November/December 2013

MICROWAVE
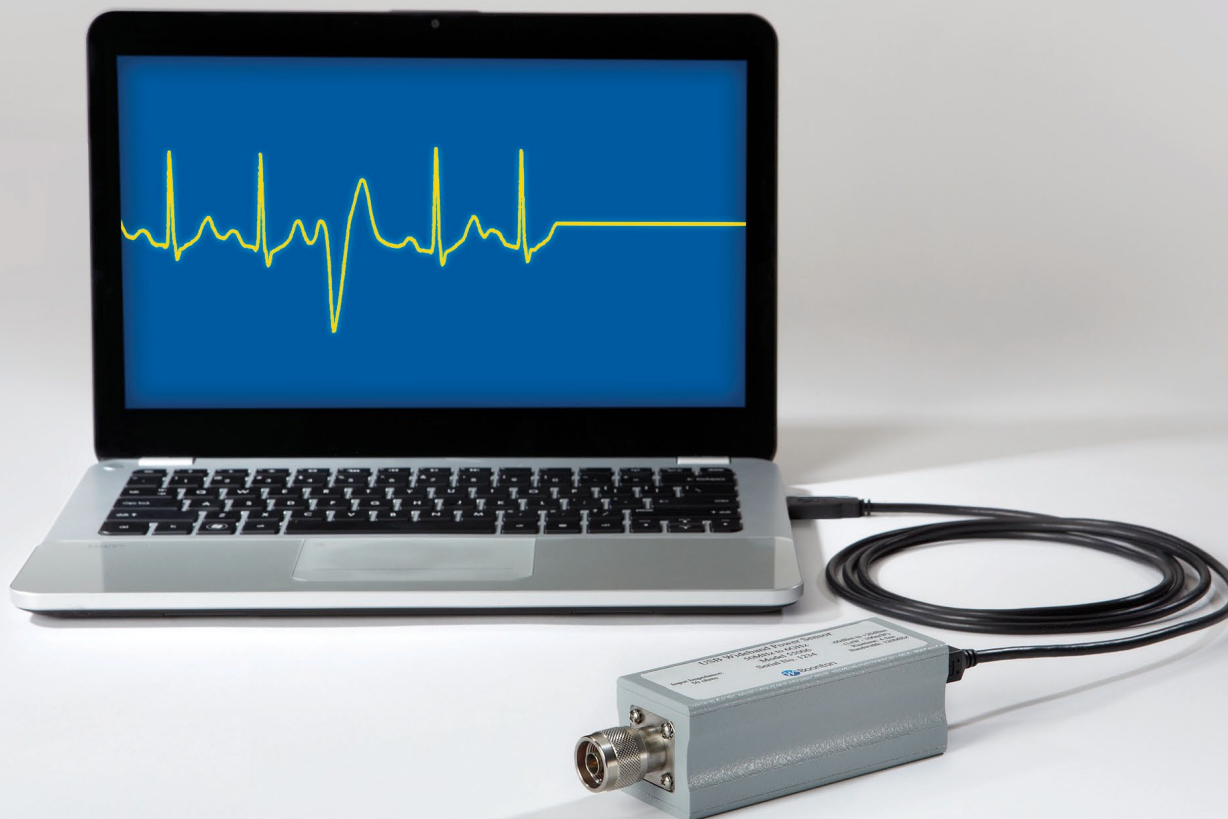## engineering europe

Modern VNA Test Solutions Improve On-Wafer Measurement Efficiency

MEMS, Nanotechnology

Microwave Materials

www.mwee.com

The European journal for the microwave and wireless design engineer

OTHER DISTRIBUTORS

A 18.7%
B 17.4%
C 15.8%
D 13.9%
E 13.6%
F 9.1%
G 5.0%
H 4.5%

2013
Most Preferred
DISTRIBUTOR

DIGI-KEY CORPORATION **51.3%**

FREE SHIPPING
ON ORDERS OVER €65!*
DIGIKEY.COM

Source: 2013 Distributor Customer Evaluation Study,
North America, May 2013, UBM Electronics

FIND CONTACT AND ORDERING
INFORMATION FOR YOUR REGION AT
DIGIKEY.COM/EUROPE

Digi-Key® CORPORATION

3 MILLION PARTS ONLINE | 650+ INDUSTRY-LEADING SUPPLIERS | 100% AUTHORIZED DISTRIBUTOR

ecia   ecsn member   CEDA

Contents

MICROWAVE
engineering europe

4G is now, but 5G already starts to take shape

Mobile network technology is evolving at a rapid clip. 4G technology in the form of LTE is currently rolling out and has a lot of innovation still waiting in the wings. It would seem that 4G still has many years left to drive the mobile market forward.

However, some are already planning 5G. To this end, last year METIS (Mobile and wireless communications Enablers for the Twenty-twenty (2020) Information Society) was launched.

Co-funded by the European Commission, METIS is a consortium of 28 key wireless industry players and the first international and large-scale research activity on 5G. Its main objective is to lay the foundation for 5G, the next generation mobile and wireless communications system. 5G will address the huge surge predicted in mobile data consumption and the wide range of wireless devices. In a wireless communications world described as the 'Internet of Things', data will become available anywhere, anytime to anyone and anything.

5G has got a lot of global interest and one might question why 4G might not suffice? Part of the answer lies in the rapid growth in smartphone use. METIS claim that smartphone subscriptions will grow from 1.2 billion in 2012 to 4.5 billion by 2018. The second reason, 4G might not cope in five years from now is that the data usage per smartphone continues to grow rapidly. Future users will also rely more on their smartphones, not only for the emerging infotainment use case, but also for a wide range of use cases such as monitor-

ing and control of smart homes, security and health care, amongst others.

In 2013 the EU announced research grants worth up to €50 million to develop '5G' technology.

As test companies are usually at the forefront of any emerging technology, 5G as defined by the METIS project has one such company currently involved, Anite, which has just announced that it has been appointed to lead the radio channel modelling Task Group within the METIS project.

Anite has participated in defining five 5G scenarios that reflect the future challenges of wireless communications standards. The five scenarios, recently made public, shape the definition of propagation conditions and form the basis of channel modelling development. METIS has derived a challenging set of requirements from these scenarios, including one thousand times more mobile data per area compared to today's average traffic. The radio channel modelling Task Group is expected to publish its first results in April of 2014.

The success of 5G radio technology development requires the efficient utilisation of the radio channel. Since the early 1990s, Anite's experienced radio channel team has pioneered research and development of radio channel models, now incorporated into its market-leading Propsim radio channel emulator product range.

Currently METIS defines 5G through a challenging set of requirements, which can be summarized as:
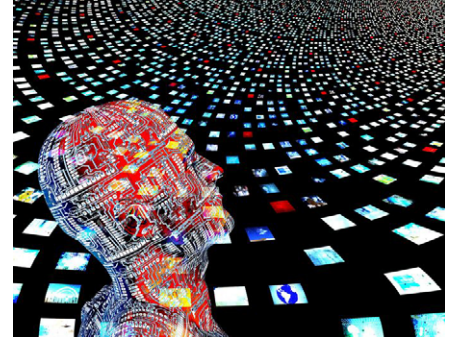
- Ten to one hundred times higher typical user data rate where in a dense urban environment the typical user data rate will range from one to ten Gbps,
- One thousand times more mobile data per area (per user) where the volume per area (per user) will be over 100 Gbps/km^2,
- Ten to one hundred times more connected devices,
- Ten times longer battery life for low-power massive machine communications where machines such as sensors or pagers will have a battery life of a decade,
- Support of ultra-fast application response times where the end-to-end latency will be less than 5 ms with high reliability, and
- to do all this under a similar cost and energy dissipation per area as in today's cellular systems.

By Jean-Pierre Joosting
Editor: Microwave Engineering Europe

Design and production service for obsolescent RF and microwave parts

Link Microtek has introduced a design and production service aimed at providing replacements for RF or microwave components that have become obsolete but are still critical to present operations.

The company is able to recreate parts with the same form, fit and function as an existing product, working either from specifications, drawings and photographs or directly from, for example, a damaged part if the original design information has been lost. In these instances, accurate measurements of the external and internal

features of a product are entered into the CST Microwave Studio modelling program, which enables Link to derive specifications such as operating frequency and return loss, as well as working out the best way to fabricate the part.

For example, some RF and microwave components now in the field were originally produced by casting, but recreating them in this way would be uneconomical for only one or two units, so the general approach is to machine them from solid aluminium, followed by dip-brazing.

Once the parts have been made, they are then fully tested at up to 40 GHz in Link's own test and environmental laboratories, if necessary using specially designed and manufactured test fixtures. For high-power products, an in-house facility allows testing at up to 200W CW over the frequency range 7-16 GHz. Each product is supplied with full mechanical drawings, electrical layouts, test specifications and test results.

www..linkmicrotekeng.com

Weightless details roadmap for IoT devices and basestations

The Weightless SIG has announced the roadmap for the roll-out of Weightless compatible hardware from SIG founder and Promoter Group Member Neul.

Tape out of its Iceni silicon returning from the foundry is scheduled for next month, November 2013, with volume production to follow in Q2 2014.

Initial Weightless modules measuring 35 mm x 45 mm and costing around $12 will ship in 2014 with a roadmap incorporating $7 modules in 2015 and 24 mm x 20 mm modules costing $4 or less in 2016. Weightless development kits are scheduled for launch to early access customers in Q2 2014.

The company's base station, NeulNET 2510 will sample in the first quarter of 2014 with pre-commercial availability in Q2 2014. BTS hardware lease costs will be "tens of dollars" per month. The company will deploy Weightless networks in at least the UK and USA in the second quarter of next year with further networks elsewhere to follow.

The 630 page Weightless Specification is available now for immediate download to SIG Members at weightless.org/roadmap.

www.weightless.org

LED lightbulbs access Internet with energy saving LiFi

Chinese scientists have claimed that Wi-fi connectivity from a LED lightbulb (LiFi) is now a step closer. Li-fi promises to be a cheaper and more energy-efficient technology than existing wireless radio systems. The general availability of LED bulbs and the omnipresence of lighting infrastructure offers major energy efficiency benefits. Although millions of WiFi base stations have been installed worldwide to boost signals most of the energy is consumed by their cooling systems. The energy utilization rate of WiFi is as low as five percent. Compared with base stations, the number of lightbulbs that can be used is practically limitless and more energy efficient.

The Chinese scientists claim that a LED lightbulb with embedded microchips can produce data rates as fast as 150 megabits per second, which is speedier than the average broadband connection in China.

Chi Nan, an information technology professor with Shanghai's Fudan University said that experiments have shown that four computers under a one-watt LED lightbulb may be able to connect to the Internet under the principle that light can be used as a carrier instead of traditional radio frequencies, as in WiFi.

Chi Nan, who leads a LiFi research team including scientists from the Shanghai Institute of Technical Physics of the Chinese Academy of Sciences, plans to display ten sample LiFi kits at the China International Industry Fair that opens on November 5, 2013 in Shanghai.

The University of Edinburgh's Prof Harald Haas in the UK originally coined the term LiFi which is a type of visible light communication (VLC) technology that delivers a networked, mobile, high-speed communication solution in a similar way to WiFi. In 2011 Prof Haas demonstrated how an LED bulb equipped with signal processing technology could stream a high-definition video to a computer.

Earlier this year, the Fraunhofer Heinrich Hertz Institute expounded that data rates of up to 1Gbit/s per LED light frequency were possible in the laboratory.

Small cell backhaul equipment market to reach $5B in 2018

ABI Research expects the market for small cell backhaul equipment to grow to over $5 billion in 2018, up from a forecast $487 million for 2013 representing a 48% compound annual growth rate (CAGR).

Sub 6 GHz technology will capture over 47% of small cell backhaul equipment revenue, or $2.4 billion with 31% of last mile links in 2018, while millimeter wave technology becomes the fastest growing technology over the forecast period, growing at 113% CAGR to reach a value of $668 million. Traditional microwave equipment remains a top technology for small cell backhaul applications with 34% share of revenue or almost $1.8 billion and 25% share of links in 2018.

"Thanks to its NLOS properties, sub 6 GHz backhaul becomes the most popular backhaul technology for small cells by 2018," says Nick Marshall, principal analyst at ABI Research. ABI Research believes that the millimeter wave bands from 60 GHz to 80 GHz will also prove compelling for small cell backhaul in many situations.

www.abiresearch.com

Google grabs gesture startup

Google has acquired Bot Square, developer of the Flutter gesture recognition application that works using a computer's webcam. The price paid for the 2010 startup was not disclosed but it was reportedly close to $40 million.

The Flutter app uses the webcam present on PC and Mac notebook computers to recognize hand gestures that can be used to control certain functions within such applications as iTunes, Spotify, Netflix, Youtube. The gestures can be used to play, pause or skip videos and songs and are said to work best at between one and six feet from the camera.

It is not clear whether Flutter intends to keep on developing features for its stand-alone application or wants to integrate Flutter gesture recognition as a standard part of the Chrome platform.

www.flutterapp.com

IBM develops two-factor security for mobile transactions

IBM scientists have developed a mobile authentication security technology based on the near-field communication (NFC) radio standard. The technology provides an extra layer of security when using an NFC-enabled device and a contactless smartcard to conduct mobile transactions, including online banking and digital signatures when accessing a corporate Intranet or private cloud.

According to a recent report by ABI Research, the number of NFC devices in use will exceed 500 million in 2014. This statistic and the fact that 1 billion mobile phone users will use their devices for banking purposes by 2017 make for an increasingly opportune target for hackers.

To address these challenges, IBM scientists in Zurich, also known for inventing an operating system used to power and secure hundreds of millions of smartcards, have developed an additional layer, a so-called two-factor authentication, for securing mobile transactions.

Today many consumers use two-factor authentication from a computer, for example, when they are asked for both a password and a verification code sent by short message service (SMS). IBM scientists are applying the same concept using a personal identification number (PIN) and a contactless smartcard. The contactless smartcard could be a bank-issued ATM card or an employer-issued identity badge.

The IBM technology is based on end-to-end encryption between the smart-card and the server using the National Institute of Standards & Technology (NIST) AES (Advanced Encryption Standard) scheme. Current technologies on the market require users to carry an additional device, such as a random password generator, which is less convenient and in some instances less secure.

The technology, which is available today for any NFC-enabled Android 4.0 device, is based on IBM Worklight, a mobile application platform that is part of the IBM MobileFirst portfolio. Future updates will include additional NFC-enabled devices based on market trends.

www.ibm.com/mobilefirst

Wireless smart meter deployments to double in market revenue

An increase in smart meter deployments will see the global market for wireless communication modules approximately double in value over the coming years, jumping from $532m in 2012 to $1.3 billion in 2020, at a compound annual growth rate (CAGR) of 12%, according to a report from research and consulting firm GlobalData.

The company's latest report states that North America, currently the dominant player in the global wireless communication modules market for smart meters, will be a key driver behind the leap, with its own market revenue expected to climb steadily from $379m in 2012 to $433.7m in 2020.

Europe will also continue to account for a considerable share of the global market, thanks to a significant number of pilot-scale projects getting underway across the region. For example, the uptake of wireless communication modules in the UK, Denmark and Ireland in particular looks promising, according to GlobalData.

www.globaldata.com

AVM selects Lantiq for VDSL, Wi-Fi 802.11ac gateway

Lantiq has announced that the Berlin-based communications specialist AVM has selected a Lantiq high integration systems-on-chip (SoC) to power its latest generation flagship VDSL2/2+ gateway FRITZ!Box 7490.

The Lantiq VDSL SoC enables highest data rates up to 150 Mbps and reliable broadband access performance, featuring VDSL2/2+ / ADSL2/2+ capability and integrated support of ITU-T standard Vectoring. The FRITZ!Box 7490 also achieves outstanding gigabit routing performance with minimum CPU load, due to the unique Lantiq smart acceleration engine.

Lantiq ITU-T standard compliant VDSL Vectoring enables carriers to deliver up to 150 Mbits access speeds, while Physical Layer Retransmission achieves

the highest possible Quality of Service (QoS) for media content. The Lantiq VRX VDSL SoC offloads data handling of the 802.11ac Wi-Fi subsystem and features and hardware acceleration for Gbit speed home networking with minimum load on the main CPU.

www.lantiq.com

Bluetooth SIG and A4WP to shape wireless charging standard

The Bluetooth SIG and Alliance for Wireless Power (A4WP) have agreed to cooperate in working towards a new consumer electronics device category: the smart wireless charging station, that will provide A4WP users with speedy and robust Bluetooth Smart-based power management.

As a first step, the Bluetooth SIG has issued a Universally Unique Identifier (UUID) to the A4WP for adoption in its baseline system specification (BSS). The A4WP BSS utilises the Bluetooth Smart radio standard to carry the session management and power control between an A4WP charging station and an A4WP-certified device, e.g. smartphone.

www.a4wp.org
www.bluetooth.com

Toyota develops its own automated driving technology
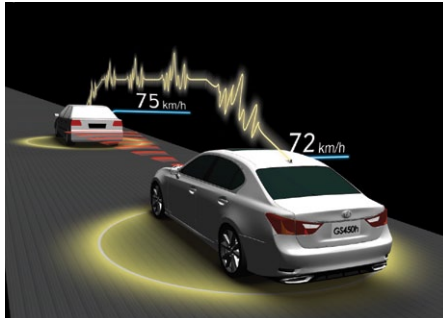
On the way to automated driving, Toyota takes a shortcut: it combines two existing technologies developed to reduce stress from the driver: a cooperative-adaptive cruise control and a lane assist with active steering.

In contrast to existing Adaptive Cruise Control (ACC) systems, Toyota's cooperative-adaptive system communicates with the vehicle in front to keep a safe distance. Towards this end, it estab-lishes a data communications channel in the 700 MHz band and exchanges acceleration and deceleration data with the vehicles in front and behind itself. This information edge translates into faster and smoother control action of the cruise control. Since not every vehicle is equipped with a transponder for this purpose, the Toyota system still relies on its own radar sensors.

The lane control unit uses camera images along with radar measurement and a sensor fusion algorithm to identify the correct lane and to keep the vehicle in the centre of the lane at any speed, as Toyota claims. Correcting variables are steer angle, thrust and braking power.

Toyota's Automated Highway Driving Assist (AHDA) was introduced at the Intelligent Transport Systems (ITS) World Congress. The company also is continuing to conduct research on autonomous driving in all situations, including in cities.

Report warns excessive security will kill the Internet of Things

Excessive security will kill the emerging Internet of Things warns the author of a new report.

"There's a certain amount of panic around the Internet of Things, that you need maximum security or not do it at all," said Prof. Jon Howes, Technology Director at Cambridge-based Beecham Research and author of a new report on machine to machine (M2M) security. "The problem with M2M is the business model is always tight so as we put tighter and tighter security in place it will kill the business model and make it uneconomic."

The key is the end-to-end architecture, he says. This is even more important with the recent launch of low cost microcontrollers such as Silicon Labs' 49¢ Zero Gecko that include an AES encryption engine to support security applications.

In recent surveys, Beecham Research has identified end-to-end solu-tion security as the leading concern for solution providers and for adopters of new M2M solutions. "Having analyzed the reality of security for M2M solutions, we have discovered emerging new principles and ways to make security both sufficient and economically viable. There is a profusion of new elements of security and new business models that will enable new markets," said Howes. "Engaged with correctly, this can at long last change security into a value producing capability instead of a resented cost."

This is not about just big players or vertical integration, he says. "It's not necessarily big companies but people that know how to implement the end to end solution in the right environment," he said. "Smart meters in the UK need a different architecture from smart meters in Germany, for example.

www.beechamresearch.com

First mass deployment of VDSL system level vectoring

Lantiq and KEYMILE have announced volume shipments of system level vectoring equipped VDSL linecards to a major telecommunications carrier.

A majority of these VDSL linecards is already deployed in the field, and vectoring based broadband services are expected to be offered to consumers by the end of 2013. The joint Lantiq/KEYMILE 192 channel vectoring offering is the world's first field deployed system level vectoring implemented in a mature, cost and power efficient System-on-Chip (SoC) - ASSP approach.

System level VDSL vectoring is critically important for service providers to efficiently extend the broadband performance of the copper network in a very cost effective manner.

Dan Artusi, CEO of Lantiq: "Lantiq has a large footprint in VDSL for central office and CPE and is rapidly gaining market share. VDSL, including vectoring and bonded lines, is worldwide becoming the key technology for superfast internet."

www.lantiq.com/vectoring

LTE to be deployed worldwide by 2018

LTE is out of the experimental stage and is being deployed worldwide. Operators in all markets are in the process of implementing LTE, but the emergence of the APAC and LATAM regions is set to challenge European and North American operators' early lead. These trends are analysed in Analysys Mason's forthcoming report on the outlook for LTE.

The first LTE deployments occurred in Finland and Sweden, and the world's largest LTE network is in the USA, but emerging APAC and LATAM have the highest number of planned LTE networks, according to Analysys Mason's Wireless networks tracker.

Strong support for LTE in APAC and LATAM will start to offset the early influence that European and North American operators have had on the device and network vendors. We expect a more-balanced global LTE market to emerge by 2018, in which markets such as Brazil, India and Russia will each account for 5% of LTE connections worldwide.

www.analysysmason.com

Redefining RF and Microwave Instrumentation

with open software and modular hardware
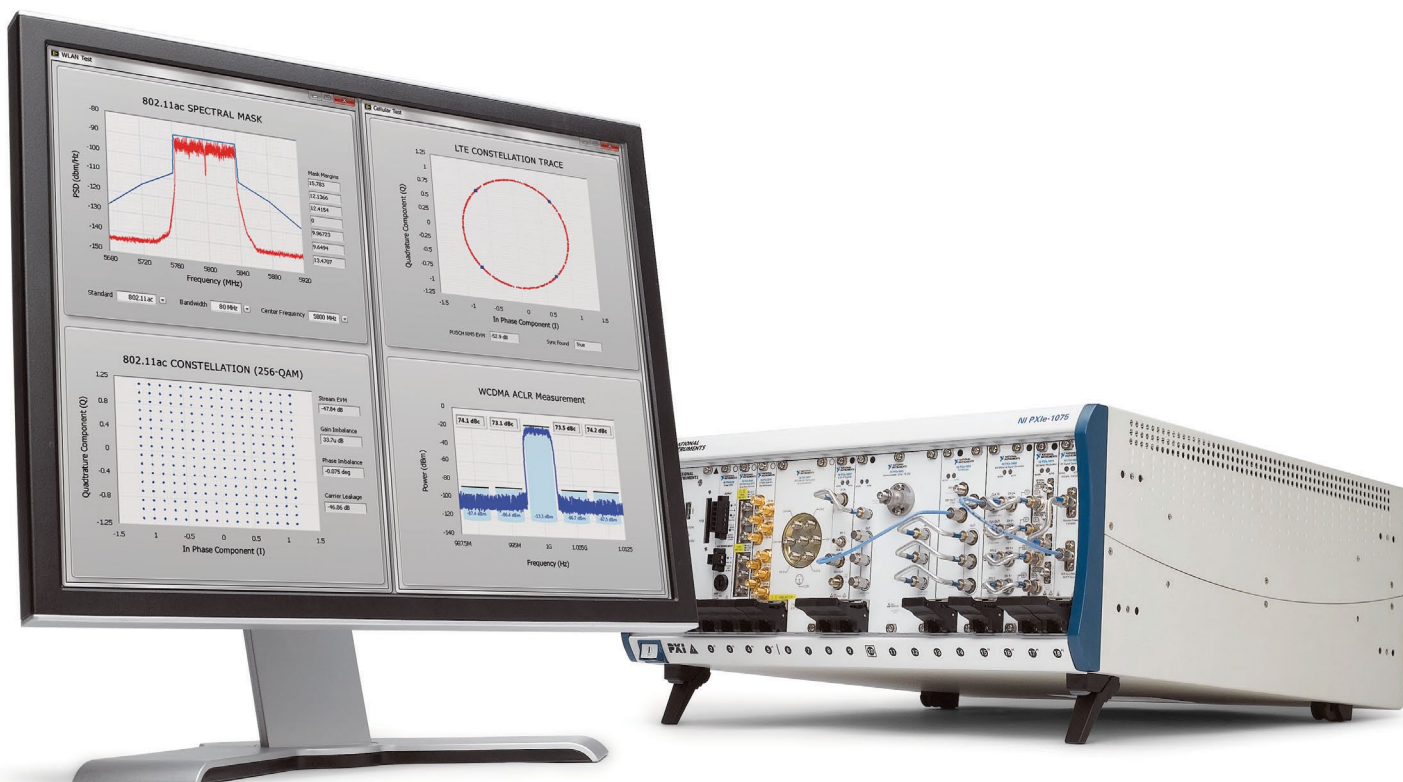
Achieve speed, accuracy and flexibility in your RF and microwave test applications by combining National Instruments open software and modular hardware. Unlike rigid traditional instruments that quickly become obsolete by advancing technology, the system design software of NI LabVIEW, coupled with NI PXI hardware, puts the latest advances in PC buses, processors and FPGAs at your fingertips.

(((WIRELESS TECHNOLOGIES)))

National Instruments supports a broad range of wireless standards, including:

LTE	GSM/EDGE
802.11a/b/g/n/ac	CDMA2000/EV-DO
WCDMA/HSPA/HSPA+	Bluetooth

>> Learn more at ni.com/redefine

Follow us on [f] [t] *Search* **National Instruments** *or* **LabVIEW**

NATIONAL INSTRUMENTS

MEMS timing device cracks cellphone market

By R. Colin Johnson, EE Times

Micro-electromechanical system (MEMS) chipmaker Sand 9 Inc., of Cambridge, Massachusetts, claims to have finally cracked the multibillion unit mobile phone and Internet of Things market with a piezo-electric design that provides the performance lacking in traditional MEMS timing chips. More than five years in the making, Sand 9 has finally announced its first piezo-electric timing chips, for which it already has mobile phone customers lined up.

"We started from the mobile market and its requirements, and worked our way backwards to find out that our MEMS chips needed to be piezoelectric," said senior director of marketing Todd Borkowski.

The key to its success in cracking the mobile phone market, Sand 9 claims, is its piezo-electric materials that give its MEMS timing chips better electro-mechanical coupling than conventional electro-static capacitive designs, resulting in ultra-stable higher-frequency operation in a tiny size and with low-power requirements.

"The piezoelectric MEMS technology we invented has 100 times better electromechanical coupling than electro-static," said Borkowski. "Basically it gets us the performance we need in a small size and at power-consumption levels on par with quartz."

From its founding in 2007 as a Boston University spinoff by co-founders Pritiraj Mohanty (inventor of its MEMS technology) and Matt Crowley (vice president of business development) Sand 9's aim has been to produce timing chips that offered a better price/performance ratio than quartz in the core markets for cellular phones and the high-speed communications chips inside Internet of Things devices.

"These are the very first MEMS timing devices in the world capable of accurately clocking what people refer to as the Internet of Things devices as well as high-speed transceivers and conductivity ICs," said Borkowski.

Sand 9 has filed more than 80 patents — with 35 granted so far — covering not only its MEMS technology itself, but also the circuits, sy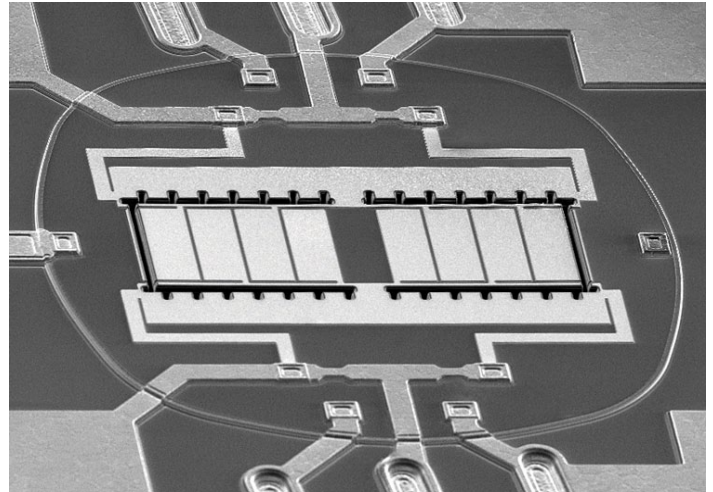stems, and process innovations that make its piezo-electric timing chips unique. In particular, Sand 9's piezo-electric resonator uses an interdigitated design that creates a standing wave at the desired frequency. The resonator itself is constructed from a silicon film with two layers of silicon dioxide, one above and one below, topped by the aluminum nitride piezo-electric material. Since higher temperatures affect silicon and silicon dioxide in an opposite manner — softening silicon but stiffening silicon dioxide — the MEMS resonator achieves 200 parts-per-million frequency stability with no external compensation.

Sand 9's interdigitated piezo-electric resonator (center) is the first MEMS timing solution for cellular phones, due to its electro-mechanical coupling that is 100 times better than traditional MEMS. (Source: Sand 9)

Sand 9 is targeting the wireless applications market being served by high-end quartz temperature compensated crystals (TCXO), especially those used by a mobile phone's cellular transceivers, power management ICs, GPS, WiFi, FM, Bluetooth, and accessories using the low-power version called Bluetooth Smart.

Its first two timing chips will be the TM061 MEMS resonator (MR) and TM361 temperature-sensing MEMS resonator (TSMR). Both devices use a sub-millimeter package size (0.76- x 0.84- x 0.5-mm) which Sand 9 claims is 50 percent smaller than the smallest quartz crystal in the industry and 10-times more resistant to shock.

The 48-MHz TM061, which targets Bluetooth Smart applications, is a resonator with a dummy cap instead of an ASIC, making it the ultra-low-cost solution. The 76.8-MHz TM361 also uses a dummy cap, but includes within the material stack a temperature sensor (thermistor) and heater for sophisticated compensation and calibration of the resonator. Integrating the thermistor into the MEMS resonator gives it 10 times better thermal coupling than quartz, which must use an external thermistor. The heater allows the TM361 to be quickly calibrated by the original equipment manufacturer (OEM). For the future, Sand 9 plans a follow-on device which integrates the phase-locked-loop (PLL) needed for a complete piezo-electric MEMS oscillator.

"Our future road map includes a temperature-sensing MEMS oscillator (TSMO), which integrates the oscillator circuitry into the silicon cap," said Borkowski.

Sand 9's chips will be manufactured in two foundries — GlobalFoundries for the MEMS portion and IBM for the application-specific integrated circuit (ASIC) — after which the two chips will use wafer-scale bonding, so that the ASIC carrying the electronics serves double duty by also capping the MEMS chip to prevent environmental contamination.

The big surprise is that, unlike quartz, Sand 9's MEMS resonators and oscillators can be over-molded into the same package as the device for which they are providing timing signals. In fact, Sand 9's business model is to sell only die in wafer-level chip-scale packages that can be flipped and over-molded into the customer's package, thus reclaiming the board-space dedicated to multiple bulky quartz crystals today.

Lake Shore enhances software capabilities of prototype turnkey THz characterization system

In response to positive feedback heard at the recent IRMMW-THz conference, Lake Shore Cryotronics has announced that it is moving forward with implementing software features that will further enhance the usability of its prototype terahertz (THz) materials characterization platform.

The features, demonstrated during the International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz) in Mainz, Germany, incorporate THz acquisition and software control of the cryogenic and magnetic platform.

"Going into this project, one of our objectives was to develop software that was easy to use. We knew this would be key to how well the system is adopted by the materials development community – particularly everyday researchers who do not consider themselves terahertz experts," said Scott Yano, Lake Shore Product Marketing Manager. "With this latest enhancement, we're one step closer to accomplishing that goal and being able to offer a truly turnkey solution."

"The software enables users to see raw scans as they are being acquired by the system. This way, they're provided real-time visualization of the scans as well as averaged data," Yano explained. The software processes raw scans into the normalized THz transmission spectra, from which electronic material properties can be derived.

Lake Shore is currently testing the functionality enabling researchers to automate measurements at variable cryogenic temperatures and magnetic fields. The system will be capable of stepping through temperature points automatically without user intervention.

At the IRMMW-THz conference, Lake Shore saw interest from scientists specifically interested in using the THz system for research into novel semiconductors, organic materials, and other electronic and magnetic materials with resonances in the THz regime. The prototype Lake Shore system provides for high-frequency measurements to above 1 THz, to temperatures as low as 5 K, and magnetic fields to 9 T.

By having a fully integrated hardware/software platform for THz materials characterization, researchers will no longer have to manually assemble a system in their lab and then build their own software to manage its operation. The

Lake Shore system bundles the management software with continuous-wave THz spectroscopy and photomixers specifically developed for cryogenic operation.

Lake Shore intends to formally introduce the system for sale in early 2014. Several key research facilities in the U.S. are already using alpha units of the system to gain valuable insight into molecular solids, thin films and other semiconductor devices.

www.lakeshore.com

Halogen-free, ultra-low loss materials for high-speed digital, RF and microwave applications

Isola Group, a leader in copper-clad laminates and dielectric prepreg materials used to fabricate advanced multilayer printed circuit boards has announced TerraGreen, the company's latest halogen-free, ultra-low loss, RF/microwave/high-speed material. TerraGreen is engineered for such high-performance applications as power amplifier boards for 4G LTE base stations, internet infrastructure and cloud computing.

TerraGreen has a full offering of cores and prepreg utilizing spread-glass fabric. The dielectric constant (ranging from 3.00 to 3.45) and dissipation factor (ranging from 0.0030 to 0.0035) remain stable over a wide range of frequencies and temperatures. Core thicknesses

from 0.002" to 0.018", 0.020", 0.030" and 0.060" are available.

TerraGreen is a lead-free assembly material and is easy to process. This high-performance material utilizes a short-lamination cycle; the product is

easy to drill, does not require plasma desmear, and the prepreg shelf life is similar to FR-4 materials. TerraGreen is suitable for high-layer count, high-speed digital, backplanes and is compatible with Isola's FR-4 materials for hybrid designs

Tarun Amla, Executive Vice-president and Chief Technology Officer at Isola, stated, "Electronics manufacturers have long-expressed the need for halogen-free, ultra-low loss, lead-free assembly material for high-speed digital and RF/microwave markets. Isola's investments in R&D have successfully resolved this issue with our proprietary TerraGreen resin system."

www.isola-group.com

Modern VNA Test Solutions Improve On-Wafer Measurement Efficiency

By Bob Buxton, Anritsu Company

Semiconductor manufacturing test engineers face increased challenges related to broadband millimeter wave (mm-wave) on-wafer testing. Developing accurate models often requires measuring frequencies that range from near DC up to 100+ GHz. Achieving accurate, stable measurements over extended time periods is a challenge for foundries and fab-less semiconductor companies that require extensive testing of on-wafer devices.

These measurements are typically performed using a vector network analyzer (VNA). In order to ensure accurate measurements, VNA re-calibration has often been required as frequently as every hour. Recent advances in VNAs, however, enable longer time periods between calibration to improve throughput, as well as broader frequency coverage to develop accurate models for high-speed designs.

Semiconductor manufacturers characterize and test transistors, such as those used for power amplifiers, as well as more complicated integrated systems. Figure 1 shows their typical stages of development: device characterization, evaluation, and production test stage.

Characterization

During the initial device characterization stage, a primary data collection set is required for "first wafers" to help determine the specifications for the future product. Characterization engineers measure full s-parameter data on multiple devices across a broad frequency range for a variety of bias conditions, power levels and, in some cases, temperatures. These measurements are often more manual in nature and require the probes to be physically moved around the wafer.

It is important that any variation from device to device across the wafer be accurately determined and not caused by test equipment drift. Hence, there is a need to ensure that the VNA system is correctly calibrated at intervals frequent enough to ensure consistent measurements.

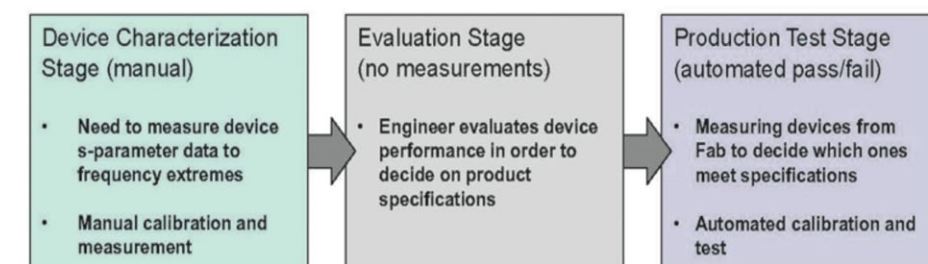The manual nature of measurement during this phase impacts the calibra-

Figure 1: Typical stages of development: device characterization, evaluation, and production test stage.

tion, as well as the need to spend time on probe contact issues, such as oxidation. In some cases, the calibration standards are included on the wafer to make it easier; however the necessary space on the wafer often means a separate calibration substrate is required. This adds even more time. In this situation, it is possible to have to perform a 20-minute calibration every hour, meaning calibration consumes one third of the test engineer's time during the device characterization stage!

Evaluation

The evaluation stage uses all of the device characterization data to assess the performance of the devices and determine the product specifications. While measurement and calibration times are not major factors during this stage, confidence in the device characterization data plays a critical role. Accurate measurements allow for smaller measurement uncertainties, so tradeoffs between tighter specifications and manufacturing yields can be made with confidence.

Production

High-volume automated test equipment is used in the production test stage and reduced data sets are collected to verify the devices are meeting their set specifications. It is not uncommon for devices to be tested in a matter of seconds. Calibration is part of the automated process, as well. During automated production testing, calibration time is reduced, but may still be required every hour. With devices being measured every few seconds, time lost to calibration can be even more critical!

VNA advances

For years, broadband VNA systems used large test heads, built from a combination of waveguide and coaxial components. While offering a practical way to reach frequencies up to 110 GHz, they had a tendency to be less stable and have reduced performance. Today, modern solutions are available using integrated MMIC technologies that result in more stable measurements and better performance. The compact nature of the test heads allow them to be more easily mounted on to the probe station and, in some cases, directly to the probe itself (Figure 2).

In addition to the improved test heads, new designs within today's broadband VNAs make them more accurate and provide more stable results, as shown in Figure 3.

Among the new capabilities are:
- Single sweep broadband frequencies ranging from 70 kHz to 110 GHz;
- Dynamic range of 109 dB at 110 GHz;
- Positive raw directivity resulting in enhanced measurement stability and reduced calibration frequency;
- Real-time power level control for more accurate linear gain and 1 dB compression measurements;
- Compact, lightweight mm-wave modules for easy, precise, and economical positioning on the wafer probe station.

The better measurement stability and accuracy delivered by this new generation of broadband VNAs allow semiconductor test engineers to perform less frequent calibrations and improve device measurement efficiency. Rather than
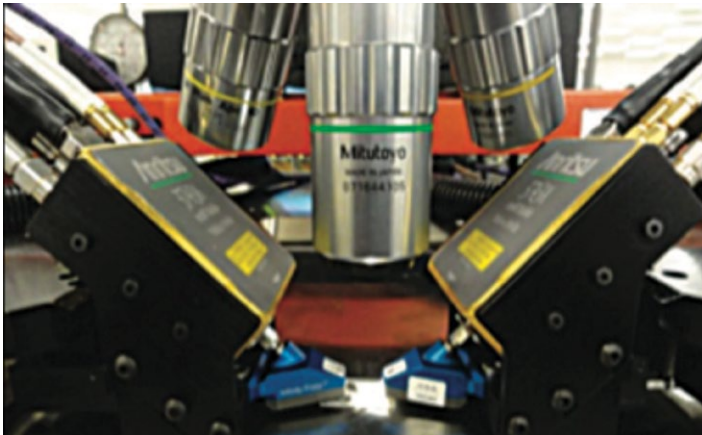
Figure 2: Compact test heads can be more easily mounted on to the probe station and, in some cases, directly to the probe itself.
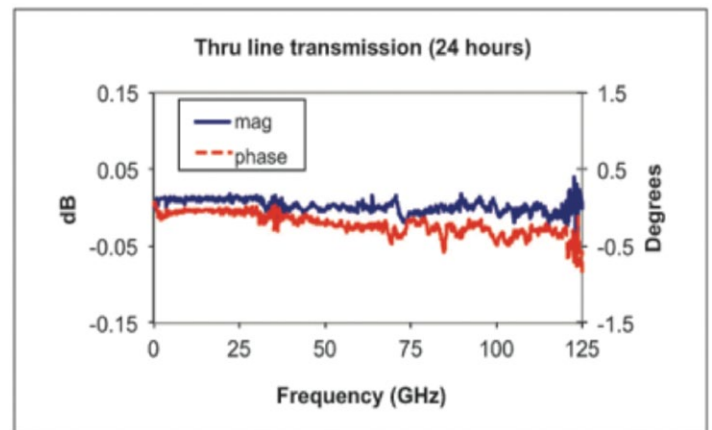

Figure 3: Improved test heads and new designs within today's broadband VNAs make them more accurate and provide stable results.

	1 Calibration per Hour (x8)	1 Calibration 8 Hour Session
Cal Time (min)	5	5
Overall Cal Time (min)	40	5
Measurement Time (min)	440	475
Measurement Efficiency	91.7%	99.0%
Efficiency Improvement		8.0%
Added # of parts tested per day (assuming 3 sec/part)		700

Table 1: Using a modern mm-wave VNA, calibrating once each day represents an increase of 8% product test time.

the 20-minute calibration required each hour, advanced broadband mm-wave VNAs now need only be calibrated once a session or even once a day. During the characterization phase of the device, this represents an increase in measurement test time of over 37% in a single four-hour session.

For the production test stage, devices are often being measured around the clock. Automated test stations and wafer handling equipment optimize the time required for evaluating each device. While many aspects are accelerated, the lesser stability of older generation mm-wave test heads can still require hourly calibrations. While this time was kept to a minimum, calibration still represents a valuable segment of the day that products are not being tested. Using a modern mm-wave VNA, calibrating once each day represents an increase of 8% product test time.

Table 1 highlights this improvement and includes an example that shows how a test station with a 3-second DUT test time could evaluate an extra 700 devices per day! For a device with a longer test time, perhaps 10 seconds/device, the number of additional parts due to the reduced calibration frequency would be 210, however in that situation they would probably be more complex and, hence, more expensive devices.

Conclusion
Modern VNA test solutions enable semiconductor test engineers to achieve accurate, stable measurements over extended time periods. The improvement in measurement efficiency allows these solutions to better characterize devices in the development phase, more confidently set product specifications, and test more products during production.

Bluetooth Smart and Wi-Fi to dominate mobile body network device market

Proprietary wireless protocols are quickly losing their dominance in the healthcare market to more standards-based wireless technologies such as Wi-Fi, Bluetooth, and IEEE 802.15.4. Over the next 5 years, Bluetooth Smart (formerly Bluetooth Low Energy) will lead in shipments and Wi-Fi will lead in revenues in the healthcare device IC market expected to exceed $100 million by 2018.

"Smartphones and tablets are the primary reason for Bluetooth Smart adoption in MBAN devices. Given their growing penetration among consumers and Bluetooth Smart Ready enablement, they are the conduit for MBAN wireless sensor data back to cloud-based healthcare services," says senior analyst, Adarsh Krishnan.

The recent IEEE 802.15.6 and IEEE 802.15.4 enabled devices that can operate in the dedicated wireless spectrum (2360-2400 MHz) allocated for MBAN use are expected to witness less trac-tion with adoption initially limited to professional on-site healthcare facilities.

ZigBee and other 802.15.4 based protocols are expected to outperform 802.15.6 standard growing at CAGR of 72% over the next 5 years. Inhibiting adoption of the newer 802.15.6 protocol is the lack of wireless spectrum harmonization across different world regions.

www.abiresearch.com

Automation the key to testing very high volumes of advanced smartphones

By Jean-Pierre Joosting

As wireless technology continues to evolve, the rise of the smartphone continues to gather pace along with the challenges of cost-effectively producing many millions of these devices. One critical component in the manufacturing chain is ensuring that test times for smartphones remain reasonable.

A leader in automated test systems, JOT Automation is driving the trend of automated test in many areas, not least the smartphone market. Testing a smartphone implies taking into consideration a multitude of functions, a list that is increasing with each generation. JOT Automation claim to offer systems that are capable of bringing complete testing of a smartphone down to just over a minute in many cases. To illustrate the necessity of keeping test times as short as possible without compromising coverage, consider that Apple and Samsung each churn out tens of millions of smartphones each quarter.

Board level and functional test

Board level testing is usually done on a panel comprising four PCBs (four phones). JOT provides test boxes that accommodate these panels. These test boxes have test fixtures that are able to accommodate 3rd part test instruments from leading companies such as Rhode & Schwarz, National Instruments, and Litepoint. The test boxes are contained in a rack system.

Automated handling is then added to the rack system. A key feature of such automated systems is their modularity, enabling customers to mix and match boxes, racks and handlers. A further benefit is that these modular systems are scalable.

Some of the checks performed by an automated system needed to fully test a smartphone include checking the screen has all the required pixels, making sure all the buttons work as required via a "finger-robot", testing the phone transmits voice via an artificial ear and mouth, and testing the camera by taking pictures to ensure the camera works and zooms to specification. Automated test systems also need to check all inter-faces, including HDMI, audio plug, USB and so on. Radios need to be verified that they work as required at the right frequencies.

Though not an exhaustive list of the tests required the above list gives one an idea of the quantitative and qualitative tests required to verify a smartphone. For example, testing the camera with an automated system removes variable human perceptions of picture quality, ensuring the same result for every smartphone under test. It is also much faster.

The JOT G3 and M10 are key to making automated testing of smartphones a reality.

Future technology developments

Customers require a partner that can meet their requirements in the years to come. One such example in the case of smartphones is in emerging radio technologies. RF complexity poses problems on the test side and most of this is carried by the instrument suppliers. On the automated test side, JOT specialises in making the environment as isolated from interference as possible to be able to test all frequencies and radios. However, the better the isolation the higher the cost. This implies a trade-off between reasonable cost for the RF test box and performance.

Since the JOT's automated systems are modular and scalar such trade-offs can be catered for, depending on the end-user requirements. Modularity, also enables the test system to be upgraded as needed as technology advances.

Why automated test?

Smartphones are complex and consequently require significantly longer test times. Further, the volume of smartphones manufactured each year is enormous and increasing. According to market research firm Juniper Research, the number of smartphone shipments exceeded a quarterly record of 250 million in Q3 2013, representing a year-on-year growth of almost 49% from Q3 2012, and quarter-on-quarter growth of 10%.

With such volumes, reliability and quality are key issues for manufacturers when it comes to maintaining customer loyalty and avoiding expensive recalls. In addition, as test times rise with increasing smartphone complexity and functionality, along with higher smartphone volumes, higher labour costs come into play as more technicians are required to test devices. These are the key factors driving the trend towards automated testing.

Automated testing removes human error and enables better reporting. It also removes subjectivity, for example, compare a human operator verifying the quality of a smartphone camera versus an automated, standardised process.

Higher volumes, increasing complexity and rising labour costs, along with

the ability to reduce error and eliminate subjectivity make a compelling business case for automated test.

G3 — final functional testing
Providing final functional testing of smart phones, the JOT G3 enables fully automatic tests on handsets in a repeatable and reliable environment, which helps to maximise capacity and quality with low labour costs.

The G3 has a smaller footprint and offers an all-in-one feature enabling all DUT interface testing including RF, screen, touch screen, buttons, audio, and plug-in connections. Another key feature is the ability to combine different tests on the same platform.

It has an easy and fast product change over, together with a simple and in-expensive product specific adaptor. With a self-diagnostic which verifies machine functionality to speed up problem solving and additional features and instruments available to add to the product, the JOT G3 offers the best choice for lean environment.

JOT has invested a lot to make better test machines such as the M10 board level test system and the G3 functional test system for the ready phone, Lauri Antila, Vice President of Marketing and Business Development JOT Automation.

M10 functional test system
The JOT M10 functional test system has been developed to address the need to speed up the development cycles and to overcome the capacity challenges in manufacturing of smart devices such as smart phones and tablet PCs or basically any electronics product with high production quality requirements.

The JOT M10 is a scalable and modular system for board and PCB-level functional testing, flashing and RF-tuning of smart devices. One of its key benefits is that the very same test solution can be taken from R&D to production to secure efficient and swift production ramp up. The other key benefit is the modular system architecture, which enables the M10 to easily adapt

to production volume variations during a product's life cycle, and also between the production lines and factories.

The JOT M10 functional test system consists of M10 test boxes, M10 test rack, and M10 test handler.

The M10 test boxes come with integrated test electronics and are available both as RF and non-RF variants, supporting both module and panel-level testing.

In a production environment, M10 test boxes can be accommodated to M10 test rack together with third-party test instruments. The M10 test rack with test boxes can be served manually or automatically with the M10 test handler. Further several M10s can be cascaded in a row. For maximum capacity, test phases can be split flexibly, both inside the rack and between the racks.

Research and development
JOT Automation has been involved in mobile phone testing almost from the beginning. The company benefits from its extensive in-house expertise and the high-level of confidence key customers have in it. Automated test is an emerging industry in electronics led by JOT Automation. To this end the company has over 100 R&D engineers working on basic platform development, customising test systems for customers and on future technical challenges in automated test.

Every major company has their unique way of both developing and manufacturing mobile phones. This means that production test strategies are somewhat different as well. To address these issues, JOT Automation provides customized solutions for each customer. To achieve this, the company always try to have R&D engineers working closely with customers.

When customers decide to roll a product or invest in new equipment, these are often characterised by scale (massive), short time cycles, and a global footprint. JOT R&D work with the customer to address these issues. The company not only delivers automated test systems but is also able to develop such systems, deploy them and ensure maintenance — all on a global basis.

JOT Automation
Since its inception in 1988 by Veikko Lesonen, the company has grown to be a global leader in its field. Due to the rapid development in mobile telecommunications during the 80's, Veikko Lesonen founded JOT Automation using his knowledge and experience, to

develop automated testing devices and supplying equipment to leading mobile phone manufacturers, among others.

The company grew through the years and reinforced its presence in the fast growing Asian economies of China. In 2003 the company was bought by Elektrobit then in 2007 by the German Rohwedder. In 2011, Jot Automation was bought back by the company founder. Today it is part of Head Invest Group, a Finnish industrial company owned by Veikko Lesonen and his family. Today, the company operates in 13 countries, on four continents

Veikko Lesonen, said: "This is a 25 year success story for a Finnish company. JOT Automation is very successful in its field and highly regarded by users in many industries. The company has continued to develop innovative automated solutions for a variety of different industries. JOT Automation is celebrating its 25th aniversary this year."

Customer value
Based on its recent analysis of the production automation testing market, Frost & Sullivan has recognised JOT Automation with the 2013 Global Frost & Sullivan Award for Customer Value Leadership. Frequent product introductions and enhancements, along with the company's strategic decision to extend its business markets, have enabled it to develop close relationships with its customers.

"Based on machine vision, robotics and sensor technologies, JOT Automation's products are best suited to deliver economies of scale to its customers," observed Shapiro. "The company is also focusing research capabilities in the areas of miniaturization and need for desktop solutions."

Conclusion
Speeding up the development cycles and overcoming capacity challenges requires modularity and re-configurability. It is simple not possible to design manufacturing solutions from the scratch for new products. The answer to such problems are platforms that can easily be adopted to a new product variant or even a totally new product.

Automated test systems such as the M10 and G3 are scalable, modular systems that address these needs from a test perspective.

Next Generation Design Flows for Signal Processing and Communications Systems

By Graham Reith, Industry Manager, MathWorks

Design-flow discontinuities are becoming increasingly disruptive and expensive in the development of complex signal processing and communications technologies. The drive to reduce the length of design and verification cycles is magnifying the impact of these discontinuities. This paper describes a few use cases–in algorithm design, system architecture, and hardware design–that illustrate significant recent advances in modeling, simulation, and code generation tools and methods.

Algorithm design for streaming systems

Many engineers begin the development of signal processing and communications algorithms in MATLAB using floating-point arithmetic. These algorithm developers can take advantage of the powerful signal acquisition and analysis capabilities of MATLAB as well as built-in algorithm libraries of several toolboxes. In some organizations, however, these algorithms are then rewritten in C code to refine them for implementation, conversion to fixed-point or integer arithmetic, or to integrate them with other design elements. This rewriting step is one example of a potentially costly and disruptive discontinuity in the design flow.

Several hundred new components for signal processing, communications, image and video processing are available for use with MATLAB as libraries of System objects. System objects are ready-for-use packaged implementations of algorithms in MATLAB – designed for designing real-time systems. They implicitly handle streaming, indexing, buffering, and state management – which makes the code much simpler to write, debug, and maintain.

As an example, Figure 1 shows a block diagram representation of a basic communication system with transmitter, channel, and receiver components. To model and simulate such a system, some engineers write many thousand lines of C code, and then look for ways to integrate the design with test equipment or analyze simulation results.

In contrast to the several thousand lines of C code that are typically written
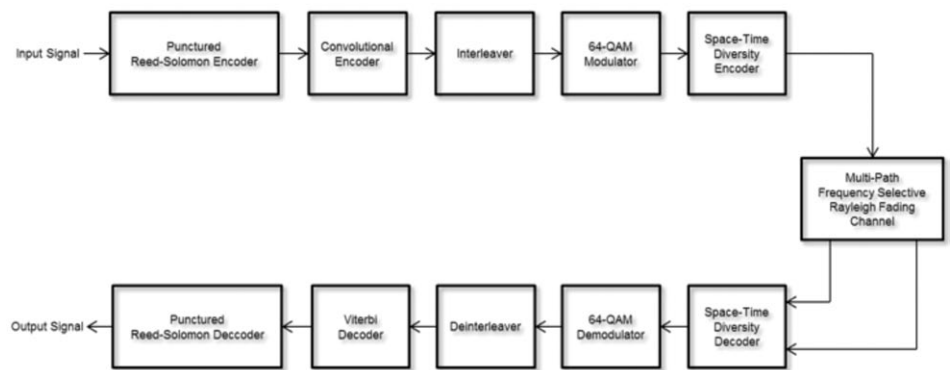

Figure 1: Block diagram view of the physical layer of a typical communication system.

to implement this communication system, the MATLAB code shown in Figure 2 uses several available System objects from DSP System Toolbox and Communications System Toolbox. For example, to model the transmitter, an engineer can instantiate and call the Reed-Solomon Encoder, Convolutional Encoder, Block Interleaver, Rectangular QAM Modulator, and Orthogonal Space-Time Block Coder System objects from Communications System Toolbox in sequence, as shown in Figure 2. The code structure enables engineers to easily compare it with the original specification or block diagram. Algorithm designers can rapidly combine this code with their existing MATLAB code and test the algorithms with live streaming data acquired from measurement instruments.

Combining MATLAB and C/C++

Algorithms coded using System objects facilitate code reuse in the system design process. Floating or fixed-point MATLAB code can be included directly in a Simulink model as part of the system architecture, modeling, and design process. Engineers can also use MATLAB Coder to generate C

Figure 2: A portion of MATLAB code showing the use of System objects from DSP System Toolbox and Communications System Toolbox.

code automatically from MATLAB code including System objects, and then use that C code for simulation or integration with other C/C++ design elements, after proper verification.

As shown in Figure 3, several important use-cases are enabled by the integration of MATLAB with C/C++ in engineering workflows. For example, engineers can directly invoke MATLAB from a C program to take advantage of MATLAB's signal processing libraries or visualization capabilities. Existing C/C++ designs can be directly used in MATLAB as external libraries. MATLAB Compiler can be used to deploy MATLAB algorithms – or alternately – MATLAB Coder can be used to automatically generate C code from MATLAB.

RF and digital system architecture

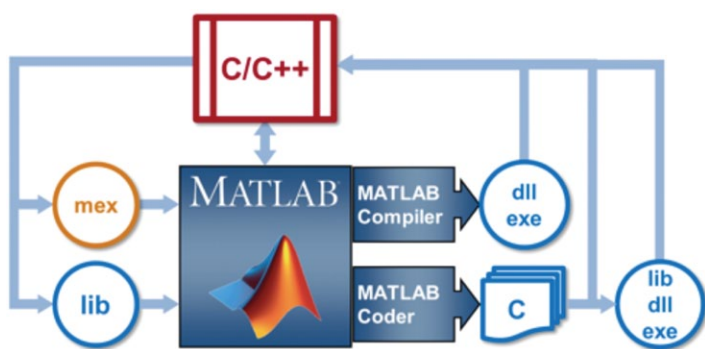Static link budget calculations are a common first step in RF designs

Figure 3: Combining MATLAB with C/C++ provides a powerful and flexible algorithm and system design platform for signal processing applications.
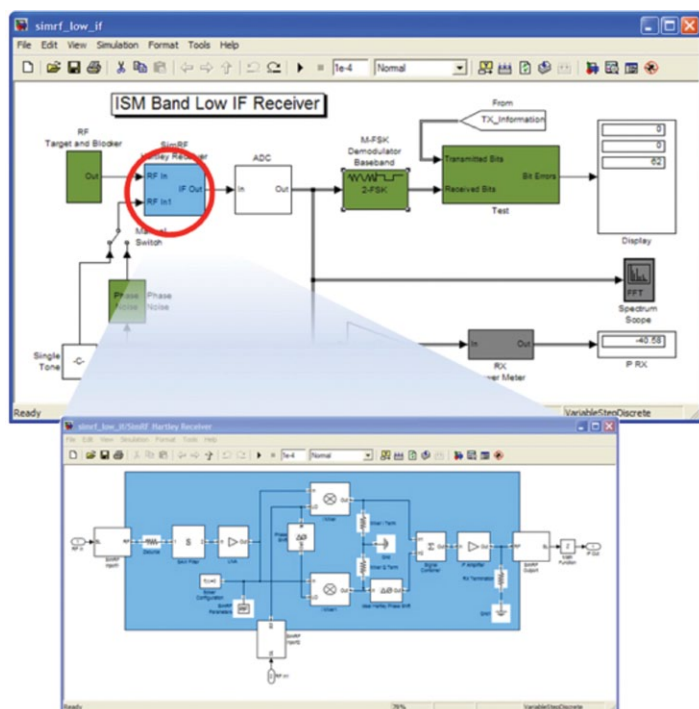

Figure 4: ISM band low IF receiver with digital and RF subsystems in one unified model (above) and detail of the Hartley receiver RF subsystem modeled in SimRF (below).

based on specifications for LTE, Bluetooth, ZigBee, Wi-Fi, or other technologies. These calculations provide a good starting point, but they do not account for input signal modulation, image effects, interferers and other real-world phenomena. To effectively model and simulate the effects of RF impairments on communication systems, system architects currently juggle multiple disconnected tools that support either digital or analog/RF designs, but not both.

SimRF is integrated with Simulink and provides a Circuit Envelope engine for the simulation of multi-frequency dynamics in RF transceivers. The SimRF component library includes behavioral models of nonlinear amplifiers, three port mixers, S-parameter blocks and other basic blocks for designing architectures with arbitrary topology and for simulating RF front ends at the system level. SimRF lets you simulate RF amplifiers to estimate gain, noise, even- and odd-order intermodulation distortion. The simulation of mixers enables you to predict image rejection, reciprocal mixing, local oscillator phase offsets, and DC conversion. You can also simulate frequency-depen-

dent mismatches between linear and nonlinear components in the time and frequency domains.

SimRF and Simulink together provide a common environment for modeling and simulating RF and baseband subsystems in a unified design. Used in combination, these tools enable system architects to perform realistic simulations early in the development process and make informed trade-off decisions in designs that include digital and analog/RF components.

Figure 4 shows the overall system model of an ISM band low IF receiver that includes both the digital signal processing components and the RF receiver subsystem. The details of the RF subsystem that implements a Hartley IF receiver are also shown. Unlike traditional modeling methods that use cascades of two-port elements and single-frequency approximations, the use of three-port elements simplifies the receiver model. The model also utilizes circuit envelope simulation technology and supports multi-frequency modeling to estimate the impact of a blocker and an image signal on a nonlinear receiver.

System architects can also explore the feasibility and relative merits of alternate approaches for image rejection such as super heterodyne or direct conversion architectures in the unified environment. In addition to simulating the effects of RF impairments, system architects can use the same system models used for design to perform the verification tasks in simulation that would normally be done on the lab bench.

Hardware design

After the algorithm design and system architecture are completed, the next step in many development cycles is FPGA implementation and verification of the digital portions–sometimes en route to final deployment as ASICs. Among the primary sources of inefficiency in FPGA prototyping and implementation are the time-consuming design iterations that are required to find the proper balance of power consumption, performance, and area.

Figure 6 shows a symmetric FIR filter implemented in fixed-point arithmetic. To realize such a filter in hardware, engineers must carefully balance the throughput and latency, and monitor the amount of hardware resources used. Critical path highlighting is a new capability that provides actionable information on potential bottlenecks in the system. Using the post-synthesis
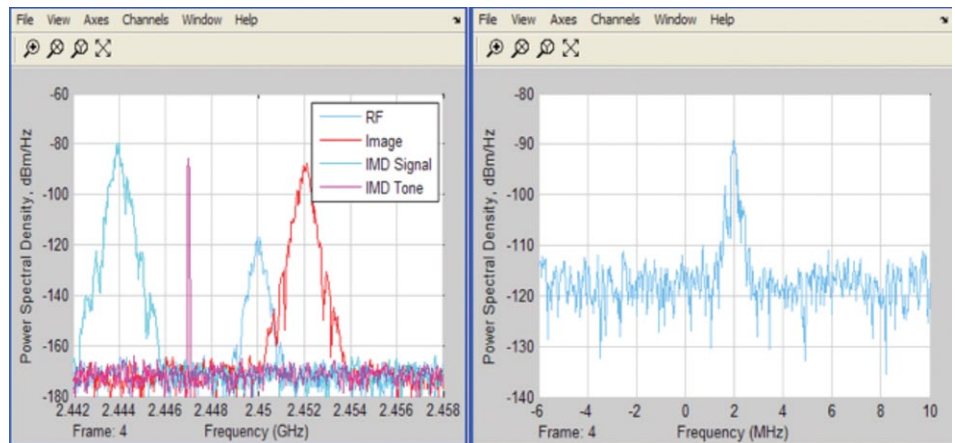

Figure 5: Input (left) and output (right) power spectral density plots showing the results of low IF image rejection.

information generated by the synthesis tool, HDL Coder annotates the critical path timing in the Simulink model. Engineers can utilize this information together with pipelining techniques to partition their designs, reduce the critical path latencies, and infer the use of dedicated DSP resources available on many FPGAs. Figure 7 shows the same filter design, with the critical paths automatically highlighted, along with estimated latency for each path segment.

Figure 6: A symmetric fixed-point FIR filter modeled in Simulink.

As mentioned above, pipelining is one of the key techniques that engineers utilize to address critical path latencies. One of the well-known challenges with pipelining is that parallel paths may have unmatched latencies, which can lead to unexpected or unwanted system behavior. Distributed pipelining–a technique employed often to address this problem–can now be automated. By choosing this option, engineers can automatically retime the model and balance the latencies introduced by pipeline registers across relevant parallel paths.

In the past, these types of design iterations and trade-off evaluations have required a significant amount of time and effort. Recent enhancements include a Workflow Advisor console that enables engineers to go through design iterations much more quickly and in an intuitive manner. This is especially helpful to those that are not experts in HDL programming, but need to take advantage of FPGA processing. In addition

to using critical path highlighting and distributed pipelining, engineers can also examine an automatically generated resource utilization report to monitor the type and number of critical hardware components being used and determine the best architectural choice for a given situation by quickly iterating through several viable design options.

Accelerating design across teams

Today's engineering managers face the challenge of coordinating geographically dispersed teams that are working on different parts of an overall system using different disconnected tools. In many cases, system-level designs are best done in graphical environments, while some lower level details are best expressed as text in MATLAB or C. This paper presented some key recent developments that improve efficiencies across various stages of the design flow.

For algorithm design, System objects are a key new development in modeling and simulating signal processing and

Figure 7: Symmetric fixed-point FIR filter showing critical paths and estimated latencies.

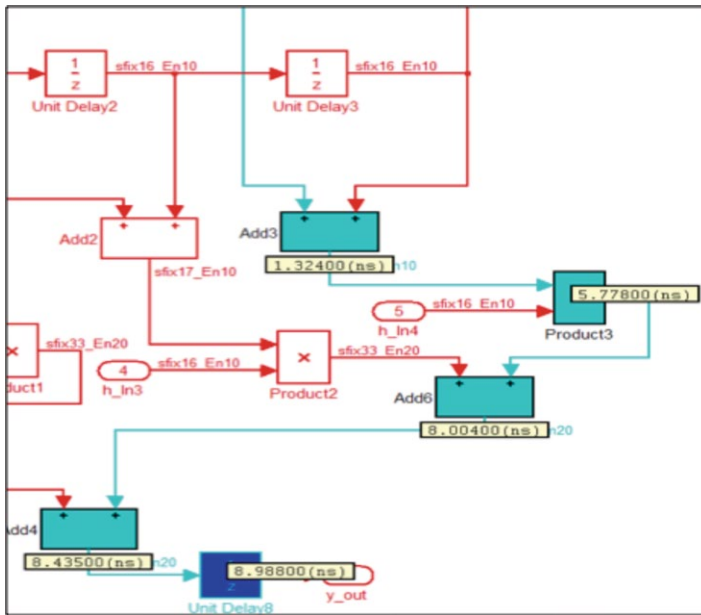communications systems. Several hundred ready-to-use signal processing and communications System objects are now available in MATLAB. Further, System objects support fixed-point arithmetic, and they can be integrated with Simulink or used for automatic generation of C code.

SimRF-featuring circuit envelope simulation technology- is an important new tool for more efficient system architecture flows.

It enables engineers to model RF and baseband system components in a unified environment and perform true multi-frequency simulations.

To improve the design iteration cycle times for hardware design, there are several recent developments in HDL Coder, including workflow advisor, critical path highlighting, distributed pipelining, back annotation, and resource utilization reports, which provide critical actionable information on system performance and a streamlined workflow framework and for hardware developers.

Whether the teams are small or large, geographically distributed or located in the same office, engineering organizations can apply some of these technologies to remove discontinuities in their workflow, and by so doing, streamline and accelerate the development of complex signal processing and communications systems.

Peregrine introduces UltraCMOS® 10 technology to solve challenges of RF front-end Integration

Peregrine Semiconductor has announced the UltraCMOS 10 platform, the latest advancement in company's UltraCMOS technology.

UltraCMOS 10 RF SOI delivers both flexibility and unparalleled performance for addressing the ever-increasing challenges of RF front-end design. It offers the performance of UltraCMOS technology with the economies of SOI, and it delivers a more than 50-percent performance improvement over comparable solutions.

The versatile 130 nm UltraCMOS 10 technology delivers the support needed for the latest generation of LTE-Advanced smartphones and, for the first time, will allow the company to deliver cost-competitive products for 3G smartphones.

Peregrine is enhancing a long-term relationship and leveraging a new one for the UltraCMOS 10 introduction – Soitec's breakthrough semiconductor materials coupled with tier-one fab GLOBALFOUNDARIES' custom fabrication flow.

Smartphone manufacturers face a number of tough design challenges, including balancing performance requirements with cost and maintaining consumers' signal quality and data-rate speeds despite the increasing number of frequency bands and volume of data. Mobile Experts' Principal Analyst of Radio Access and RF Semiconductors Joe Madden offers his perspective on the challenges and growth curve of the smartphone market by stating, "The iPhone 5S has more than double the frequency bands than the iPhone 5, and this is just one example of how dramatically the requirements for smartphone components are increasing. LTE units are expected to grow from 150 million in 2012 to 1.2 billion in 2018 (42 percent CAGR)." Peregrine's UltraCMOS 10 technology will outpace these increasing performance needs so consumers will continue to see improved connectivity.

The UltraCMOS 10 130 nm generation delivers the industry's best RON COFF performance and enables improved performance and scaling. The RON COFF figure of merit is a ratio of how much loss occurs when a radio signal goes through a switch in its ON state (RON, or on-resistance) and how much the radio signal leaks through the capacitor in its OFF state (COFF, or off capacitance). The RON COFF performance metric for UltraCMOS 10
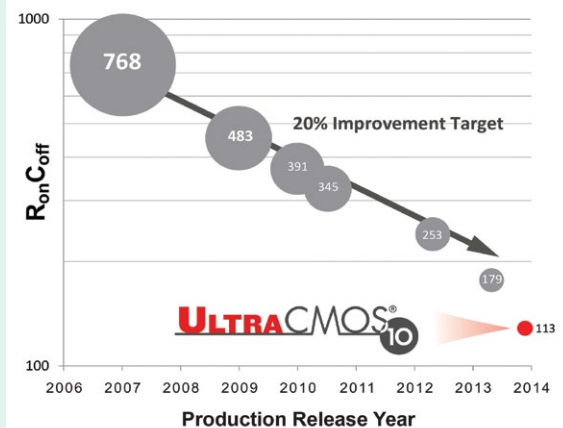
technology is 113 fs. This is a five-fold improvement over the first generation released by Peregrine 10 years ago. It represents Peregrine's expertise in using best-in-class engineering methodologies and materials to lower insertion loss without sacrificing isolation performance. In addition to improved RON COFF performance, UltraCMOS 10 platform leverages Peregrine's patented design technology, which delivers linearity of more than 75 dBm at 900 MHz and equates to higher data rates and improved co-existence for consumers.

www.psemi.com

Signal and spectrum analyzer
characterizes wideband and pulsed signals continuously up to 67 GHz
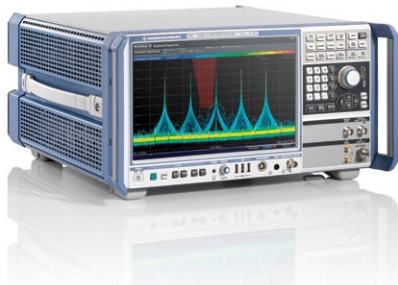
A high-end signal and spectrum analyzer, the FSW67 from Rohde & Schwarz features a frequency range up to 67 GHz, plus an integrated preamplifier up to 67 GHz as well as an analysis bandwidth as high as 320 MHz.

The analyzer helps developers perform complex measurement tasks in the microwave range for aerospace & defense applications and wireless communications.

The FSW67 claims to be the only instrument on the market to cover the frequency range from 2 Hz to 67 GHz in a single sweep. It simplifies test setups and does away with external harmonic mixers — requiring no complex cabling. Image frequencies and other spurious emissions caused by harmonic mixing are suppressed.

Thanks to its analysis bandwidth of up to 320 MHz, the FSW67 also measures wideband, hopping and chirp signals. Until now, this required complicated test setups consisting of a digital oscilloscope and a downconverter, for example.

Users can now easily perform spectrum measurements and modulation measurements in the 60 GHz band. This makes the FSW67 ideal for the development, testing, verification and production of transmitters and components for radar applications, satellite and military communications systems. The analyzer also provides valuable assistance when performing development tasks relating to fast wireless communications based, for example, on WiGig (IEEE 802.11ad) or WirelessHD.

The FSW67's integrated preamplifier up to 67 GHz makes it very sensitive even in this high frequency range. The smallest of spurious signals will be detected, and noise figures of components will be measured with high precision. Featuring a phase noise of -111 dBc (Hz) at 10 kHz offset from the carrier at 67 GHz, the analyzer offers a high dynamic range even for measurements close to the carrier. This keeps inherent instrument errors especially low during signal analysis. The FSW67 also provides high reproducibility of results.

The integrated multistandard radio analyzer (MSRA) measures spectrum and modulation parameters of signals with different modulations simultaneously, and also correlates these signals in time. With the MSRA function, users can efficiently analyze how and why different signals affect each other.

www.rohde-schwarz.com

Modular USB scope range expands
with 20-GHz electrical, 9.5-GHz optical sampling units

Pico Technology, designers of USB modular scopes that use PCs or laptops for display and control functions, has expanded its range with the PicoScope 9300 Series TDR/TDT sampling oscilloscopes, for use with repetitive signals.

The 9300s can perform time-domain reflectometry and transmission mismatch and network analysis on high-frequency cables, PCBs, backplanes and interconnections. Their built-in differential fast edge generators have a rise time of 65 ps at up to 6 V (PicoScope 9311) or 40 ps at over 250 mV (PicoScope 9312, via plug-in pulse heads), providing a typical distance-to-fault resolution down to 10 mm.

"The PicoScope 9300 Series are the only compact, full-featured PC-based sampling oscilloscopes on the market," claims Alan Tong, Managing Director, Pico Technology. "Their specifications and features are a match for traditional full-sized bench top instruments but at a fraction of the cost."

The scopes also have LAN and USB interfaces, and advanced large-screen display features such as colour and density profiling, multiple trace windows, histograms, multiple measurements and statistics. With a sampling rate of 1 Msample/s, they can build waveforms and persistence displays faster than other sampling oscilloscopes.

The small footprint of the PicoScope 9300 scopes allows them to be positioned close to the device or port under test, on the bench or in the field, without pull-out sampling modules or lossy extension cables. Specification highlights include: 17.5 ps input rise time, dual 16-bit, 60 dB dynamic range ADCs, 5 ps/div dual time-base, 14 GHz trigger bandwidth, built-in clock recovery up to 11.3 Gb/s, and time interval resolution of 64 fs. Typical input noise is 1.5 mV RMS at full bandwidth, with trigger jitter of 1.8 ps RMS and recovered clock jitter of 1 ps RMS.

The company's PicoSample software has been updated, extending the range of controls with intuitive graphics, click-and-drag operations and measurement labels to simplify and speed up operation. The flexible layout displays only the controls and menus you need, leaving the maximum possible space for your data. A suite of measurement and analysis functions contains 61 math operations, 138 automatic measurements and 167 standard comms masks from 1.54 Mb/s to 12.5 Gb/s. PicoSample 3 is compatible with all 32-bit and 64-bit versions of Microsoft Windows from Windows XP to Windows 8.

www.picotech.com

Handheld analyser
pulse measurements simplify radar field testing

Agilent Technologies has introduced a pulse measurement option for its FieldFox handheld analyzers that is designed to further simplify radar field testing. With the new pulse-measurement option, FieldFox analyzers allow users to carry a single instrument into the field to verify and measure radar pulse characteristics, S-parameters, spectrum analysis and transmitter power. Moreover, all measurements made with FieldFox are consistent with those of benchtop analyzers.

The FieldFox pulse measurement option efficiently characterizes radar signal quality by leveraging Agilent U202x peak-power sensors (available in 18- and 40-GHz models). Working together, the pulse measurement mode and U202x enable maintenance crews to check radar signal quality without having to carry a heavy benchtop instrument into the field.
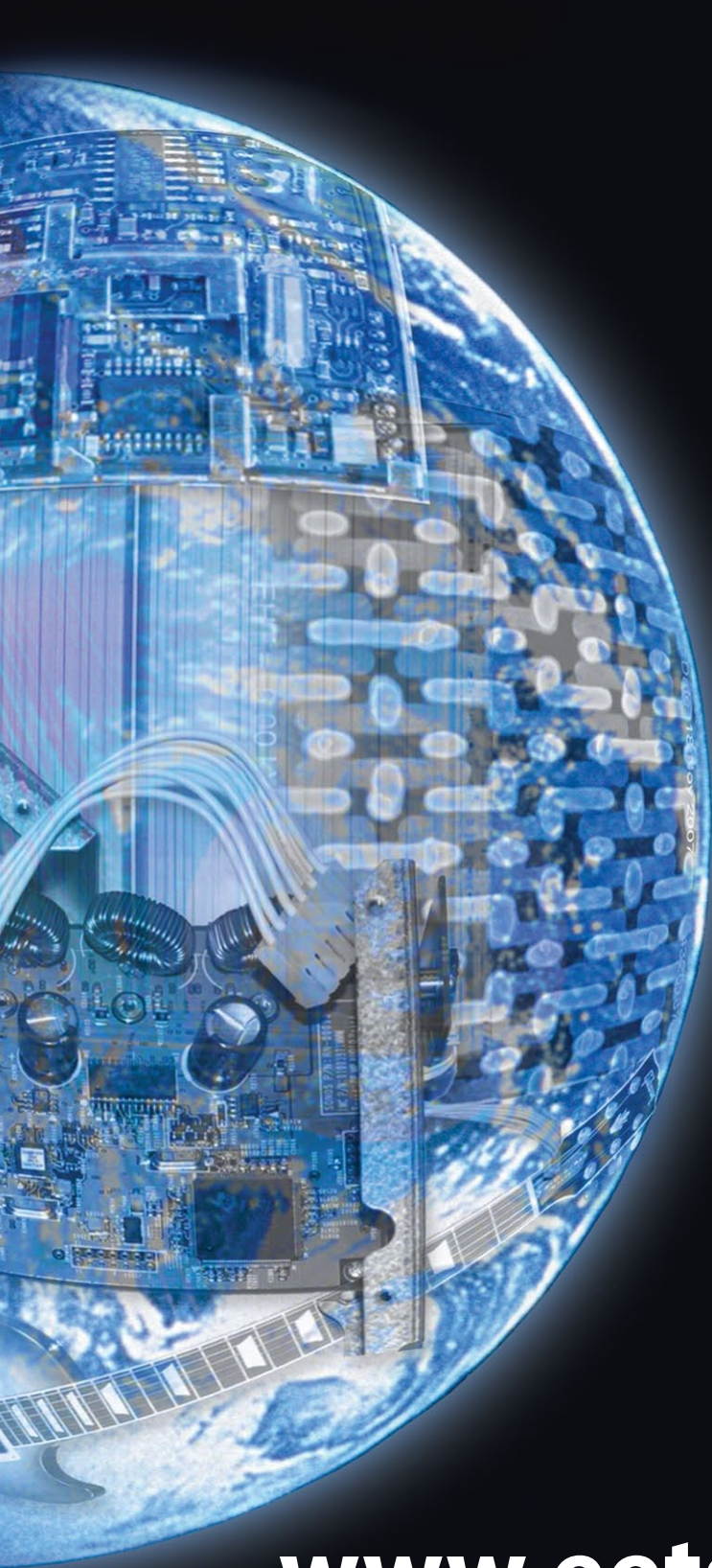
www.agilent.com

Low loss 4x2 hybrid diplexer
for low PIM head end DAS applications

Microlab, a Wireless Telecom Group company, is adding a new hybrid diplexer to its popular hybrid combiner product line. The CM-20 is an integrated 4x2 hybrid multi-band combiner with a unique design that combines two low band signals within 698 to 960 MHz with two high band signals within 1710 to 2170 MHz. This configuration allows combining of multiple carrier frequencies onto a common antenna. Perfect for combining LTE-700-MHz, SMR-800-MHz, or Cellular-850-MHz with PCS-1900-MHz, and AWS-2100-MHz. This product is packaged in a compact design with either N-type or 7-16 DIN female connector interface.

"Capable of handling power levels up to 50 W per input, this assembly induces very little passive intermodulation (PIM) distortion", says Karl Hricko, Product Manager. "This is a versatile combiner/diplexer assembly combining multiple high and low band frequencies. The CM-20 can be utilized as a multi-band neutral host point of interface building block in DAS trays and DAS interface panels."

Multiple CM-20 assemblies can be custom configured into 19" rack mountable trays to suit your installation requirements. Microlab's CM-20 is manufactured in the USA. They are 100% tested to meet a guaranteed PIM level of -153 dBc or lower.

www.microlab.fxr.com

Online thermal analysis tool
estimates accurate MMIC "package bottom" temperature

Custom MMIC has launched a free, easy-to-use, web-based thermal analysis tool which tackles the problem of estimating the rise in temperature between the ambient surrounding and the bottom of a packaged MMIC when attached to a printed circuit board (PCB).

Until now, engineers generally assumed these two temperatures were the same, with the PCB acting as a perfect heat sink. The only other option, a detailed analysis of the problem, required sophisticated thermal simulation software that was often expensive and time consuming.

However, Custom MMIC's new online calculator provides an easy and fast way of estimating the rise in temperature without the need for a full 3D thermal simulation environment. With this tool, engineers can now develop a reasonable estimate of temperature at the bottom of a package based upon the construction of the PCB.

Users simply select the package type, the power dissipation inside the package, the PCB board material, the via construction, and the base plate temperature (typically 85 °C). The calculator then determines the temperature rise through the PCB to the bottom of the package, under the following assumptions: the PCB is plated with 1 ounce copper (1.4 mils thick), the package is attached to the PCB with solder (2 mils thick), and the base plate is an ideal heat sink.

www.CustomMMIC.com

Location-aware IoT prototyping kit
wirelessly connected

The companies, u-blox and ARM have jointly released a flexible and easy-to-use prototyping kit for designing wirelessly connected, location-aware internet devices: the ARM mbed-enabled u-blox C027 Internet-of-Things (IoT) starter kit.

The C027 delivers out-of-the-box wireless internet connectivity based on a compact u-blox 2G, 3G or CDMA cellular modem plus global positioning module. Together with the ARM Cortex-M3 32-bit processor and access to all the resources of the ARM mbed project, the kit enables developers to quickly move prototypes of intelligent ARM-based technology into production-ready designs.

The C027 kit measures only 54 x 98 mm, it contains a u-blox "SARA" GSM or "LISA" UMTS/CDMA cellular modem, a "MAX" GPS/GNSS positioning module, and an ARM 32-bit Cortex-M3 microcontroller with 512k of Flash Memory and 64kB RAM, user programmable via USB. CAN bus and Ethernet interfaces are provided. The board also provides direct connector with 22 GPIOs to access components via I2C, SPI, UART, and I2S digital audio.

The hardware is supported by the open-source ARM mbed development platform (http://mbed.org) which provides free software libraries, hardware designs and online tools for professional and rapid prototyping of ARM-based designs.

www.u-blox.com

Power amplifiers
cover select bands from 20 to 100 GHz
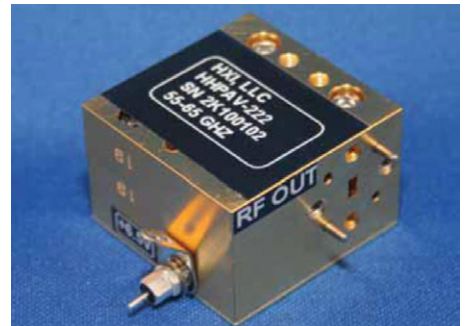
The HMPA and HHPA series of medium and high power amplifiers covers select bands from 20 to 100 GHz. A wide variety of gain and bandwidth combinations are available to provide the designer with a solution for most applications.

Custom designs are available and in many cases NRE is not required. MMIC technology is exclusively employed for high reliability and repeatability. Each power amplifier contains a voltage regulator and bias sequencer allowing the use of a single bias voltage to power the amplifier, saving the user the complication of providing this circuitry.

The amplifiers can be used in radar or communications systems transmitters and also as gain blocks in LO chains and test equipment. Low noise amplifier stages can be combined with the power amplifier stages for high gain/high P1dB performance. The power amplifiers can also be packaged with other functions for custom configurations.

www.hxi.com

Myriad RF connector board
for multiple FPGA platforms

A multi-carrier FPGA connector board for field programmable RF transceiver systems has been launched to significantly cut the cost of RF product development. The ESO-001 board is a joint development between field programmable RF chip developer Lime Microsystems, distributor Azio Electronics and FPGA system designers E-Elements. It will be sold via the Azio website sales portal.

The twin-standard mezzanine board supports both DE0-Nano and FMC FPGA interfaces, enabling it to link the majority of field programmable RF boards — including Lime's development platform, Myriad RF — with both Xylinx and Altera FPGA developer kits. The launch enables wireless networks of almost any size and complexity to be easily created on any mobile standard or frequency.

The board also integrates USB functionality enabling you to connect it straight to a PC or Raspberry Pi, enabling the PC itself to act as the baseband.

www.limemicro.com
www.azio-tw.com
www.e-elements.com/tw

WPC 1.1 wireless power receiver
targets portable applications

Integrated Device Technology has announced a wireless power receiver meeting the Wireless Power Consortium's (WPC) 1.1 "Qi" specification and optimized for high-volume portable consumer applications.

The IDTP9025 is a single-chip wireless power receiver IC certified to meet the requirements of the WPC 1.1 specification, offering improved foreign object detection (FOD) compared to earlier versions of the standard. The highly-integrated device includes an onboard synchronous full-bridge rectifier and low-resistance low-dropout (LDO) regulator, enabling customers to achieve excellent power transfer efficiency with minimal external component count and board space. The high-efficiency, cost-effective design is ideal for use in high-volume portable devices where battery life and physical size are a primary concern, such as in smartphones, tablets, and related accessories.

For added control, IDTP9025 is capable of passing communication and power transfer information to a local microcontroller, as well as fault and safety monitors, through the integrated I2C port. This allows the customer to build custom control algorithms and user interfaces to enhance the user experience.

www.wirelesspowerbyidt.com

Long range wireless transceiver platforml
addresses IoT communications

Semtech has introduced the SX1276/77/78 end-node wireless network components, which integrate the company's new LoRa (long range) technology.

The SX127x platform incorporates LoRa (long range) spread spectrum technology in addition to the traditional GFSK modulation. Spread spectrum technology has been used in other applications for a number of years but has not been available until today as a low-cost solution suitable for sensor networks.

Using the LoRa technology, the SX127x family achieves a range of more than 15 km in a suburban environment and 2 km to 5 km in a dense urban environment while operating under US, EU, Chinese and Japanese regulatory limits. Most deployed systems for metering, security or industrial automation are limited in range to 1-2 km in a suburban environment. The additional range provided by LoRa eliminates the need for repeaters in these applications, significantly simplifying the system design and lowering the total cost of deployment.

The SX1276 covers all the major sub-GHz frequency bands while the SX1277 is a cost-optimized version targeted at applications that utilize data rates from 5 kbps to 40 kbps such as security systems. The SX1278 is optimized for the rapidly growing smart meter market in China using the 470-510 MHz band.

All devices deliver over 100 dB of blocking immunity to out-of-band interfering signals, which is a 15 dB advantage over competing devices. Additionally, the SX127x family has a 25 dB improvement over FSK devices for rejecting in-band interfering signals.

www.semtech.com

Software-defined dual transceiver chipl
tunable over 70 MHz to 6 GHz

The AD9361 RF agile transceiver from Analog Devices provides up to three times the noise performance of alternative solutions and significantly reduces BOM cost. It comes with design kit, and FPGA rapid prototyping environment to reduce design times and risk.

The AD9361 is a monolithic software-defined radio chip that contains two complete transmit and receive channels, can operate anywhere in the spectrum from 70 MHz to 6 GHz, and with channel bandwidths from 200 kHz to 56 MHz. In designing it to enable programmable radio applications that operate over a wide range of modulation schemes and network specifications such as defence electronics, instrumentation equipment and communications infrastructure. The AD9361 is supported by a wide range of design resources to expedite time to market including a software design kit and FPGA mezzanine card (FMC) to rapidly develop software defined radio solutions.

The transceivers integrate an RF front end with a selection of low-noise-ampli-

10x10mm 144 BGA

ANALOG DEVICES AD9361
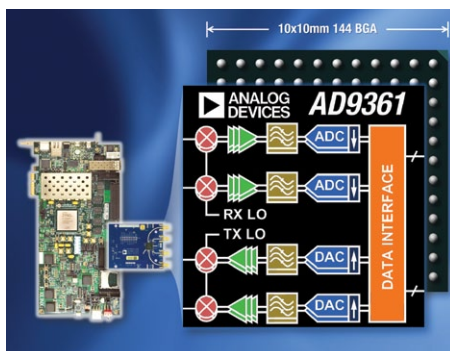
fiers, flexible mixed-signal baseband section, frequency synthesisers, two analogue-to-digital converters and two direct conversion receivers. Functional blocks are combined, alternate blocks such as LNAs selected and parameters (such as local-oscillator frequencies – there are full fractional-N synthesis LO blocks on-chip) set according to the needs of any given signal, and everything can be changed and reconfigured on-the-fly. Among other capabilities, you can build a complete 2x2 MIMO configuration with the chip.

Two independent direct conversion receivers have a state-of-the-art noise figure and linearity. Each receive subsystem includes independent automatic gain control, DC offset correction, quadrature correction, and digital filtering, eliminating the need for these functions in the digital baseband. The AD9361 also has flexible manual gain modes that can be externally controlled.

Two high-dynamic-range A/D converters per channel digitise the received I and Q signals and pass them through configurable decimation filters and 128-tap FIR filters to produce a 12-bit output signal at the appropriate sample rate.

www.analog.com

Low power FPGAs
enable always-on sensor systems for context-aware mobile apps

<1mW

LATTICE iCE40 FPGA

With its ultra-low-density iCE40 FPGAs, Lattice Semiconductor claims to be delivering the world's most flexible, single-

chip sensor solutions for making a new generation of context-aware, ultra-low power mobile devices possible.

Delivered in a 16-ball 1.48x1.40mm wafer level chip scale package (WLCSP), the iCE40LP integrates an RGB LED driver and is flexibly programmable to implement advanced functions such as IrDA, barcode emulation (requiring a dedicated LED driver), service LED, and more in a single chip with available logic for additional customer defined functions.

With hard IP for strobe generators, I2C and SPI interfaces, the iCE40LM FPGAs deliver near-zero latency to the mobile market, enabling context-aware systems with the real-time capturing of user and environmental inputs with minimal delay or error, all from a WLCSP measuring 1.71- x 1.71- x 0.45-mm (0.35-mm pitch).

Because the iCE40LM draws just under 1 mW in active mode, it can be used to constantly monitor sensors, buffering data for up to a dozen of seconds before it wakes up the application processor for context-specific responses. This hardware combination can reduce power consumption by a factor of 100x over traditional application processor-only implementations, says the manufacturer, hence extending overall battery life of the mobile application.

www.latticesemi.com/iCE40

Solid-state high-power amplifier module
targets military jamming systems

Now available from Link Microtek is a solid-state high-power amplifier module that operates over the frequency range 20 to 520 MHz, making it ideal for use in either broadband mobile jamming systems to counter the threat of IEDs or band-specific high-power linear applications in the UHF and VHF bands. Manufactured by Empower RF Systems, the 1163 module features a rugged construction for excellent long-term

reliability and is guaranteed to deliver 125 W output power and related RF performance over the full bandwidth and under all specified temperature and environmental conditions.

The amplifier is equipped with an RS485 serial interface and built-in control and monitoring circuits, including a non-volatile memory for event recording and factory setup recovery. Comprehensive protection features guard the device against conditions such as over current, under or over temperature, under or over voltage and reverse polarity on the I/O lines.

Operating from a 28 VDC input, the module utilises the latest high-power RF LDMOS transistors to achieve a typical output of 150 W and a typical small-signal gain of 54 dB. The device has a maximum input return loss of -10 dB, and its noise figure is specified as 15 dB

www.linkmicrotek.com

PNA Network analyzer metrology option
sets new standard in precision S-parameter measurements
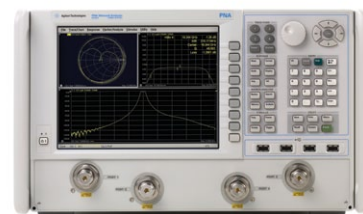
Agilent Technologies has introduced a metrology option for its PNA family of network analyzers that offers national metrology institutes and calibration laboratories around the world the ultimate in S-parameter measurement accuracy.

The metrology option employs a unique technique for accurately characterizing the thermal stability of its network analyzers, independent of the effects from cables and adapters. The technique provides 48 hours of stabilization data that accurately characterizes instrument drift stored on the analyzer's hard drive. This data can be used to calculate measurement uncertainty.

In addition, the metrology option has optimized the raw performance of the PNA family to address the specific measurement needs of metrology laboratories. For example, all front-panel loops were removed to improve stability.

The PNA's raw source match and load match were also optimized. Breakthrough receiver linearity was realized by specialized hardware techniques based on Agilent's in-house semiconductor processes.

The metrology option is now available on both two-port and four-port versions of all PNA frequency models up to 67 GHz. It does not support the configurable test set, attenuator or bias tee hardware options.

www.agilent.com

Precision oscillators
offer improved phase noise and reduced jitter

Fox Electronics (part of IDT) has released the next generation of XpressO technology, XpressO-Ultra, describing them as a new class of precision oscillators for modern high-speed data transmissions

The improved phase noise and reduced jitter of the XpressO-Ultra Series enables the oscillators to be effectively used in a variety of modern high-speed data applications over an extended operating temperature range of -40°C to +85°C. Phase jitter (12 kHz to 20 MHz) is reduced to to 250 fs typical compared to 750 fs typical of the traditional XpressO.

These configurable oscillators offer a combination of competitive pricing and improved performance, with availability in days for production runs. As an extension to Fox's XpressO oscillator technology, XpressO-Ultra incorporates the same noise-reducing ASICs—developed exclusively by Fox—that offer the ability to select output type and supply voltage.
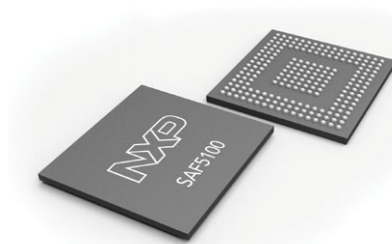
http://foxonline.com

Software-defined radio processor
for car-to-car and car-to-infrastructure communication

NXP Semiconductors has announced that the SAF5100, the first product from the RoadLINK™ range, is now available for automotive customer design-in.

The SAF5100 is a flexible software-defined radio processor for car-to-car (C2C) and car-to-infrastructure (C2I) communication, helping to realize NXP's vision for a complete C2X (C2C+C2I) solution. Scheduled for mass production in the second half of 2014, the SAF5100 is also the first product to become generally available from the MK4 reference design for connected vehicles, following its unveiling in July by NXP and Cohda Wireless.

The SAF5100 processor is fully programmable and can support unique algorithms to improve reception in wireless communication. It can support multiple wireless standards as well as different OEM antenna configurations like 802.11p antenna diversity, providing OEMs with the flexibility to support emerging standards across multiple regions via firmware updates. It also provides best-in-class wireless link performance via the 802.11p firmware from Cohda Wireless, which is a fully integrated part of the device.

www.nxp.com

Gallium arsenide foundry upgrades PDKs

Gallium arsenide semiconductor chip supplier and foundry United Monolithic Semiconductors SA (UMC) has the availability of improved process design kits (PDKs) for chip designers.

The improvements allow engineers to use recent innovations added to IC design software from Agilent Technologies Inc.

The PDKs for UMS's III-V processes can provide information for integrated 3D electromagnetic simulation engines within Agilent's ADS and support chip stacking and native air-bridge, via hole and dielectric opening descriptions. This improves design accuracy beyond the native design rule check (DRC) and layout-versus-schematic (LVS) check, said Eric

Leclerc, manager of UMS's foundry business department, in a statement.

With the upgraded PDKs customers will be able to use Momentum, a 3D planar electromagnetic simulator and an integrated 3D finite-element-method analyser.

www.ums-gaas.com
www.agilent.comt

802.11 dual-band Wi-Fi platform
for industrial wireless M2M

B&B Electronics has launched its next generation Airborne M2M 802.11 a/b/g/n Wi-Fi platform to provide secure, dual-band (2.4 and 5 GHz) Wi-Fi connectivity to rugged and mission-critical M2M networks.

With dual-band support and robust, enterprise-class security options, AirborneM2M is designed to enable integrators, VARs and OEMs to reduce the risk of obsolescence as enterprises both upgrade their security policies, and increasingly migrate their Wi-Fi infrastructure to the 5 GHz band. AirborneM2M products feature industrial strength packaging and a wide temperature rating (-40 to 85 °C) to withstand challenging M2M environments.

The 5 GHz support gives system designers and installers improved flexibility and reliability, as enterprises adopt 5 GHz in order to avoid the crowded 2.4 GHz band, which hosts competing wireless transmissions.

Security protocols, including robust authentication and encryption, are also important to mission-critical wireless M2M applications. AirborneM2M products are designed to handle the processor-intensive advanced encryption techniques defined for enterprise-class security that are not available on entry-level Wi-Fi products. Features include network security (EAP), wireless security (802.11i and WPA2-PSK), access security

(authentication and firewalls), communication security (SSH) and device security (encryption).

www.bb-elec.com

Software development tools
address the Internet of Things

Wind River now addresses software development for Internet of Things (IoT) gateways with a its Intelligent Device Platform, a complete software development environment used for building machine-to-machine (M2M) applications and devices that communicate with the cloud.

The platform is a scalable and secure solution that simplifies the development, integration, and deployment of IoT gateways. It is based on Wind River's operating systems, which are standards-compliant and fully tested. The platform contains device security, smart connectivity, rich network options and device management.

The Wind River Intelligent Device Platform is optimized for Intel architecture and is an integral part of the Intel-based family of intelligent gateway solutions, a packaged and pre-validated hardware and software product for gateways that connect legacy systems and provide common interfaces between devices and the cloud.

http://windriver.com/iot

Multi-GNSS platform
supports concurrent positioning

Swiss-based u-blox has announced its latest core positioning platform u-blox M8. The chip forms the basis of the company's upcoming line of positioning modules which are able to acquire and track different satellite systems concurrently to achieve higher accuracy and reliability. Supporting all deployed as well as upcoming Global Navigation Satellite Systems (GNSS), the platform is based on the UBX-M8030 concurrent

multi-GNSS receiver IC which is able to track American GPS, European Galileo, Japanese QZSS, Russian GLONASS, and Chinese BeiDou satellites.

Concurrent tracking of GPS (QZSS) and GLONASS or BeiDou, or concurrent tracking of GLONASS and BeiDou satellites increases performance for applications requiring maximum availability and accuracy. The chip is prepared for the European Galileo system through a future firmware upgrade once the constellation is fully available.

The platform will ultimately support special functions such as Automotive Dead Reckoning and precision timing to support a wide variety of vehicle, industrial and consumer applications.

To further improve acquisition performance, the globally available "AssistNow" assisted-GNSS service for accelerated positioning has been extended for M8 products; the service supports both GPS and GLONASS, and the validity of downloaded assistance data is now able to support offline operation for up to 35 days.

M8 chips feature low power consumption in concurrent reception mode, thanks to an innovative single-die architecture combined with sophisticated software algorithms. The extended supply voltage range and 1.8-V/3.0-V I/O compliance supports a wide variety of system architectures. Sophisticated radio architecture and interference suppression using active jamming detection ensure maximum performance even in GNSS hostile environments.

www.u-blox.com

AWR Connected™ for AMPSA
synthesis-through-simulation design flow

AWR Corporation and AMPSA recently announced AWR Connected™ for AMPSA, a synthesis-through-simulation design flow specifically developed to improve design throughput and productivity for amplifier designers.

AMPSA's software provides synthesis solutions for impedance-matching networks and high dynamic range RF and microwave amplifiers that integrate directly with AWR's Microwave Office® circuit design software. The control provided over the harmonic impedances in Version 10 of the IMW and ADW also facilitates the design of high-efficiency amplifiers.

The solution enables high-frequency circuit designers to get a jumpstart on their designs by first leveraging the AMPSA synthesis tool, consisting of Impedance-Matching Wizard (IMW) and Amplifier Design Wizard (ADW) environments, to find the best solutions for the designer to optimize. With AWR Connected for AMPSA, migrating from synthesis through to simulation (nonlinear harmonic balance) of amplifiers and related matching networks is a straightforward process.

www.ampsa.com

GaN transistors
offer superior gain, thermal management and efficiency
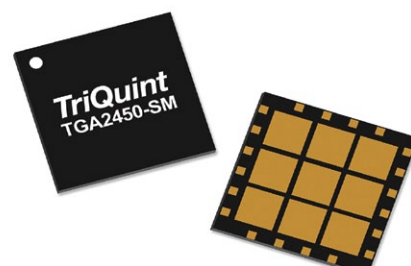
TriQuint Semiconductor has released gallium nitride (GaN) transistors that offer superior gain, thermal management and efficiency for commercial and defense RF amplifier designs.

Products span from optical modulator drivers, to a family of small cell amplifiers, to Spatium PAs that replace TWTAs, and the company's ever-growing portfolio of GaN based products and processes.

Two of the latest high-power GaN packaged transistors include the 200-W T1G4020036-FS/FL and the 285 W T1G2028536-FS/FL. Both devices offer excellent gain, which enables smaller RF amplifiers and reduced part-counts in many applications; both devices are widely exportable. The T1G2028536-FS/FL covers DC-2 GHz while the T1G4020036-FS/FL covers DC-3.3 GHz. Both devices are ideal for commercial and defense applications including professional communications, commercial and defense radars, avionics and RF test systems.

These GaN transistors are joined by GaN amplifiers and low-noise amplifiers that also deliver high efficiency and improved performance compared to competing products for wide-ranging commercial and defense applications.

www.triquint.com
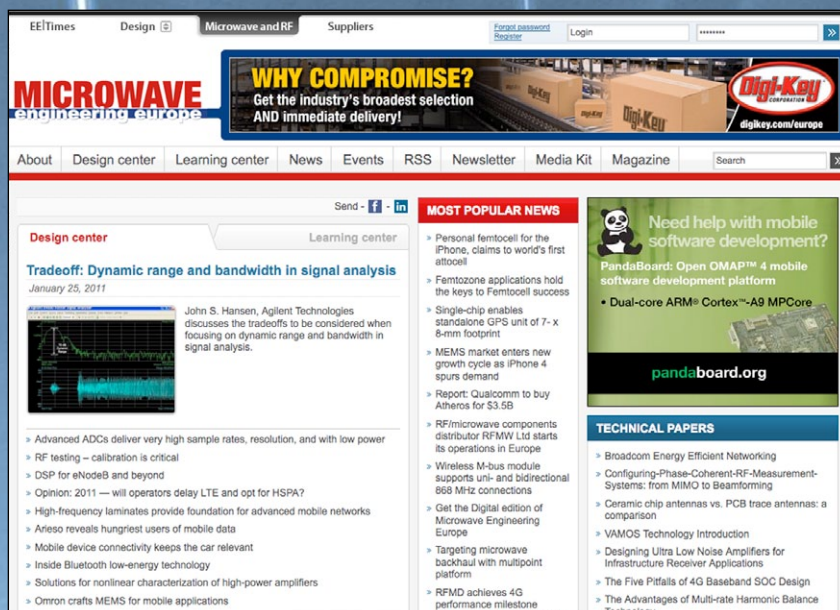
Your Global Link to the Electronics World