to Cisco — and the sheer volume of data generated will overwhelm current methodologies. Advances in big data and analytics will be a key area to focus on.

Some of the challenges will be how to manage such high voumes of data, what data is redundant and what data is usable, segregating out data that should be processed locally or at the edge of a network and also how to handel legacy data and systems. A lot of earlier IoT attempts have resulted in systems that will need to be interfaced into new systems and have in fact become data silos.

The key challenge for the IoT era will be collect data efficiently and organise it in way that it becomes useful. There are claims that up to 90 percent of data generated today is not acted upon or used in a meaningful way. To this end operators will need to distinguish between useful and redundant data —throwing up large challenges in improving data and analysis capabilities. Further, it is likely that a lot of the data generated by the IoT will not worth collecting or using due to its cost — an issue that will also need to be addressed.

By Jean-Pierre Joosting, Editor, MWEE

CMOS RF power amplifier firm raises $35 million

Acco Semiconductor Inc., (Sunnyvale, CA), a private company that was founded near Paris in 1994, has raised $35 million to accelerate sales and development of its CMOS RF power amplifier and other front-end circuits.

Acco has developed and patented a design of transistor that delivers performance similar to that of gallium arsenide but in a CMOS fabrication process. In October 2015, Acco announced the start of mass-production of its AC26120, A CMOS multimode, multiband PA for smartphones and Internet of Things (IoT) applications. The transistor offers highly linear performance and can operate at high power without breakdown or degradation. The use of CMOS RF front-ends is expected to reduce size and cost for applications in smartphones and IoT.

Strategy analytics estimates that the annual market for mobile power amplifiers is $3.5 billion.

www.acco-semi.com

Startup looks to spiral modulation for comms revolution

Astrapi Corp., (Dallas, Texas), a six-year-old startup founded to apply non-periodic signal modulation to communications engineering, has formed a research partnership with TSR Research Lab at the University of the Basque Country (Bilbao, Spain). The company has a similar research agreement with San Diego State University, in California.

Jerrold Prothero, Astrapi co-founder and CEO, has been working for a number of years on so-called spiral polynomial division multiplexing (SPDM) as an alternative to orthogonal frequency division multiplexing (OFDM). The claim is that the method – based on the use of non-periodic wave forms to create a spiral signal in phase space – exploits an alternative form of orthogonality and has the benefit of minimal power/bandwidth needed to achieve tight and fast synchronization.

Astrapi also claims that OFDM-based systems are sensitive to frequency synchronization and tend to suffer from a poor power amplifier power ratio, providing scope for spiral modulation to improve on the status quo.

Put more generally, Astrapi provides novel ways to build symbol waveforms used to encode digital transmissions. By applying this novel mathematics to signal modulation, Astrapi is able to improve the trade-off between the four fundamental parameters in telecommunications: bandwidth, signal power, data throughput, and error rate. The company claims the resulting efficiency translates into higher spectral performance with more bits available at a lower cost.

The partnership with TSR Research Lab is intended to start building real systems and to explore how spiral-based modulation can increase information transmission rates, mitigate interference, facilitate synchronization, and combat phase impairments.

Astrapi – the name comes from the Greek word for lightning – has raised $2.2 million to date.

www.astrapi-corp.com

Bluetooth to find opportunities in IoT

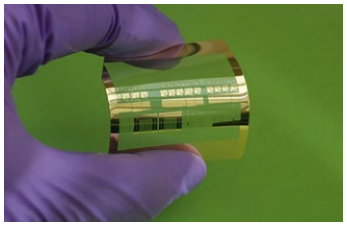
According to market intelligence firm ABI Research, annual Bluetooth device shipments will reach 5 billion by 2021. Though smartphones will still account for 43% of Bluetooth device shipments at this time, Bluetooth Smart, also known as Bluetooth Low Energy, is exhibiting the strongest growth with a predicted 34% CAGR between 2016 and 2021, driven by emerging opportunities in beacons, home automation, and wearable applications in which lower energy consumption is critical. As a result, the firm predicts that Bluetooth Smart Devices will account for 27% of total Bluetooth shipments by 2021.

"While there remain significant opportunities for Bluetooth smartphone accessories and connected home devices, there will be increasing traction toward connecting to everyday household objects," says Andrew Zignani, Industry Analyst at ABI Research.

www.abiresearch.com

Fast flexible silicon transistor with wireless capabilities

University of Wisconsin-Madison engineers have pioneered a unique method, based on a a very, very tiny knife, that could allow manufacturers to easily and cheaply fabricate high-performance transistors with wireless capabilities on huge rolls of flexible plastic.



The researchers — led by Professor Zhenqiang (Jack) Ma, and research scientist Jung-Hun Seo — fabricated a transistor that operates at a record 38 GHz, though their simulations show it could be capable of operating at 110 GHz. In computing, that translates to lightning-fast processor speeds.

In wireless applications, the transistor can transmit data or transfer power wirelessly, a capability that could unlock advances in a whole host of applications ranging from wearable electronics to sensors.

The researchers' nanoscale fabrication method upends conventional lithographic approaches — which use light and chemicals to pattern flexible transistors — overcoming such limitations as light diffraction, imprecision that leads to short circuits of different contacts, and the need to fabricate the circuitry in multiple passes.

Using low-temperature processes, the reserchers patterned the circuitry on their flexible transistor — single-crystalline silicon ultimately placed on a polyethylene terephthalate (PET) substrate — drawing on a simple, low-cost process called nanoimprint lithography.

www.wisc.edu

Lime Microsystems announces crowd-funding for SDR platform

Lime Microsystems has luanched a crowd-funding campaign to bring their LimeSDR software defined radio platform into full-scale production. The campaign, hosted on the Crowd Supply platform, aims to raise $500,000 to fund the final stages of development and mass production of the LimeSDR platform. The LimeSDR platform is a low cost application-enabled software defined radio (SDR) platform that can be programmed to support virtually any type of wireless standard – including Wi-Fi, ZigBee and Bluetooth through to cellular standards such as UMTS, LTE and GSM and to the emerging IoT communication protocols such as LoRa.

Measuring just 100 x 60 mm, the LimeSDR board uses the Lime Microsystems LMS7002M field programmable radio frequency (FPRF) transceiver to provide continuous coverage of the frequency range 100 kHz to 3.8 GHz with a 120 MHz RF bandwidth. The transceiver contains two transmit and two receive chains for provisioning a 2x2 multiple in multiple out (MIMO) capability. Complementing the wireless transceiver is an Intel/Altera Cyclone IV field programmable gate array (FPGA) that allows high bandwidth DSP tasks to be carried out in hardware. Interfacing to the host application is via USB 3.0 using a Cypress USB 3.0 microcontroller. Transmit output, up to 6.5 dBm continuous wave, is through four U.FL connectors, providing two outputs per transceiver chain. Six U.FL connectors, three per receiver chain, are used for receiver antennas.

Ebrahim Bushehri, CEO of Lime Microsystems comments, “With LimeSDR our aim is to bring the same level of programmability we have in the digital domain into RF and as a result, we believe the next generation of wireless networks could bring real innovation into this field.”

www.crowdsupply.com/lime-micro/limesdr
www.limemicro.com

3GPP approves Power Class 5 for NB-IoT

Swiss company, u-blox in collaboration with Neul has convinced its peers of the need for an extra power class for devices used in Narrowband-IoT (NB-IoT) applications.

As a result, a maximum transmit power of 20 dBm has been approved on the occasion of the latest 3GPP RAN working group meeting ramping up to the 3GPP Release 13 of NB-IoT standards in June. This additional power class with lower maximum transmitted power could help to reduce the peak current consumption from the battery, hence enabling NB-IoT to be suitable for a wider range of IoT applications, such as wearables and tracking.

NB-IoT is a Low Power Wide Area (LPWA) technology for IoT applications, available for deployment over existing mobile networks, in licensed radio spectrum. These applications have low data rates, require long battery lives and operate unattended for long periods of time, often in remote locations.

www.u-blox.com

Graphene as a filter for future THz wireless devices

Scientists at EPFL and UNIGE have developed a graphene based microchip that essentially filters out unwanted radiation ensuring that a wireless data signal remains uncorrupted. The discovery, the results of which are published in Nature Communications, could help wireless telecommunications share data at a rate that is ten times faster than currently possible. The microchip works by protecting sources of wireless data from unwanted radiation in a similar fashion to the way polarised sunglasses work, ensuring that the data remain intact by reducing source corruption.

The reasearchers discovered that graphene can filter out radiation in much the same way as polarized glasses. The vibration of radiation has an orientation. Like polarized glasses, their graphene-based microchip makes sure that radiation that only vibrates a certain way gets through. In this way, graphene is both transparent and opaque to radiation, depending on the orientation of vibration and signal direction. The EPFL scientists and their colleagues from Geneva used this property to create a device known as an optical isolator.

“Our graphene based microchip is an essential building block for faster wireless telecommunications in frequency bands that current mobile devices cannot access,” says EPFL scientist Michele Tamagnone.

Further, the microchip works in a frequency band that is currently empty, called the Terahertz gap.

www.epfl.ch/index.en.html

SIGFOX collaborates with Microsoft on IoT

SIGFOX has announced it will integrate the SIGFOX Cloud with Microsoft Azure IoT Hub, enabling customers to use data for real-time analytics, make better decisions across diverse business functions, and intelligently automate operations. Currently operating in 14 countries, including the U.S., and registering over 7 million devices in its network, SIGFOX provides subscription-based LPWA communications for the IoT.

SIGFOX’s cloud-to-cloud integration, which will be available to both SIGFOX and Microsoft customers, is based on Azure IoT Hub, which provides an easy and secure way to connect and control millions of devices. The collaboration allows users to utilize both SIGFOX’s low-power, wide-area network and the power of advanced analytics and storage on Microsoft Azure to collect, analyze and visualize large quantities of operational data.

www.sigfox.com

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Protection from electromagnetic fields

By Narda Safety Test Solutions

Directive 2013/35/EU must be implemented in national legislation by 1st July 2016. Employers will then have to make a risk assessment for every workplace. Suitable measuring equipment is already available.

Directive 2013/35/EU, published on 29th June 2013, is not just a replacement for the previous Directive 2004/40/EC. It also replaces national regulations, because one aim of the EU is to unify workplace health and safety practices in order to minimize distortion of competition between the member states. In Germany, for example, the EMF Directive will be implemented through a new health and safety regulation, which will abolish the old familiar accident prevention regulation BGV B11, now known as DGUV 15. The contents of the Guidelines are incorporated into a technical regulation that replaces the performance regulations BGR B11, currently DGUV Rule 103-013.

EXPOSURE LEVEL VALUES AND ACTION LEVELS

Among the new points in the EMF Directive are the exposure level values in the lower frequency range up to 10 MHz, which are primarily based on the recommendations of ICNIRP (International Commission on Non-Ionizing Radiation Protection) from 2010, whereas the previous Directive 2004/40EC was based on the ICNIRP recommendations of 1998. The limits for electric field strengths have also been tightened to some extent. In contrast, the permissible values for magnetic fields in the low frequency range are much more generous. The latest research and scientific knowledge has led the ICNIRP to adjust its limit value recommendations.

The EMF Directive takes two types of direct biophysical effect caused by electromagnetic fields into account. Firstly, these are thermal effects such as tissue heating caused by energy absorption, which occur with high frequencies. Strong high frequency fields can cause internal burns, leading to blindness in extreme cases, for example. Secondly, the EMF Directive considers effects such as muscle, nerve and sensory organ stimulation that can be caused by low frequencies. Such effects can cause optical illusions, for example.

In addition to this, the EMF Directive takes indirect effects into account, such as spark discharges and contact currents that can be induced by electromagnetic fields, interference with heart pacemakers or metallic implants, and the projectile risk from ferromagnetic objects – even a paperclip can become a dangerous missile in a strong static magnetic field.

The exposure level values (ELV), which are based on the actual field strengths within the human body, are mandatory for protection against biophysical effects. They cannot, however, be measured in practice. For this reason, the EMF Directive specifies so-called action levels (AL), which can be measured outside the human body. Human safety is adequately demonstrated as long as these action levels are not exceeded. This then automatically ensures compliance with the exposure level values.

ACTION LEVELS – HOW TO MEASURE, WHEN TO ACT?

The EMF Directive makes a distinction here between thermal and non-thermal effects. Thermal effects are not only dependent on the field strength, but also on the frequency. For this reason, the Directive defines frequency dependent action levels in the range from 100 kHz to 300 GHz. Protective measures are needed if they are exceeded. Any measuring equipment used must therefore evaluate the field strengths correctly for frequency and accurately sum the individual effects, since there are usually lots of frequencies “on air” in the high frequency range – e.g., close to transmitter equipment. Personal field monitors worn on the person can warn staff of excessive field strengths in such situations.

Non-thermal effects are also frequency dependent. The EMF Directive therefore defines frequency dependent action levels for the range from 1 Hz to 10 MHz: Low action levels, above which sensory effects – transient changes in

Figure 1: Robot welding equipment.

sensory perception – may occur, and high action levels, above which effects detrimental to health are to be expected. Protective measures are already required if the low action levels are exceeded. Preventive measures must be implemented to ensure that the high action levels are not exceeded.

Typical low frequency fields are primarily present in the industrial environment and are often pulsed fields. For this reason, the EMF Directive specifies the use of the weighted peak method, which weights the peak values in the time domain, as the reference method for non sine wave fields. Measuring instruments specifically designed for safety applications already implement this measurement method, also known as Shaped Time Domain (STD).

EMPLOYERS OBLIGED TO ACT

A new requirement of the EMF Directive is that employers must carry out a risk assessment for every workplace. This does not mean that measurements always have to be made everywhere, though. In many cases, such as in offices or laboratories where only low current devices are used, the compliance statements (CE marks) of the equipment manufacturers are sufficient. However, the sum of the exposure levels must be considered and calculated here where necessary.

In other cases, measurements must be made. If the action levels are exceeded, the employer must take action: Technically, by making use of alternative procedures, adding screening, providing protective equipment; or organizationally, by controlling access, limiting length of stay, operational instructions, etc.

The EMF Directive does not specify particular protective measures or any details of implementation. The guidelines to facilitate implementation of the Directive that the EU Commission cover calculation methods, describe the weighted peak method for the low frequency range, explain how to sum multi-frequency fields in the high frequency range, and give simplified procedures for small and medium-sized businesses as well as the formal requirements that have to be met by employers. This does not mean that there will need to be any changes in the measurement technology itself, however.

TEST EQUIPMENT

Narda Safety Test Solutions provide a comprehensive program of test equipment for verifying that workplaces comply with 2013/35/EU. Measurements are simplified and incorrect measurements avoided by means of wideband measuring sets that automatically allow for the frequency-dependent action levels, use of the Weighted Peak method, and direct display of the results as a percentage of the action level. Selective measuring equipment allows analysis of individual field sources, while at the same time providing an assessment of the overall field exposure that complies with the Directive. Personal monitors worn on the body give warning even before entering an area where the field strength is above the permitted level. Narda also provides suitable software for further evaluation, documentation, and management of the results.

Figure 2: Person in transformer station

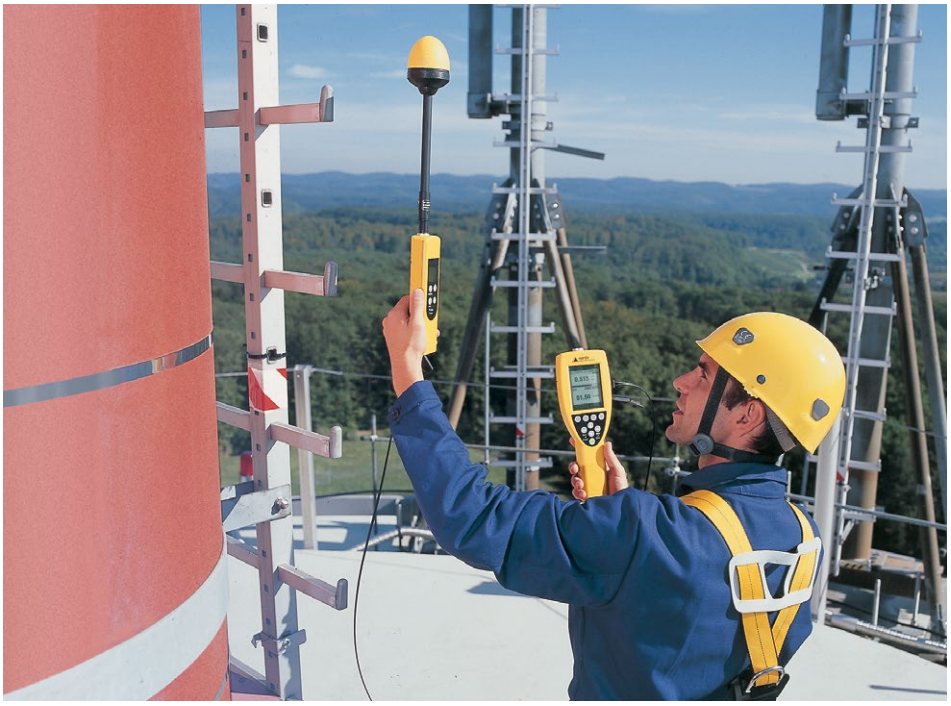

Figure 3: Person near transmitter.

Test challenges of modern day networks

By George Acris, Director of Marketing, Europe, Microlease

Contemporary society is heavily fixated on the transfer, manipulation and sharing of large quantities of data. As a consequence of this, exacting pressures are starting to be placed upon existing commu-nication infrastructure. There are 2 questions that now need to be asked. Firstly, can the network resources being made available keep pace with our seemingly unquenchable thirst for more and more bandwidth? Secondly, what are the test implications going to be?

Numerous factors are contributing to the elevated data volumes being witnessed, calling for a ramp up of capacity and increased test activity. Alongside these, a number of industry trends are beginning to appear that will mandate more sophisticated test procedures.

IOT DEPLOYMENT

Internet of Things (IoT) is only just starting to emerge, but the activity around it is certain to ramp up very rapidly. It seems certain that IoT will have a major effect on how M2M communication is exe-cuted, with a wide range of different sectors benefitting from this technology. Via IoT more effective factory automation, building access, smart metering, surveillance, home appliance and countless other systems will be made possible.

BIG DATA

Here the desire to analyses and process more and more data means that greater quantities of it need to be handled. This can then be used for all sorts of task such as predictive modelling or the optimiz-ing of system performance. The compiling of these extensive data sets obviously calls for robust net-works that can carry high capacities of data.

EXPONENTIAL GROWTH IN MOBILE DATA

Though mobile communication was originally voice centric, this can no longer be said to be the case. Projections recently made by ABI Research indicate that mobile data consumption will have reached a staggering 2,289 MBytes per month by 2019. The latest edition of the Ericsson Mobility Report pre-dicts that by 2020, around 70% of the global population will be using smartphones and that current data usage here in Europe and in North America will have increased six-fold. The accessing of videos, playing of online games, sharing of photos, use of over-the-top messaging apps, plus the growing popularity of location-based services are all adding to the data load that mobile networks and their supporting backbone networks need to carry.

PREVALENCE CLOUD COMPUTING APPLICATIONS

Continued movement away from localized PC hosted software packages towards the use of cloud based services will enable a broader array of applications to be benefitted from, as well as offering much bigger reserves for data storage purposes. Forecasts from IDC suggest that investment in cloud IT infrastructure during 2015 will reach $33.4 billion (this equates to approximately a third of the overall worldwide IT infrastructure spend). By 2019 this figure will have reached $54.6 billion and represent almost half the total outlay on IT infrastructure.

NEW NETWORKING HARDWARE

In order to improve efficiency, network operators are progressively making greater use of reconfigu-rable optical add-drop multiplexer (ROADM) devices. As ROADMs dispense with the need for opto-electric conversion, network architectures into which they are incorporated exhibit much higher throughputs.

SECURITY ISSUES

It's not just the volume of data that needs to be dealt with, in addition there are growing concerns about maintaining security over networks, with cyberattacks and suchlike becoming increasingly commonplace. The frequency with which these take place is only likely to rise, as remote working becomes more popular (with telecommuting already increasing by 80% in the last decade) and cloud services gain further traction. Furthermore, the bring-your-own-device (BYOD) phenomenon has serious repercussions in terms of system security. Infected portable electronics equipment could, via interfacing with a company's data networks, pass on viruses or malware. The problem is accentuated by companies rarely having a well-formulated BYOD policy or adequate authentication practices.

In response to these different dynamics, networks must be continuously scrutinized and upgrades made when appropriate. This is an ongoing process across the entire operating life of the network. First of all effort must be made to ensure that the physical installation is fully compliant with the stipulated requirements. This may involve the physical testing of LANs to certify their conformance to the relevant standards (such as CAT6 or CAT7). This can be done using a number of very specific tools, such as the Fluke Versiv system for certifying either copper or fiber networks, or the EXFO Max-tester 940 FiberCertifier for fiber networks. Alternatively it could be verifying the characteristics of a fiber in a WAN network, which may include dispersion testing and thorough optical time domain reflectometer (OTDR) measurements, using products such as the Viavi

Figure 1: Equipment examples.

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(formerly JDSU) MTS2000 plat-form, the EXFO FTB-1 platform, or the Anritsu MT9000 platform. With OTDRs, all of the major manu-facturers produce a wide range on modules designed to meet different measurement require-ments. You will need to select a unit that covers the wavelengths that you will be operating at and a dynamic range that will allow you to measure the full length of your fiber. Depending on the wavelength, optical fiber can have an attenuation factor of between 3 dB/km and 0.2 dB/km. The higher losses are in the multimode wavelengths, whilst for single mode fiber it is around 0.2 to 0.4 dB/km. Therefore if you are looking at a fiber that is 100km long, you will need a minimum dynamic range of 30 dB to 40 dB.

Once the physical environment of the network has been verified, then the data performance can sub-sequently be test-ed. This could be a simple RFC-2544 test of the network, (which covers fun-damental parameters like throughput, latency, etc.), however more advanced Y-1534 test procedures (where quality of service and network performance elements are both dealt with) are now applied with growing regularity. Suit-able solutions are offered by the major equipment brands (Anritsu, EXFO, Viavi and Veex) and the product you select will often depend on other factors, such as any additional functionality you may require — like fiber channel capability.

There are a multitude of different aspects that need ongoing testing and monitoring as networks con-tinue to be expanded and upgraded. It is critical, therefore, that the operators, contractors and en-terprises which find themselves caught up in this maelstrom can source the test tools that will allow them to react to constantly changing demands.

With the increasing use of ROADMs to improve the performance of net-works, more specialist test equip-ment is required in order to measure the performance of these networks. State-of-the-art opti-cal spectrum analyzers (OSA) and power meters are designed to look at these systems. Suitable ROADM capable OSAs could be the EXO FTB-5240SP or the Viavi OSA500R. Also the widespread de-ployment of LTE networks has meant that synchronization of network in-frastructure is even more critical now than ever before. Even small errors can result in dropped calls and failed handovers, which will frustrate sub-scribers. Therefore use of packet-based timing technology, such as Synchro-nous Ethernet (SyncE) and IEEE 1588v2 Precision Time Protocol (PTP), are both being widely adopt-ed. To complement this, more in-depth testing of network stability is being carried out too. This can be done using products from lead-ing timing equipment manufacturers such as Calnex with its Para-gon family of synchronization testers, or by using the additional functionality available in the stand-ard network testers previ-ously mentioned.

After it has been established that the network is at optimum performance, it is necessary to give con-siderable thought to the security aspects. The concerns about violations and expo-sure to viruses, that were mentioned previously, dictate thorough testing of firewalls and the implemented secu-rity software via systems which are designed to emulate denial-of-service (DoS) attacks, etc. This testing be-comes more specialized and requires the use of High end Network simulation tools from compa-nies such as Ixia and Spirent.

All of these different dimensions need to be monitored and tested on a regular basis as the networks involved are, over time, grown and modified. As additional devices are connected, changes to the profile of the network will be witnessed. This will affect how well it responds to the demands being placed upon it.

To address the array of different test requirements that have been outlined here, companies need to be able to obtain suitable instrumentation in a cost-effective and timely manner. Their supplier should have a broad array of products to choose from. This will mean that the company can select the equip-ment that best matches their require-ments at that time and is not forced to make com-promises or is inadequately provisioned to upgrade if this becomes necessary.

In addition, the com-pany should, with help from their test equipment partner, be able to decide which sourc-ing option is most appropriate from a financial point of view (whether rental, purchase, new, used, or even uti-lizing divide-by programmes) and be able to keep total flexibility.

Figure 2: Testing WANs and LANs.

We've been traveling safely at speeds up to **79 GHz** for many years

Circuit boards are being pushed harder, with frequencies for automotive radar systems and mobile backhaul communications links climbing to 79 GHz and beyond. Just as designers of satellite communication systems have for decades, now designers of these commercial applications are counting on the circuit boards and materials used within them for consistent, reliable operation at millimeter wave frequencies. History proves that Circuit Materials from Rogers Corporation are the ideal choice.

Whether they are based on Rogers RO4835™ LoPro® circuit materials or RO3003™ laminates, these higher-frequency applications depend on reliable substrates with consistent performance in the 79 GHz range. Both RO4835 LoPro and RO3003 circuit materials feature best in class electrical performance across diverse environments including a wide temperature range and elevated humidity.

Future electronics systems are making greater use of millimeter wave frequencies, through 79 GHz and higher. Make sure those systems provide consistent, reliable performance essential to millions of users, with low-loss RO4835 LoPro and RO3003 circuit materials from Rogers.

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Cutting antenna design time — novel algorithm streamlines 4G/5G

By R. Colin Johnson, Advanced Technology Editor, EE Times

The antennas for smartphones capable of operating anywhere in the world at 4G and in the future at 5G, are becoming progressively more difficult to design with all the different frequencies they must transmit and receive. The answer, already being used in advanced design is multiple-input multiple-output (MIMO) antennas (also called multi-port antennas) that can dissect the frequency band cheaply and efficiently.

Unfortunately, today's experienced antenna designers use "black magic" (their experience and savvy) to guess at what the optimal antenna configuration should be, then run full-bore simulations of all the factors involved that sometimes take a week of computer time to run. And if the results are poor, then they have to do it all over again until they get a good-enough design — never knowing how close their design is to the optimal configuration.

Now North Carolina State University (NCSU) researchers think they have a better idea. Instead or running super detailed simulations conjured by their most experiencer "black magic" radio frequency (RF) expert, they simplify the problem to its bare basics, by eliminating all but the most important parameters, and solve for the most optimal antenna configuration. These algorithms can be run in minutes instead of weeks, allowing the RF expert to tweak the configuration repeatedly until a optimal seems to have been reached. Then the old-school detailed simulator can be brought in to validate the design in greater detail before manufacturing begins.

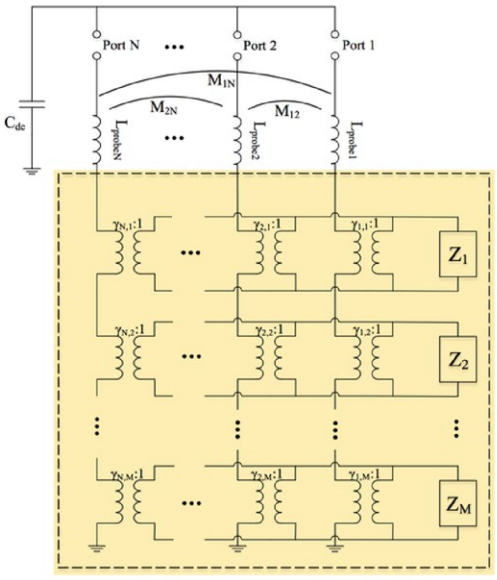


Figure 1: Typical circuit diagram for a three-port micro-strip planar antenna. (Source: NCSU).

"Our motivation was to be able to study multi-port antennas and understand how they work at a fundamental level," siad professor Jacob Adams. "Our work will be very important for 5G, because instead of using a conventional full-wave simulation for each port configuration, we can instead model the antenna as a resonator in all its modes, then can insert virtual ports and estimate where they should be."

The key to his method is first modeling the proposed antenna with no input — a technique that is normally not done — but the result is a model of its Eigen mode fundamental resonances that represent all the ways that the antenna can respond.

"We are exploiting a method that models antennas without a source, so we can then introduce sources and see their response very quickly," said Adams. "The resultant mode that a gets excited depends on where and what kind of excitation it receives."

Using their method they can find the optimal antenna configuration, minus ignored factors such as the material used. Using conventional methods there is no analytical way to find the absolute optimum, according to Adams, "but we can define what the optimum should be, propose an approach and quickly test how close we get to the theoretical optimum."

Once their approximation algorithm finds an optimal configuration, the RF engineer runs the conventional algorithm which takes into account the material's properties, the dual geometry of the feed and the other factors ignored by NCSU's approximation algorithm. The time savings comes from only having to run the conventional algorithm — which can take 116 hours or more — because all the trial-and-error was done with NCSU's model which runs in as little as 15 minutes.

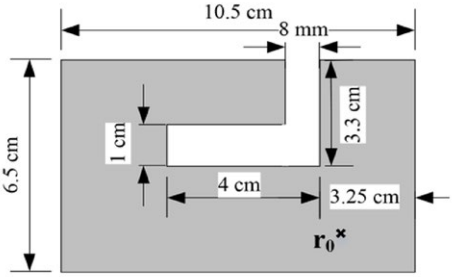


Figure 2: Typical geometry of a slotted patch antenna. (Source: NCSU)

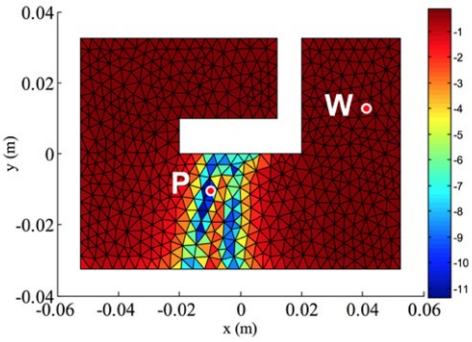


Figure 3: NCSU's dB map of the first resonant frequency (856.5-MHz), with the optimal antenna attachment position marked as P and the worst position marked as W. (Source: NCSU)

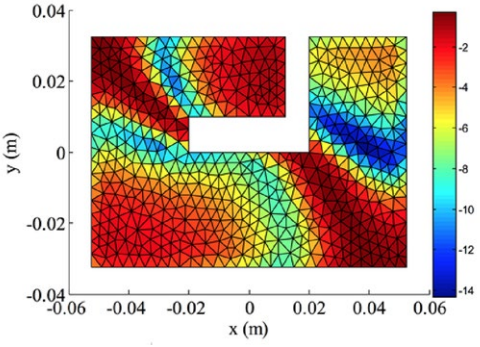


Figure 4: NCSU's dB map at the second resonant frequency (1.6-GHz). (Source: NCSU)

On-chip RF circulator doubles Wi-Fi speeds with a single antenna

Full-duplex radio ICs that can be implemented in nanoscale CMOS to enable simultaneous transmission and reception at the same frequency in a wireless radio were first invented last year by Columbia Engineering researchers. That system required two antennas, one for the transmitter and one for the receiver. Now the team, led by Electrical Engineering Associate Professor Harish Krishnaswamy, has developed a breakthrough technology that needs only one antenna, thus enabling an even smaller overall system.

This is the first time researchers have integrated a non-reciprocal circulator and a full-duplex radio on a nanoscale silicon chip.

To enable full-duplex communications where the transmitter and the receiver share the same antenna, the circulator has to "break" Lorentz Reciprocity, a fundamental physical characteristic of most electronic structures that requires electromagnetic waves travel in the same manner in forward and reverse directions.

The traditional way of breaking Lorentz Reciprocity and building radio-frequency circulators has been to use magnetic materials such as ferrites, which lose reciprocity when an external magnetic field is applied. But these materials are not compatible with silicon chip technology, and ferrite circulators are bulky and expensive. Krishnaswamy and his team were able to design a highly miniaturized circulator that uses switches to rotate the signal across a set of capacitors to emulate the non-reciprocal "twist" of the signal that is seen in ferrite materials. Aside from the circulator, they also built a prototype of their full-duplex system — a silicon

The first CMOS full duplex receiver IC with integrated magnetic-free circulator. Image courtesy of Negar Reiskarimian, Columbia Engineering.

IC that included both their circulator and an echo-cancelling receiver — and demonstrated its capability at the 2016 IEEE International Solid- State Circuits Conference this past February.

www.engineering.columbia.edu

Designing with enhanced load pull measurements for base station power amplifiers

By Chris Bean, AWR Group, NI

Load-pull simulation is a very simple yet powerful concept in which the load or source impedance presented to an active device is swept and its performance is measured. Performance contours are then plotted on a Smith Chart, which shows the designer how changing impedances impact the device's performance (Figure 1).

Load pull has been used for decades in RF circuit design flows, especially for high-power applications such as base station power amplifiers (PAs). Recent advances in data file formats by load-pull measurement system vendors such as Maury Microwave and Focus Microwaves have significantly expanded the usefulness of load-pull characterization. These new file formats support a sweep of an independent variable such as input power, DC bias, temperature, or tone spacing (in the case of two-tone load pull), in addition to the swept source or load impedances. The ability to import and manipulate these load pull data sets in a circuit simulator greatly simplifies and speeds the design process, and gives designers a broader design space to explore. NI AWR Design Environment™ V12 enables designers to take full advantage of these new load-pull file capabilities in an intuitive manner by offering important load-pull measurements and graphing control features. Today in the industry designers are predominantly sweeping input power and, consequently, V12 load-pull features focus on input power sweeps, but it's important to note that essentially any parameter can be swept and the data manipulated in the design environment.

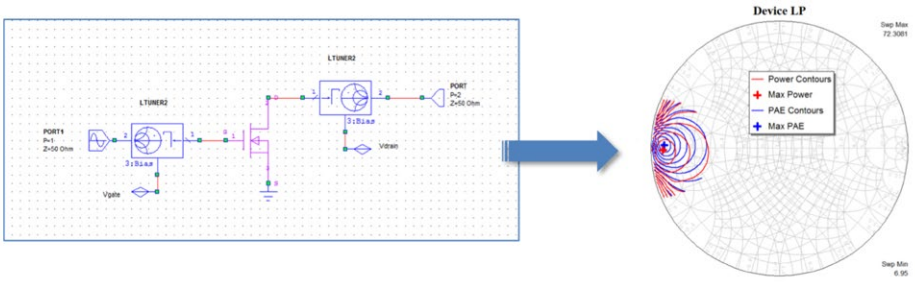


Figure 1: The load-pull methodology in which the load (or source) impedance of a device is swept and measured, then performance contours are plotted on a Smith Chart.

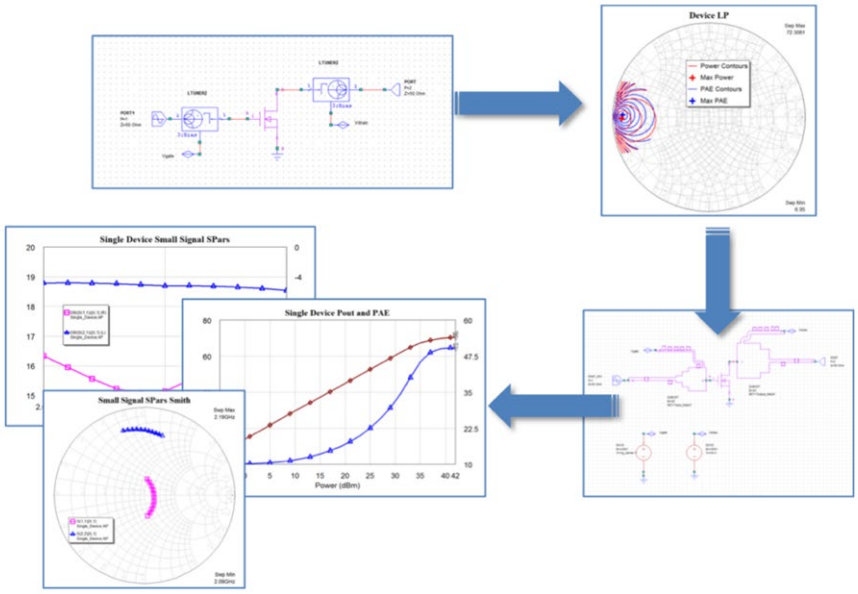


Figure 2: A traditional design flow, including nonlinear model of the device and load pulling of that model in circuit design software.

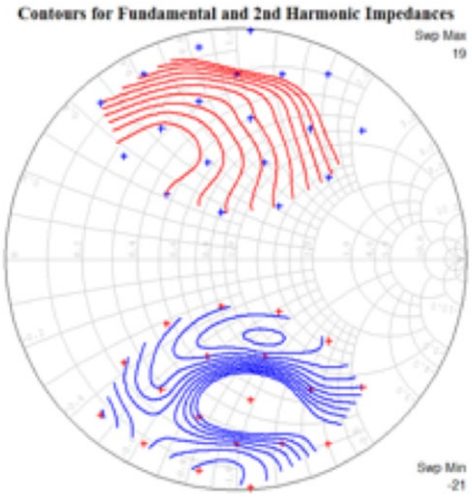


Figure 3: Data plotting and manipulation example of contours for fundamental and 2nd harmonic impedances.

TRADITIONAL DESIGN FLOW

The traditional circuit design flow typically involves running a load-pull simulation on a nonlinear model of the device in the circuit design software, as shown in Figure 2.

The input and output matching networks are then designed based on load pull contours from the device model, and performance criteria that are important for the design are plotted. From that point the designer tweaks the

matching networks until all design goals are met or at least optimized to the fullest extent possible.

There are several issues with this traditional design flow. The first problem is overall accuracy of nonlinear models. It is difficult to create a nonlinear model that is accurate over all operating conditions such as bias, frequency, and power level. The second issue is the simple availability of nonlinear models within short design cycle times.

USING MEASURED LOAD-PULL DATA AS A BEHAVIORAL MODEL

To circumvent this, PA designers have begun designing their matching networks and associated circuitry directly from measured load-pull data. This has several advantages, one of which is that the entire process is within the control of the design group itself and data can be regenerated or redefined in house if necessary, rather than relying on a third party for model generation.

The challenge for EDA companies is to provide intuitive methods for dealing with complex swept load-pull data sets. These data sets can include nested harmonic load pull, nested load and source pull, and two-tone excitation, in which intermodulation distortion levels can be analyzed as a function of load impedance. The data can also include multiple fundamental frequencies. As such, an entire array of possibilities exists for manipulating the data, including plotting as a function of frequency, power, bias, load or source impedance at the fundamental frequency, and load or source impedance at harmonic frequencies. Figure 3 shows a data plotting and manipulation example of contours for fundamental and 2nd harmonic impedances.

Measurements to be plotted can include power capability, gain, efficiency, intermodulation distortion levels, AM-PM performance, or essentially any other performance metric which can be measured on a modern load-pull system. If the device's internal matching elements and package parasitics are known, measurements can also be de-embedded to the current generator plane of the device.

Above and beyond viewing and plotting swept load-pull data, the ability to directly optimize matching networks is of paramount importance. Matching networks that are designed from measured load-pull data enable fast and accurate prototype builds, as the uncertainty of a nonlinear model is removed, and replaced with empirical, verifiable data. The challenge for EDA companies in this case is establishing a means of interpolating device performance from load-pull data using the impedances computed from an output matching network. In this way, after the load-pull data have been imported into the circuit design tool, the matching networks can be designed directly.

A final consideration is the ability to produce equivalent data sets from nonlinear models. The circuit design software must be capable of producing data that can be fit to empirical data, in order to enable modeling groups to produce accurate device models. In other words, the ability to produce equivalent measurements entirely within the software is necessary, in order to

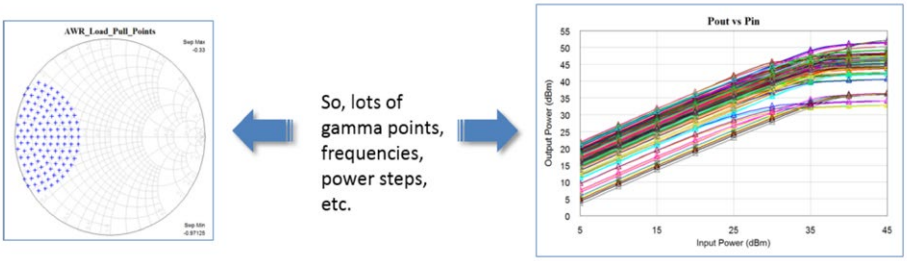


Figure 4: In NI AWR software, the denser the data sets, the better the focus is on post-processing of data.

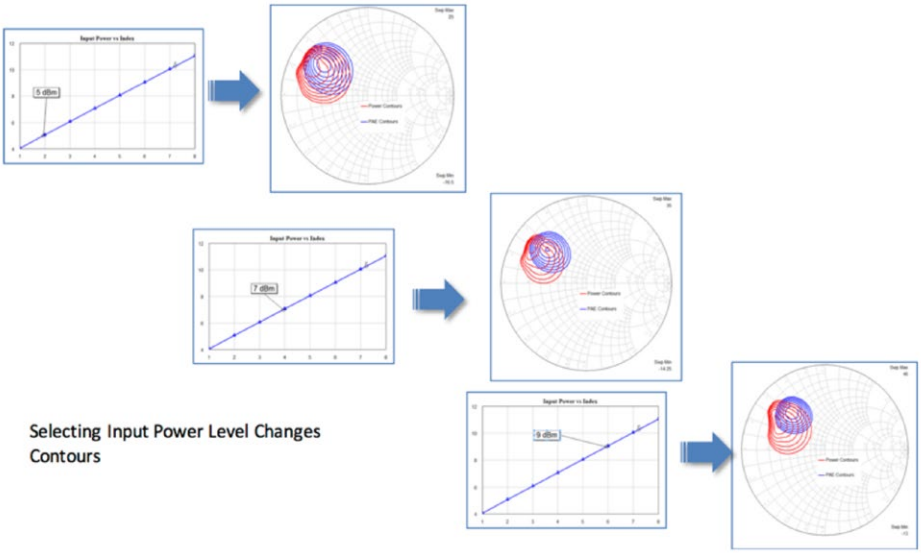


Figure 5: The rectangular graph on the left shows the input power versus index. A marker points to a specific input power and plots the contours in the Smith Chart. When the marker is moved, a new set of contours is plotted.

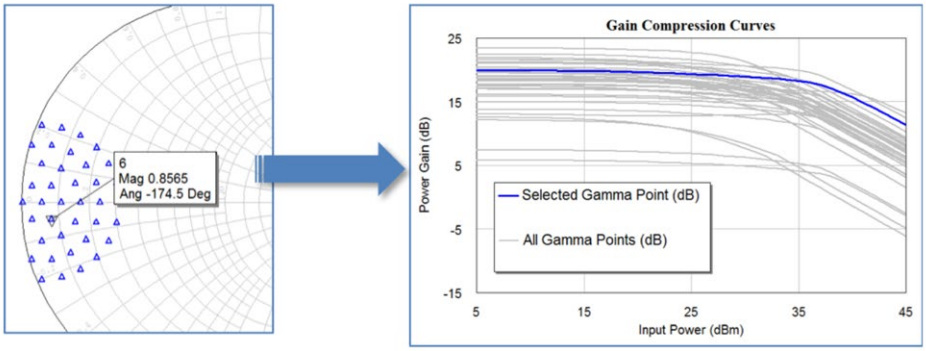


Figure 6: The user chooses a gamma point from the impedances in the local file and plots gain compression curves. The grayed out curves are gain compression curves for all gamma points and the dark blue trace corresponds to the gamma point that has been swept with the marker.

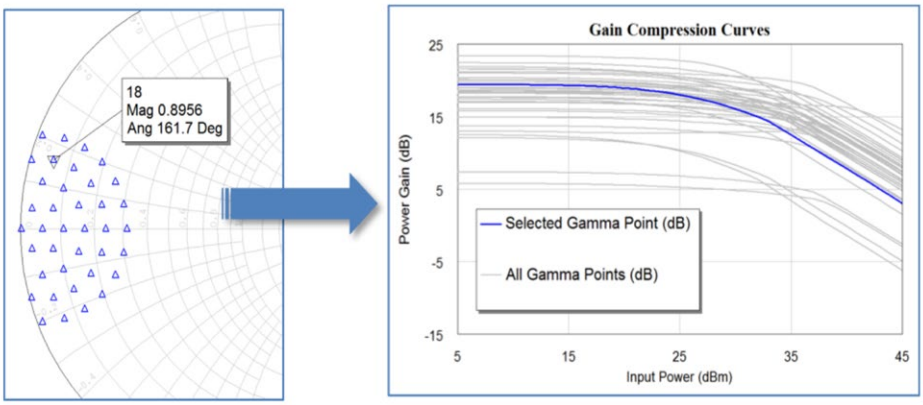


Figure 7: If the marker is moved to another gamma point, the gain compression curve changes to update that impedance.

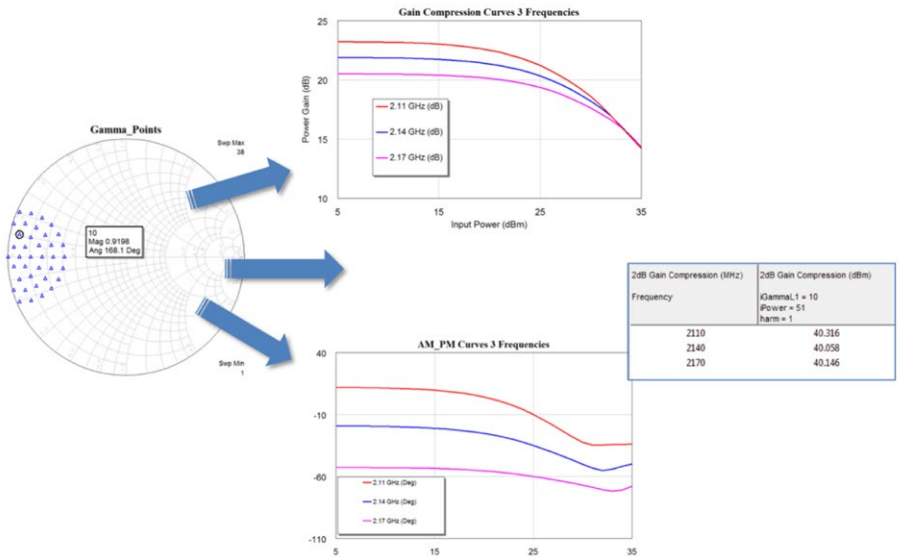


Figure 8: Impedance points being plotted for a 2.1 GHz, 80 W LDMOS device.

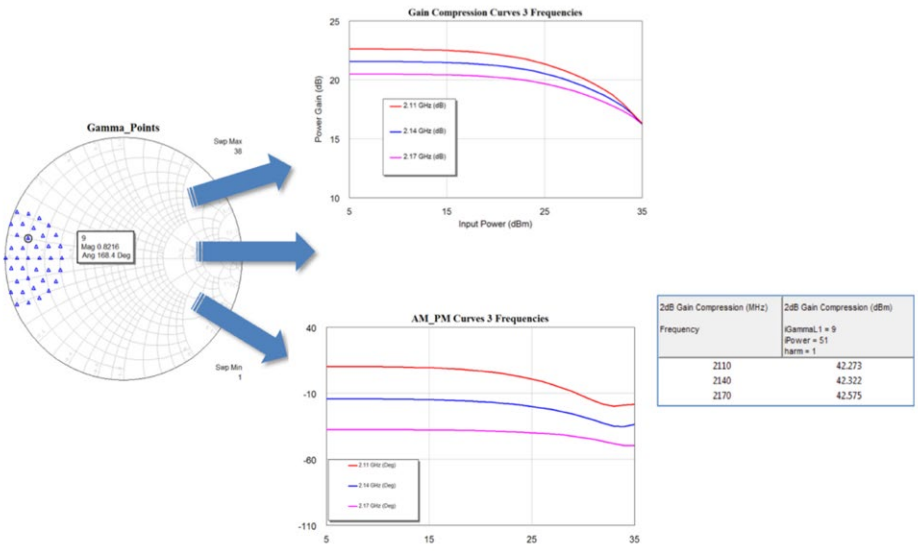


Figure 9: Users can move the marker around, use different gamma points, and parse through the performance space of the device, assessing tradeoffs as they go.

provide simulated data sets that can be compared to empirical data. In this way, the circuit simulator can be used not only for data manipulation and circuit design, but also for improving the accuracy of nonlinear device models.

TYPES OF SUPPORTED DATA IN NI AWR DESIGN ENVIRONMENT

Historically single sweep point files have been supported (Maury Microwave LP/SP files, Focus Microwaves LPD files). V12 now supports multi-dimensional files such as Maury SPL, Maury CST, and Focus LPD, which have swept data. With NI AWR software, the denser the data sets (gamma points, frequencies, power steps), the better the focus is on seamless, intuitive post-processing of data (Figure 4).

The new load-pull formats in Microwave Office circuit design software give designers access to an extensive array of data manipulation possibilities. Figure 5 shows on the left a rectangular graph of the input power versus the index. There is a marker that points to a specific input power and the contours for that power level are being plotted on the right. If the marker is moved, another set of contours is obtained that correspond to that power level. If the marker is moved again, a third set of contours is obtained. This is something that can't be done with older single point local files.

Conversely, instead of choosing an input power level and plotting contours, users instead can choose a gamma point or impedance and plot swept data. Figure 6 shows how the user chooses a gamma point from the impedances that are in the data file and gain compression curves are plotted. The grayed out curves are the gain compression curves for all the gamma points in the file and the dark blue trace corresponds to the gamma point that has been selected with the marker.

Similarly, if the marker is moved to another gamma point, the gain compression curve changes to reflect the performance at the new impedance (Figure 7).

NEW DESIGN FLOWS USING AWR LOAD-PULL CAPABILITIES

What would a typical design flow look like now that designers have the the new load-pull capabilities in NI AWR software? Figure 8 shows the impedance points being plotted for a 2.1 GHz, 80 W (P1dB power level) laterally diffused metal oxide semiconductor

(LDMOS) device. A gamma point has been chosen and the AM-to-PM and gain compression curve is plotted for three frequencies that are in the file (2.11 GHz, 2.14 GHz, and 2.17 GHz). The 2 dB gain compression power capability is also plotted in tabular format.

Figure 9 shows how users can move the marker around, selecting different gamma points, and parse through the performance space of the device, assessing tradeoffs as they go. If another impedance point is chosen, a new set of curves is automatically generated that corresponds to that load impedance, as well as another set of AM-to-PM and gain compression curves, and another 2 dB power figure.

Designers can do this until they reach what they consider their optimum desired impedance for their design goals. In Figure 10 another gamma point has been chosen that has a very flat gain compression, very flat AM-to-PM, and a 2 dB power that is now close to 100 W.

Another new capability in V12 enables something called an overlap contour. Figure 11 shows general contours for output power and power-added efficiency (PAE), along with the overlap contour for specific output power and PAE levels. 50 dBm power capability and 70 percent PAE have been chosen, and the overlap contour shows the tiny locus of impedances where both of these design criteria are being met.

If you are a base station designer, you are never designing for just one target. When there are multiple performance criteria that must be met simultaneously, this measurement helps the designer narrow in very quickly using specific performance criteria to the locus of impedances where both criteria are reached simultaneously.

An additional point to make here is that just because users are sweeping input power doesn't mean they are constrained to making all their measurements based on input power. If designers are interested in plotting contours or designing in terms of output power or gain compression level as most people do, they can simply take input power sweeps and use the capability in NI AWR Design Environment to easily plot output power-based or gain compression-based contours.

Figure 12 shows three curves of the actual gain compression value going up to about 6 dB gain compression at three frequencies. The center band at 2.14 GHz and a 3 dB compression point is chosen, then the contours can be plotted for whatever measurements the designer chooses. In this figure the user has stuck with the PAE and output power capability contours.

Additionally, matching networks can be optimized directly from the load pull data itself. In Figure 13 output power capability, gain, and PAE have been plotted, this time as a function of frequency. The matching networks can now be tuned or optimized based directly on these performance criteria. Note that the software enables users to tune directly, or optimize using a wide variety of included optimization algorithms. The bars in the figure are the goals for the optimizer. Once goals have been set the optimization runs on the matching network to meet the desired performance, and the physical parameters for the matching network are updated.

Figure 14 shows the result of the optimization and the updated matching network. The goals can easily be modi-

fied to further optimize the design, and the matching network parameters will be updated based on the optimization result. This ability to optimize directly from the local performance data file itself is a very powerful concept.

CONCLUSION

Load pull will continue to be an integral part of the design flow for microwave and RF power devices for the foreseeable future. The new swept format files combined with EDA vendors updating their capabilities has served to encourage the use of load pull. For an empirical based design, load pull has lowered the dependency on outside factors and increased the design group's control. Designers can go back and tell their load pull group to take more data points or different gamma points, different power levels, making the design cycle more closed loop and enabling quicker feedback rather than waiting for nonlinear device models to be created. The collection of a rich load-pull data set can shorten design cycles, particular with swept input power. NI AWR Design Environment provides enough flexibility in interacting with load-pull data that users have the ability to chose whatever is best for each design project and/or design with their own use models.

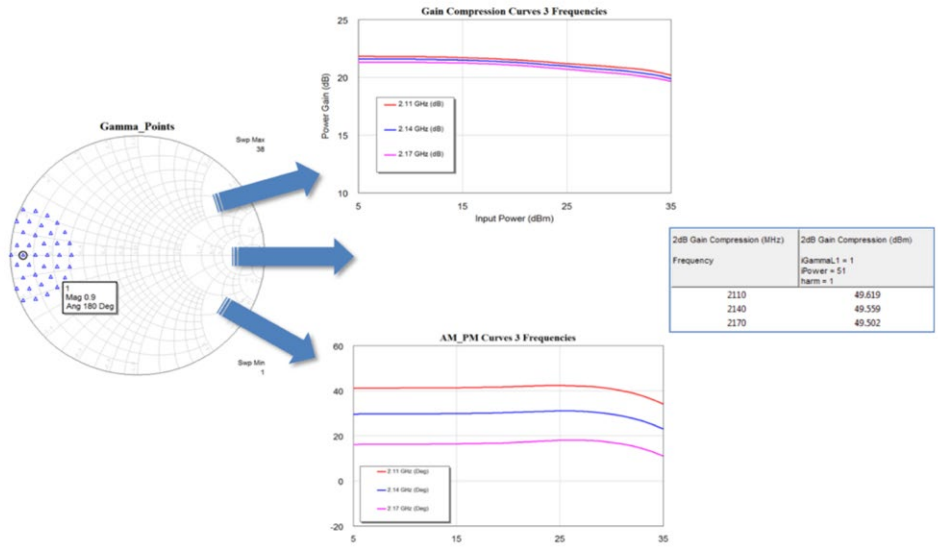


Figure 10: Another gamma point has been chosen that has a very flat gain compression, very flat AM to AM/AM to PM, and the 2 dB power is now close to 100 W.

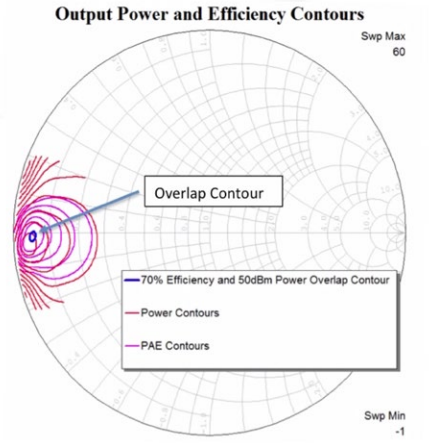
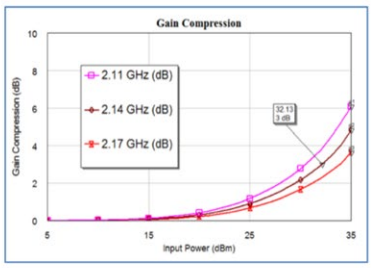


Figure 11: Overlap contour for design criteria of both 50 dBm power and 70 percent PAE.



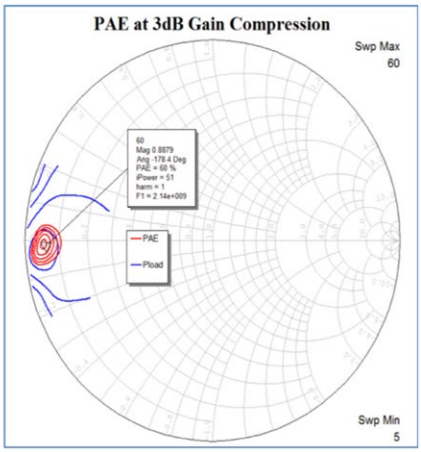


Figure 12: The left graph shows three curves of actual gain compressions value going up to about 6 dB gain compression at three frequencies. The right chart shows the PAE at 3 dB gain compression.

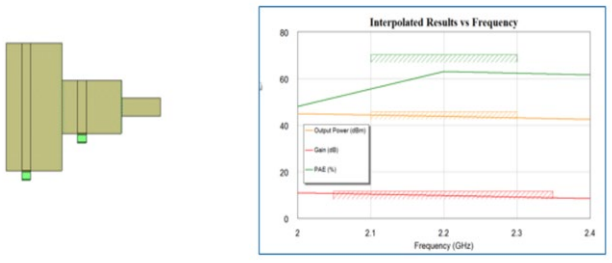


Figure 13: Several performance criteria have been plotted and matching networks can now be optimized based directly on those performance criteria.

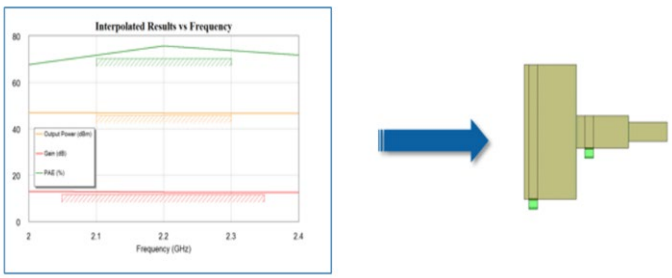
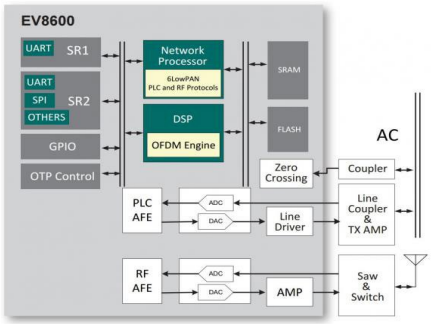


Figure 14: Performing the optimization based on empirical load pull data updates the matching network's physical parameters.

Chip combines LoRA wireless and powerline

Semtech has developed the first chip to combine the LoRa long range wireless protocol with a powerline communications controller for smart grid, smart metering and IoT applications.



The EV8600 dual modem combines a Power Line Communications (PLC) modem operating at 10-500 kHz and an RF modem operating in the range of 142-1050 MHz for the LoRa long range wireless protocol that is being rolled out across cities to support applications in the Internet of things (IoT). It also provides a LoRa fallback mode in the event of a complete network outage caused by a natural disaster or other unforeseen events. The integration can help reduce network operational costs of Advance Metering Infrastructures (AMI) by up to 50 percent says Semtech and enables seamless LoRa gateway network deployment of Internet of Things (IoT) systems for smart city and industrial automation.

To simplify the design effort, the chip handles all the bridging and routing algorithms between the two internal modems in an internal applications processor with embedded dual image flash memory as well as support for the Wireless M-BUS protocol for sub-metering applications. It supports the G3-PLC, PRIME, P1901.2 and S-FSK standards with a programmable frequency range from 9 kHz to 490 kHz for the PLC, while the wireless modem supports the LoRa Modem, WMBUS and 802.15.4g standards with a 168 dB maximum link budget from a +14 dBm high efficiency power amplifier.

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PIN diode switches

cover 10 MHz to 67 GHz

An expanded portfolio of in-stock solid state PIN diode switches from Pasternack covers frequencies from 10 MHz to 67 GHz – adding 69 unique models of 50 ohm PIN diode switches in compact connectorized package styles.

Delivering impressive isolation, insertion loss, and switching speed performance, these PIN diode switches suit applications where fast switching and long lifetime are critical, such as in aerospace, defense, and commercial RF, microwave, and millimeter-wave communication systems, switch matrix assemblies, and production testing environments for a variety of signal routing functions between control components. Integrated TTL-compatible driver circuitry offers accurate logic controls for computer command and automated test systems.

The PIN diode switches are available in popular configurations including SPST, SPDT, SP3T, SP4T, SP5T, SP6T, SP8T, SP12T, and Transfer models that cover select broadband frequencies ranging from 10 MHz to 67 GHz. These switches offer superior performance with high isolation up to 80 dB, fast switching speeds down to 50 ns, insertion loss levels as low as 1 dB, and dual operating voltage ranges from -15 to -5 and +5 Vdc. Maximum RF input power handling varies from 0.1- to 1-W (CW) depending on the model.

www.pasternack.com

28-V, 30-W GaN HEMT bare die

targets diverse applications

Wolfspeed, a Cree Company, has released a 28-V, 30-W GaN HEMT bare die designed for up to 8 GHz operation at the IEEE Wireless and Microwave Technology Conference (WAMICON.

The GaN HEMT die exhibits 12 dB typical small signal gain at 8 GHz, 17 dB typical small signal gain at 4 GHz, and 30 W typical PSAT. Additionally, due to the superior material properties of GaN compared to silicon (Si) and gallium arsenide (GaAs), the GaN HEMT die also deliver higher breakdown voltage, higher temperature operation, higher efficiency, higher thermal conductivity, higher power density, and wider bandwidths than Si and GaAs transistors. As such, the CGH80030D is ideal for use in a diverse range of applications, including: UHF-, L-, S-, and C-Band radar; broadband, public safety, and ISM (industrial, scientific, and medical) amplifiers; broadcast, satellite, and tactical communications amplifiers; UAV data links; cellular infrastructure; test instrumentation; and two-way private radios, among others.

www.wolfspeed.com

Precision adaptors

applications up to 110 GHz

HUBER+SUHNER has announced a series of PC 1.0 to PC 1.0 adaptors for use in microwave applications up to 110 GHz.

These are precision test components which the company has designed to feature optimum return loss and insertion loss as well as excellent mechanical stability and very high reliability. The adaptors are also phase matched within the series.

The latest PC 1.0 adaptors comply with the IEEE standard 287™-2007 (Annex J) which is the standard for coaxial connectors designed for precision electrical measurements to 110 GHz.

HUBER+SUHNER has also announced a true 80 GHz coaxial-to-PCB transition with superb electrical performance combined with an easy snap connection mechanism to the circuit board.

The system is composed of field-tested standard MMPX snap connectors on the PCB side coupled with an MMPX male-to-PC 1.0 female adaptor. The adaptor and test equipment are linked using a HUBER+SUHNER Astrolab 1-mm male-to-male cable assembly.

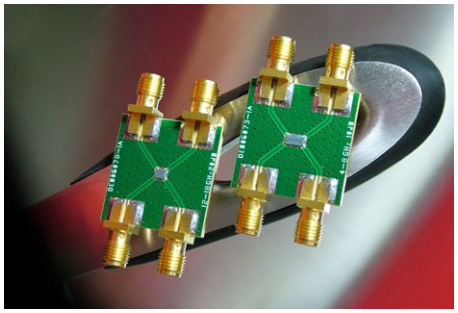
www.hubersuhner.co.uk

Directional couplers

for turnkey or custom designs

The latest series of directional couplers from Knowles brand, DLI, are based on

high permittivity, temperature stable materials to reduce size/weight and provide excellent performance repeatability. These small size directional couplers are manufactured using DLI's precision thin film technology and are ideal for microwave systems in commercial, military and space applications.



Designed for a 50Ω characteristic impedance, they offer a turnkey surface mount option for high frequency power monitoring. The four port couplers are excellent for high frequency signal monitoring applications where board space is a premium and quality power detection or injection is required. COTS devices covering C, X and Ku bands offer quick turn solutions in a solder surface mount package with flexible PCB feed line configuration. Both 10 dB and 20 dB coupling values are available within each frequency band both with a common footprint for maximum flexibility.

The devices are designed to provide high directivity, excellent repeatability and stable frequency over the temperature range -55 to +125 ºC. Chip and wire mount devices with the same performance are also available - custom solutions are also available to suit individual size and performance parameters.

www.knowles.com

High power spiral antennas

Cobham Antenna Systems is pleased to announce the FPA-0.7-2.7R/2319, which is the first in a new range of high power, directional spiral antennas.

The FPA-0.7-2.7R/2319 offers high power, high gain and circular polarisation within a compact, low profile, rugged housing. It is suitable for multi-band communications as well as cellular countermeasure and security applications. The low profile housing means that this antenna can be used to replace much larger and more expensive, Log-Periodic, Horn or Conical spiral antennas and also be used in situations where height/profile is critical.

The FPA-0.7-2.7R/2319 covers the frequency range 700 MHz to 2.7 GHz and has a beamwidth of 60° x 60°. It has a peak gain of 10 dBiC and has been designed to handle up to 150 W (with the potential of operating efficiently at much higher power).

The combination of high power and high gain means that a very significant Effective Isotropic Radiated Power (EIRP) can be generated to increase signal strength to overload any hostile system at greater distance.

The narrow beamwidth helps to ensure that the disruptive signals are targeted where they need to be while reducing the effect on friendly areas.

Providing circular polarisation ensures that the antenna will "couple" with any polarised linear signal, giving more chance of disrupting hostile systems. The high power spiral range currently includes four products covering 0.4-6.0, 0.7-2.7, 1.7-6.0 and 2.0-5.9 GHz.

www.european-antennas.co.uk

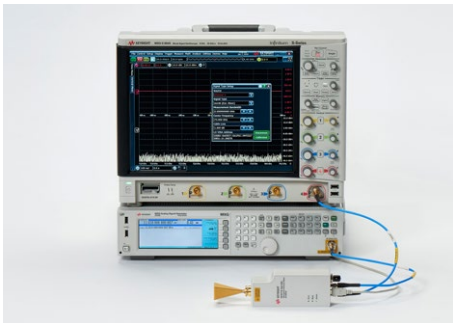
E-band signal analysis reference

for multichannel mmW test

Keysight Technologies, Inc., has announced an E-band signal analysis reference to provide low-cost millimeter wave analysis capability for applications in the 60-90 GHz range. The reference is based around the 10-bit ADC Infiniium S-Series oscilloscope to provide 2.5 GHz of high-fidelity, millimeter wave frequency analysis bandwidth.

The E-Band signal analysis reference provides a powerful test platform for analyzing emerging communication standards operating at millimeter wave frequencies. Two-channel capability allows for testing of multichannel devices; different antenna polarizations simultaneously; and channel sounding measurements.

The reference is made up of a combination of hardware instruments and software. The latest N8838A external mixer assistant software enables the S-Series oscilloscope to control the N5183B MXG X-Series microwave signal generator and the M1971E waveguide smart mixer. Also with the 89601B vector signal analysis software, engineers can make insightful measurements for complex signal analysis. This makes it simple to get accurate, calibrated measurements on E-band signals.



According to Dave Cipriani, vice president and general manager of Keysight's oscilloscope business, the refermec is low-cost, simple-to-use and maintains high performance making it ideal for customers addressing applications such as 5G, WiGig, automotive radar and millimeter wave backhaul.

www.keysight.com

60 GHz chipset for WiGig outdoor infrastructure

Canadian fabless chip maker Peraso recently announced production of its X610 wireless infrastructure chipset; now the company has added that it is able to support higher production volumes due to the introduction of a fast and comprehensive production testing regime at 60 GHz.

Peraso Technologies' (Toronto) 60 GHz WiGig ICs are, the company believes, the first WiGig solution in production for the infrastructure market, and is suited for end-use applications such as wireless broadband for internet service providers (WISP), small cell backhaul, video surveillance, private networks and new hybrid fibre-wireless.

The X610 chipset includes the PRS1126 direct conversion 60 GHz RFIC and the PRS4601 baseband IC to implement complete RF to baseband functionality compliant with the IEEE 802.11ad (WiGig) standard. The chipset provides multi-gigabit per second throughput and operates across the industrial -40°C to 85°C temperature range. It incorporates a high-speed USB 3.0 system interface to integrate with common low-cost network processor ICs.

The X610 chipset 60 GHz V-band spectrum to enable rapid, licence-free deployment in most major geographic markets. The 60 GHz band offers a large contiguous operating band to deliver multi gigabit per second throughput, and is particularly well suited to avoid the increasing interference problems suffered by traditional 2.4 GHz and 5 GHz WiFi bands.

www.perasotech.com

Flexible RF mixers

deliver low power, wide bandwidth

Integrated Device Technology has introduced its VersaMixer™ family of ultra-wide bandwidth RF mixers, comprising the high linearity F1192 and F1792 devices that designed for any radio system requiring high performance and low power operating between 400 MHz and 3800 MHz. The F1192 is a dual-channel RF mixer, while the F1792 is single-channel.

The devices offer configurable-gain operation for use in a wide array of radio card applications, including 2G-to-5G multimode remote radio units, backhaul systems, and public safety infrastructure. Coupled with ultra-wide bandwidth, this gives radio system designers the flexibility to optimize the receive system gain, noise, and linearity budget for virtually any application. Low power consumption — typically just 835 mW total for two channels — supports high-density PCB layout design in modern remote radio units and small cells.

Unlike competitive offerings, the VersaMixer devices function over the entire operating bandwidth without any changes in external components. This means that a single bill of materials can support various RF and IF operating bandwidths, easing integration into different systems, and keeping a check on costs and time to market.

Based on IDT's FlatNoise technology, the configurable gain feature keeps the noise figure relatively unaffected as the gain setting is reduced and the Input IP3 and Input P1dB are actually increased. Gain is controlled via 2 parallel pins with settling times of <100 ns, allowing for dynamic adjustment of gain to maximize performance "on-the-fly" if the radio designer desires.

www.IDT.com

Programme extends lifecycle of packet microwave radios

DragonWave Inc., has launched its Harmony Care services, which wll provide legacy support to the company's installed base of over 400,000 units, including the product line acquired in the 2012 acquisition of Nokia's Microwave unit.

Harmony Care allows our operator customers the ability to extend the lifecycle of their installed microwave base products, including FlexiPacket Radio, FlexiPacket MultiRadio, Hub800, FirstMile 200, FlexiTrunk, SRT1f, Horizon Compact, Horizon Compact+, Horizon Duo and Horizon Quantum. The Harmony Care service offering is an added option which includes hardware and software warranty, along with 24 hour help desk and level 2 support.

www.dragonwaveinc.com

RF transmitters

boost range and simplify design of license-exempt links

Radiometrix has launched three compact RF transmitters that allow designers to build longer-range low-power radio systems in space-constrained applications that cannot accommodate a conventional 12.5-kHz / 25-kHz narrowband FM transmitter.

The MTX1, MTX2, and MTX3 are 4-channel transmitters operating on 120-180 MHz, 420-470 MHz and 850-950 MHz respectively. State-of-the-art RF components keep module measurements to a compact 23- x 12.5- x 7-mm, while +10 dBm transmit power allows a typical usable range of up to 500 metres with a matching narrow band receiver.

The transmitter's conformance to EN 300 220-2 (radio) and EN 301 489-3 (EMC) guarantees exemplary performance and meets all regulatory requirements for license-exempt short-range devices. Built-in shielding enables slim-line equipment designs, while avoiding additional mechanical design complications, while careful and robust circuit design reduces susceptibility to mechanical vibrations, to ensure a clean and reliable signal under challenging operating conditions.

Each module contains the transmitter IC and baseband circuitry, with user-accessible digital and analogue inputs, which enables even analogue signals like AFSK, GMSK, DTMF tones to be transmitted. A 3V voltage regulator and brown-out reset controller are also built in. Programming is via a simple RS-232 serial interface. The wide input voltage range of 3.1V to 15V also helps simplify system design while energy conscious performance (drawing typically 20mA) maximises the lifetime of battery-powered applications.

www.radiometrix.com

Emulator supports 3GPP MIMO OTA testing

Anite's Propsim F32 Channel Emulator is now able to support advanced MIMO OTA mobile device testing using a Multi Probe Anechoic Chamber (MPAC) methodology, as recommended by 3GPP1.

The innovative test environment enables users to verify that mobile devices with the latest technology features, including multiple antenna configurations and carrier aggregation, perform as expected.

Anite has been an integral part of 3GPP since the start of the study on test methodologies for advanced MIMO OTA testing. All major test system integrators have benefited from using Anite's Propsim F32 Channel Emulator to provide results to the standards community. In September 2015, Anite also announced that it had helped to accelerate the initial release of the CTIA standardised MIMO OTA performance test plan.

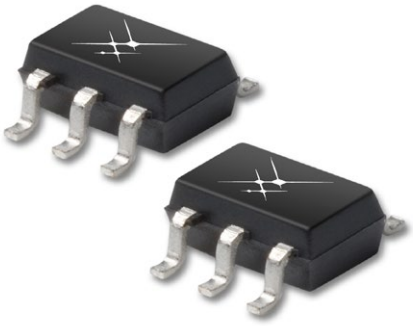
The Propsim F32 is a single unit channel emulator that supports eight dual polarized antennas for MIMO OTA testing in an anechoic chamber. The emulator can

be expanded to support 16 dual polarized antennas (required for testing larger devices), making it a future-proof solution for upcoming technologies and device formats.

www.anite.com

Front-end low-noise amplifiers

for set-top box applications



Skyworks has introduced two broadband, 75 Ohm MMIC front-end, low-noise amplifiers (LNAs) designed specifically for set-top box applications – the SKY65450-92LF (with bypass mode) and the SKY65452-92LF.

These devices provide high linearity and excellent gain over a wide frequency range (40 MHz to 1 GHz) with minimal external components, enabling OEMs to leverage cost efficiencies through lower bill of materials. In addition, these LNAs offer low current consumption and low noise figure of 2.9 dB typical, delivering energy-saving features, and are packaged in compact 6-pin SC-70 (SC-88, SOT-363) with 2.0 x 2.2 x 0.95 mm footprint.

www.skyworksinc.com

Digital attenuator and signal generator

Vaunix Technology Corporation will be debuting two test application products at the 2016 International Microwave Symposium (IMS) in San Francisco, the LDA-203 and the LMS-802DX.

The LDA-203 is a new digital attenuator with an operating frequency of 1 to 20 GHz. It features a 0 to 63 dB attenuation range and a step size resolution of 0.5 dB. Cost is $1,199.

The LMS-802DX is one of a new series of Lab Brick portable signal generators. Covering 2 to 8 GHz it boasts an internal and external pulse modulation width as low as 100ns and an output power of +10 to -70 dBm. The LMS-802DX also features harmonics less than -40 dBc to support high performance amplifier, mixer and other non-linear device characterization. Cost is $3,249.00.

Powered by USB and controlled by easy-to-use, graphical-user-interface (GUI) software, Lab Bricks are designed to meet the needs of wireless test engineers and technicians who work either in the lab or in the field.

www.vaunix.com

Fixed frequency synthesizer

features integrated reference

RoHS compliant, the fixed frequency phase locked loop model RFS5900A-LF from Z-Communications is a fully integrated synthesizer operating at 5900 MHz, which is phase locked to a 10 MHz reference with a stability of ±2.5ppm.

This low cost PLL features a typical phase noise of -80 dBc/Hz, -85 dBc/Hz, and -103 dBc/Hz at the 1 kHz, 10 kHz and 100 kHz offsets, respectively.

The RFS5900A-LF is designed to deliver an output power of 3±2 dBm while operating off a VCO voltage supply of 5Vdc and drawing 35mA and a phase locked loop voltage of 3Vdc while drawing 15mA. This product features a 2nd harmonic suppression of -25 dBc and spurious suppression of -65 dBc. It is housed in the company's standard PLL-V12N package measuring 0.6- x 0.6- x 0.13-inches. The RFS5900A-LF is also ideal for automated surface mount assembly and is available in tape and reel packaging.

www.zcomm.com

TWT amplifier

delivers up to 2 kW

The Model 176X/Ku TWT amplifier from Applied Systems Engineering provides up to 2 kW at duty cycles up to 6% from 1.0 to 18 GHz and pulse widths up to 100 µs.

The amplifier has been designed specifically to operate pulsed traveling wave tubes in the 1 to 2 kW peak power range at frequencies up to 18 GHz. Particular emphasis has been placed on the generation of the output RF pulse shape without the use of RF switches. Pulse width control is with an external pulse.

Internal power supplies are DC-DC converter designs with fast loop response times so that output level variations are minimal for any PRF including a non-periodic or burst type PRF. The modular power supplies and grid pulse generator have very low ripple, with attendant low phase noise in the TWT amplifier.

The modular design of the Model 176 provides convenient accessibility to all elements in the TWT amplifier. Plug-in PC boards are accessible through the front panel. The PC card cover contains a legend for PC card located test points and controls. High voltage modules are encapsulated, plug-in assemblies. There is no exposed high voltage. Most modules are interchangeable between all units regardless of frequency.

www.applsys.com

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