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This month's cover illustrates the continuing growth in wireless communications which is becoming a key part of everyday life for billions of people. The latest 4G networks are set to revolutionize the way we conduct business in almost every area of life.

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Sophisticated characterization techniques help power amplifier designers maximize the advantages of envelope tracking technology.

13 Low power RF: 3G RF chip with PAs...2.4 GHz transceiver draws under 10 mW...Radio chips for Smart Home evolution

14 National Instruments launches true software instrument set to revolutionize RF test
To address today's test bottlenecks in RF, National Instruments claim to offer the first true software instrument, the NI PXIe-5644R vector signal transceiver (VST). Not only does this instrument bring Moore's law to the test world but it can be customized down to firmware. The VST represents a class of instrument that is truly software designed, with capabilities limited only by the user's application requirements—not the vendor's definition of what an instrument should be. As RF DUTs become more complex and time-to-market requirements become more challenging, this level of instrument functionality shifts control back to the RF designer and test engineer.

16 Advanced radar systems design with Visual System Simulator
The VSS for radar systems provides an advanced simulation and verification platform that's required for the complex signal processing algorithms in today's radar systems, including the models needed for signal generation, transmission, antenna, T/R switching, clutter, noise, jamming, receiving, signal processing, and measurements. Through AWR Connected, VSS for radar systems also provides third party solutions for a robust algorithm modeling and debugging environment that supports a variety of languages such as C++, LabVIEW, MATLAB, and more.

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IN BRIEF

Enterprise small cells to catch up with DAS by 2016

The enterprise small cell market is roughly one-third of the DAS (distributed antenna systems) market today, however, with the growing popularity of small cells as a coverage option for small to medium enterprise, it will catch up with DAS by the 2016 timeframe.

According to ABI Research, both DAS and enterprise small cell equipment will each reach the $2 billion mark by 2016. Both markets are growing at a steady rate with DAS continuing to see deployments in large and medium sized public buildings, mostly above 150,000 square feet. However enterprise small cells will see most of their deployments in smaller buildings below 100,000 square feet.

As per ABI Research's estimates, in 2017 DAS systems will largely be driven by traditional macro base stations, repeaters, and remote radio heads. But close to one-fourth of DAS systems will be fed with small cells as they are easier to install, smaller in size, and cheaper than other solutions.

www.abiresearch.com

$19 million for public small cell hotspots

UK developer of 3G and LTE intelligent small cells Ubiquisys has raised $19 million to accelerate delivery of its tri-mode 3G/LTE/WiFi public small cell hotspot technology.

The oversubscribed funding round included new investors Mobile Internet Capital and Nissay Capital, together with existing investors including 5CCG/ Sallfort Privatbank AG, Accel Partners, Advent Venture Partners, Atlas Venture and Yasuda.

The Swindon-based company is building on its leadership position in residential and enterprise femtocells, where its adaptive radio technology has underpinned successful high volume deployments, working with more than 70 operators across the world and shiping in over 50,000 cells.

www.ubiquisys.com

Prototype 64-way antenna system saves power and spectrum

US researchers have unveiled a new 64-way multi-antenna technology that could help wireless providers keep pace with the demands of data-hungry smartphones and tablets. Designated Argos, the technology aims to dramatically increase network capacity by allowing cell towers to simultaneously beam signals to more than a dozen customers on the same frequency. The first implementation was described at the Association for Computing Machinery's MobiCom 2012 wireless research conference in Istanbul.

Argos was developed by researchers from Rice, Bell Labs and Yale University and the prototype uses 64 antennas to allow a single wireless base station to communicate directly to 15 users simultaneously with narrowly focused directional beams. In tests at Rice, Argos allowed a single base station to track and send highly directional beams to more than a dozen users on the same frequency at the same time, allowing carriers to increase network capacity without acquiring more spectrum.

"The key is to have many antennas, because the more antennas you have, the more users you can serve," said Argos project co-leader Lin Zhong, associate professor of electrical and computer engineering and of computer science at Rice. The theory for multi-user beamforming has been around for some time, but implementing technology has proven extremely difficult.

"There are all kinds of technical challenges related to synchronization, computational requirements, scaling up and wireless standards," he said.

Argos uses new techniques that allow the number of antennas on base stations to grow to unprecedented scales. The Argos prototype, which was built by Rice graduate student Clayton Shepard, uses an array of 64 antennas and off-the-shelf hardware — including several dozen open-access test devices called WARP boards that were developed at Rice's Center for Multimedia Communications. In tests, Argos was able to simultaneously beam signals to as many as 15 users on the same frequency. For wireless carriers, that performance would translate to more than a six-fold increase in network capacity. Zhong said the base-station design can be scaled up to work with hundreds of antennas and several dozen concurrent users.

"There's also a big payoff in energy savings," said Shepard. "The amount of power you need for transmission goes down in proportion to the number of antennas you have. So in Argos' case, we need only about one-sixty-fourth as much energy to serve those 15 users as you would need with a traditional antenna."

Zhong and Shepard said Argos is at least five years away from being available on the commercial market. It would require new network hardware and a new generation of smartphones and tablets. It might also require changes in wireless standards. Those are big hurdles, but Zhong said the potential benefits of multi-user beamforming technology make it a likely next big step for the wireless industry.

http://argos.rice.edu

Fraunhofer Institute develops smart wireless power outlets

An Internet-enabled power outlet developed by researchers at the Fraunhofer Institute for Communication Systems ESK in Munich will allow users to control household appliances via their smartphone, and reduce their energy costs into the bargain. The smart socket was developed in collaboration with the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern and the industrial partner embedded brains GmbH.

The solution means that soon there will be no need for special timers to switch lighting on and off or operate household appliances when the homeowner is absent. In future, all this can be done by means of a smartphone or PC, thanks to Internet-enabled wireless power outlets that support the new IPv6 Internet protocol.

The wireless power outlets are a component of the HexaBus home automation system that was developed by the ITWM as part of the mySmartGrid project (www.mysmartgrid.de).

www.fraunhofer.de/en.html

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Bringing Moore's law to test and measurement

At the last NI week in August this year the company unveiled an instrument that claims to represent a new paradigm in how engineers approach test. The NI PXIe-5644R vector signal transceiver (VST) is purported to be the first true software based instrument available. It is described in more detail on pages 14 and 15.

Not only does the VST dramatically improve test times (an order of magnitude and more in many cases) but it also makes possible test scenarios that were previously too complex to attempt. The instrument is much smaller than conventional boxes, even those that are software programmable and consumes barely 60 W.

Key to the VST is that it can be programmed down to its firmware or as National Instrument's puts it 'engineers are able to touch the pin through software'. Practically, this enables engineers to custom design their test scenarios to suit their needs, they can even change the nature of the beast by programming the VST to do everything differently. However, the instrument will work as is, without any programming as well, combining a vector signal generator (VSG) and vector signal analyzer (VSA) with FPGA-based real-time signal processing and control into a single PXI modular instrument.

By allowing engineers to customize test to whatever level they choose and by bringing dramatic improvements in test speed through a different architectural approach, the VST challenges every traditional test box in the way test is done. I do not expect traditional test to change much, but at the high end where traditional approaches are struggling the VST offers another way of solving complex test problems. The improvement in speeds and costs will also enable test coverage to be significantly improved.

Although there are software instruments available, none claim the performance, size and power benefits offered by the VST and its ability to be completely customized. Before, the architecture of the instrument limited both its form and function. Now the architecture has been put into an FPGA silicon fabric and has become software based.

This is an exciting development and it will set the stage for a different approach to test where Moore's law can be brought to bear on complex, time consuming or intractable test problems.

Jean-Pierre Joosting
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www.microwave-electronics.com

IN BRIEF

Startup demos 60-GHz Wi-Fi

Nitero (Austin, Texas), a fabless chip company with Australian roots, has announced it has begun demonstrating 60-GHz, multi-gigabit Wi-Fi ICs for mobile devices to selected companies. The names of the companies that Nitero is demonstrating to was not revealed

Nitero, founded in 2011, also announced that Trailblazer Capital has joined Southern Cross Venture Partners and Austin Ventures in the latest round of funding. It is reported that Nitero raised $3.1 million in the latest round.

The company is developing chips that can operate at multi-gigabit rates over distances of a few meters or less. This is expected to be fundamental to a market for docking stations, computer displays and other peripheral devices that will then be able to stream video wirelessly.

www.nitero.com

US intelligence interested in Lime Micro's flexible radio technology

UK chip designer Lime Micro has signed a partnership with an independent, non-profit organisation that identifies innovative technology for the US Intelligence community.

The partnership with investment firm In-Q-Tel (IQT) will fund advances in multi-band, flexible transceiver technology to be deployed in commercial and government markets, and the creation of new systems that can be used across a diverse array of applications.

"IQT's partners require exceptional reliability, high performance and a proven product, so the partnership is a significant validation of both our transceiver and our stringent manufacturing and testing procedures," said Lime CEO, Ebrahim Bushehri. "Furthermore, it demonstrates application of our technology in multiple markets where performance and reliability are of prime importance."

www.limemicro.com

Research in molybdenum disulfide sparks new applications

Molybdenum disulfide, used for many years as an industrial lubricant, promises to become another 2-D platform for electronic devices on par with graphene, itself a 2-D platform for new electronic devices. Last year scientists at the Swiss university EPFL produced a transistor on the MoS_2 material. Meanwhile researchers at the Massachusetts Institute of Technology have succeeded in making a variety of electronic components from MoS_2. The researchers claim the material could help usher in radically new products, from whole walls that glow to clothing with embedded electronics to glasses with built-in display screens.

"It's the most exciting time for electronics in the last 20 or 30 years," said Tomás Palacios, the Emmanuel E. Landsman Associate Professor of EECS who thinks graphene and MoS_2 are just the beginning of a new realm of research on two-dimensional materials.

The MIT researchers found making progress with graphene difficult because that material lacks a bandgap, and MoS_2 comes with one. The lack of a bandgap means a switch made of graphene can be turned on, but not off. "That means you can't do digital logic," said researcher Han Wang.

Researchers have been searching for a material that shares some of graphene's extraordinary properties and has a bandgap, and molybdenum disulfide does.

Wang and Palacios were able to fabricate an inverter; a NAND gate; a memory device; and a ring oscillator, made up of 12 interconnected transistors, which can produce a precisely tuned wave output.

Also, by using one-molecule thick MoS_2 material for transistors in large-screen displays to control each pixel of a display eliminates millions of atoms-thick silicon used in conventional transistors, potentially reducing cost and weight and improving energy efficiency, claim the researchers.

Further on, the material could be used, in combination with other 2-D materials, to make light-emitting devices lighting up an entire wall as well as for antenna and other circuitry of a cellphone being woven into the fabric of clothing, according to the researchers.

Solid state MASER operates at room temperature

Scientists in the UK have developed the first solid-state MASER to operate at room temperature, paving the way for its widespread adoption.

The researchers from the National Physical Laboratory (NPL) and Imperial College London suggest that room-temperature MASERs could be used to make more sensitive medical instruments for scanning patients, improved chemical sensors for remotely detecting explosives; lower-noise read-out mechanisms for quantum computers and better radio telescopes. The microwave equivalent of a laser, masers deliver a concentrated beam of microwaves by amplifying microwaves using hard inorganic crystals such as ruby. But they have always required extreme conditions such as extremely low pressures or temperatures close to absolute zero (-273.15°C), as well as strong magnetic fields from large magnets.

The team have demonstrated pulse masing in a solid-state device working in air at room temperature with no applied magnetic field. This could dramatically reduce the cost to manufacture and operate a MASER, which could lead to them becoming as widely used as laser technology.

The team used a completely different type of crystal, namely p-terphenyl doped with pentacene, to replace ruby and replicate the same masing process at room temperature. As a curious twist, the pentacene dopant turns the otherwise colourless p-terphenyl crystal an intense reddish pink. The first device only works in pulsed mode for fractions of a second at a time. They aim to get it to operate continously over a range of microwave frequencies, instead of its current narrow bandwidth, which would make the technology more useful.

In the long-term, the team have a range of other goals including the identification of different materials that can mase at room temperature while consuming less power than pentacene-doped p-terphenyl. The team will also focus on creating new designs that could make the MASER smaller and more portable.

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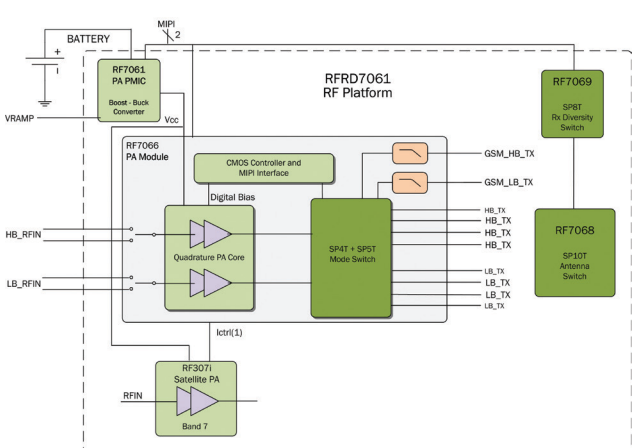

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IN BRIEF

One phone in five to have facial recognition by end of 2012

By the end of 2012, almost 20% of annual smartphone shipments will include facial recognition capabilities, according to new data from ABI Research.

In five years' time, shipments of smartphones and tablets with the technology will increase to 665 million annually. Currently, only Google's Ice Cream Sandwich and Jelly Bean mobile operating systems support the technology in significant volumes. The Samsung Galaxy SIII is one of the most notable smartphones to feature this technology. Over the next two to three years, many more operating systems and mobile OEMs will incorporate the technology.

www.abiresearch.com

European commercial In-Vehicle Telematics to triple by 2016

The number of active fleet management systems is set to grow 17.9 percent a year from 2.5 million units at the end of 2011 to 5.7 million by 2016 says new research from Berg Insights.

The research suggests that the European fleet management market has entered a growth period that will last for several years to come, though individual markets may suffer temporary setbacks, depending on the local economic developments. The penetration rate in the total population of non-privately owned commercial vehicles is estimated to increase from 8.8 percent in 2011 to around 20.1 percent in 2016.

Commercial vehicle fleets play an essential role in the European economy. According to official statistics, there were 35.5 million commercial vehicles in use in EU23+2 in 2008. The 6.2 million medium and heavy trucks accounted for more than 75 percent of all inland transports, forming a € 250 billion ($308 billion US) industry.

www.giiresearch.com

Researchers print wireless power antenna for less than 1 cent

Researchers in Korea have developed a low cost technique to print antennas that can be used to deliver power wirelessly.

The rectenna (rectifying antenna) design couples with an AC field to provide a DC output to power devices such as sensors. The design, by researchers at the Printed Electronics Engineering programme of Sunchon National University and the Paru Printed Electronics Research Institute in Sunchon, can even harvest the energy radiated by mobile phones to power devices.

This could allow sensor networks such as RFID tags, price tags, smart logos, signage and sensors could be fully interconnected and driven by DC power of less than 0.3 W.

"What is great about this technique is that we can also print the digital information onto the rectenna, meaning that everything you need for wireless communication is in one place," said Gyoujin Cho, co-author of the study Gyoujin Cho. "Our advantage over current technology is lower cost, since we can produce a roll-to-roll printing process with high throughput in an environmentally friendly manner. Furthermore, we can integrate many extra functions without huge extra cost in the printing process."

The DC power is inductively coupled AC from a 13.56 MHz power transmitter through a rectenna, consisting of an antenna, a diode and a capacitor, which would be cheap to integrate with inexpensive smart electronic devices. To integrate the rectenna with a minimum cost, a roll-to-roll (R2R) gravure printing process has been considered to print the rectenna on plastic foils.

The researchers show that the R2R gravure printing system including printing condition and four different nanoparticle based inks is able to print the rectenna (antenna, diode and capacitor) on plastic foils at a printing speed of 8m per minute and more than 90% device yield for a wireless power transmission of 0.3 W using a standard 13.56 MHz power transmitter. This translates to an antenna cost under 1¢.

http://paru.co.kr/en/main.html

Terahertz emitter leverages 45-nm CMOS

Millimeter wavelength alternatives to traditional X-rays are already using terahertz-range frequencies to safely scan passengers, luggage and cargo at airports, albeit using bulky discrete devices. Silicon-based terahertz range emitters and detectors could downsize millimeter wave devices for a wide variety of applications beyond airport security, including safer medical imaging along with industrial and environmental applications aimed at detecting hazardous substances.

Earlier this year, Semiconductor Research Corporation (SRC, Research Triangle, N.C.) sponsored research demonstrating a CMOS detector operating in the terahertz range. Now, Texas Instrument's has demonstrated a companion terahertz-range emitter created in cooperation with the SRC-sponsored Texas Analog Center of Excellence at the University of Texas at Dallas. TI's terahertz-range emitter uses a phase-locked loop (PLL) to stabilize its frequency, a necessity for making millimeter wavelength systems in CMOS commercially feasible.

"This is the highest frequency ever demonstrated for a phase-locked loop," claimed Brian Ginsburg, a design engineer at TI's Kilby Labs. "Stabilizing these ultra-high frequencies is [the] key to the future commercial success of millimeter wavelength CMOS applications [and] PLLs are fundamental to all high-performance electronics."

The demonstration used an on-chip antenna that emits 390-GHz frequencies, but the researchers believe that improvements will enable the CMOS emitter to reach 600 GHz or higher using TI's 45-nm process technology.

"The [Federal Communications Commission] defines the terahertz range to be from 300 GHz to 3 THz," said Eunyoung Seok, a design engineer at TI's Kilby Labs. "For the future, we want to use our 45-nanometer process to cover more of this wider frequency range, as well as to increase our output power."

The current demonstration chip operates at 390 GHz using a multiplying PLL architecture with two frequency dividers in the feedback loop. The power emanating from the on-chip antenna was 2.2 microWatts.

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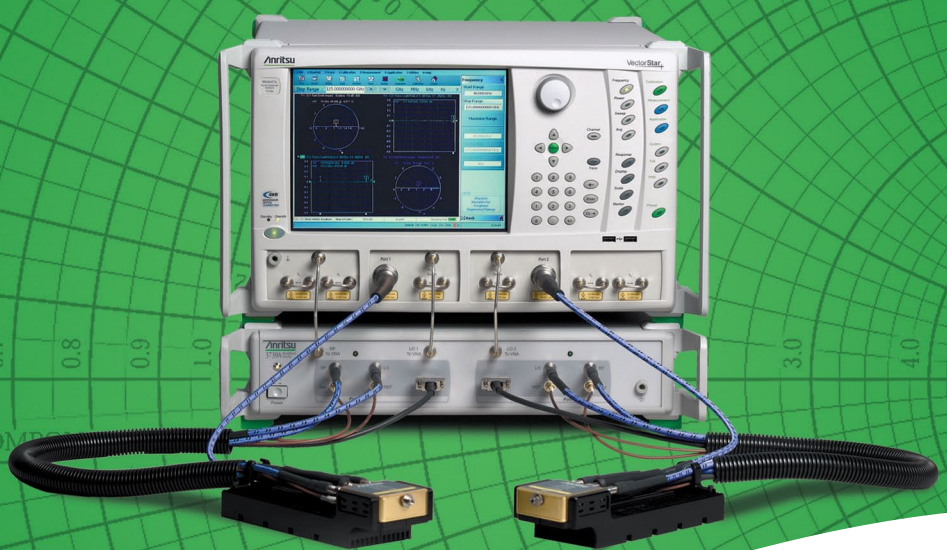

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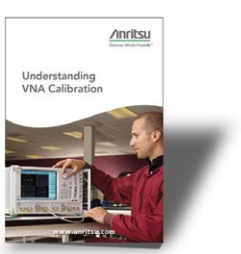

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Practical solutions for envelope tracking power amplifier characterization

Gerard Wimpenny, Chief Technology Officer, Nujira

Envelope tracking brings many advantages to power amplifier design, ranging from higher efficiency to increased output power, improved operation into mismatched loads and insensitivity to temperature variations. But, while the criteria and metrics for designing traditional fixed supply power amplifiers (PAs) are well defined and known, for Envelope Tracking (ET) PAs there is added complexity requiring more sophisticated characterization techniques.

Envelope Tracking essentials

ET is a technique used to improve the efficiency of power amplifiers carrying signals with high peak to average power (PAPR). High PAPR signals, like LTE transmissions for example, are needed to achieve high data throughput within limited spectrum resources.

Whilst traditional fixed supply PAs are highly inefficient under these conditions, efficiency is vastly improved by varying the PA supply voltage in synchronism with the envelope of the RF signal – this is Envelope Tracking.

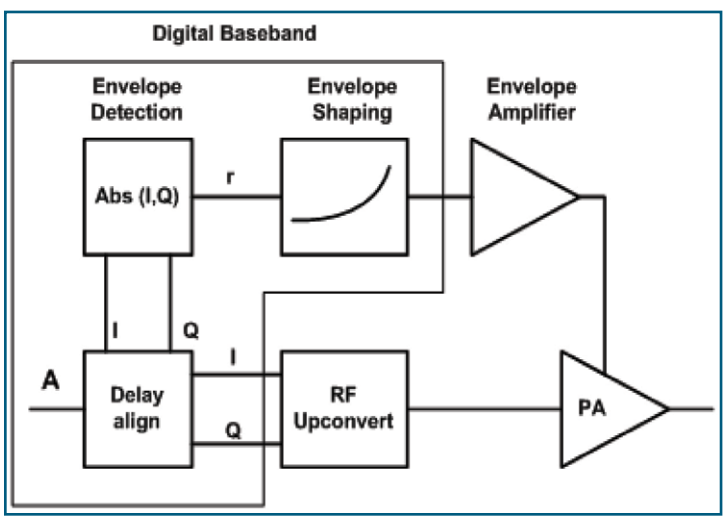
The challenge for designers is that when operating in ET mode the PA's fundamental output characteristics (power, efficiency, gain, phase) now depend on the complex interplay of two 'control' inputs: RF input power and supply voltage.

The first step in such a design is to build a simple 'quasi static' behavioural model of the PA: one that ignores memory effects. This can be constructed from AM/AM and AM/PM characteristics and, along with other key PA metrics such as power and efficiency, are profoundly influenced by the mapping between instantaneous RF envelope and applied supply voltage. In an ET system this mapping is determined by the contents of a 'shaping table' in the envelope path (see Figure 1)

Definition of the shaping table requires measurement of the PA's fundamental characteristics (output power, efficiency, gain and phase) over the full range of supply voltage and input power.

These values could be measured using a continuous-wave network analyzer and a

Figure 1: Envelope tracking PA system.



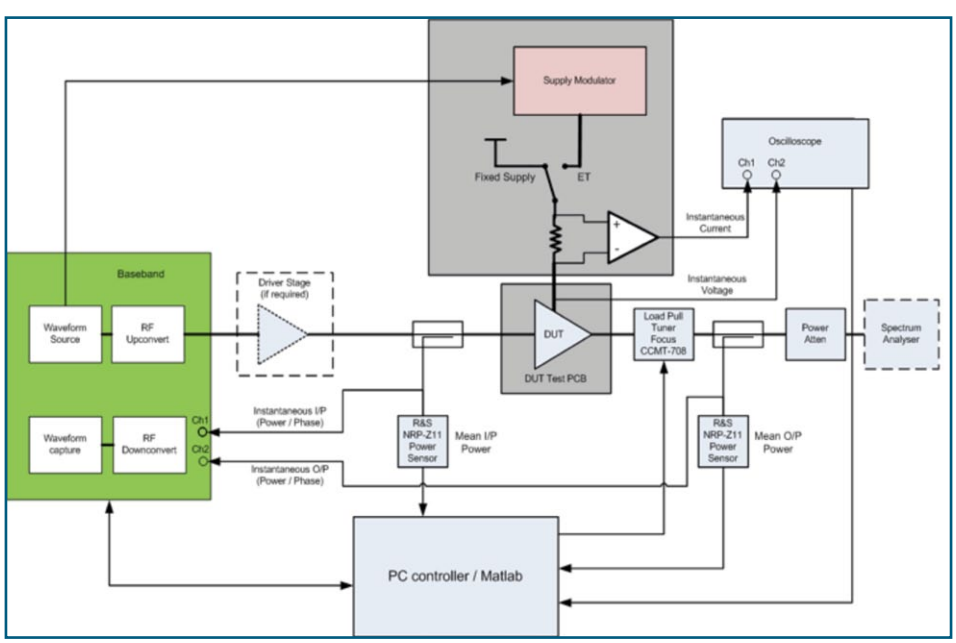


Figure 2: ET PA Characterization bench.

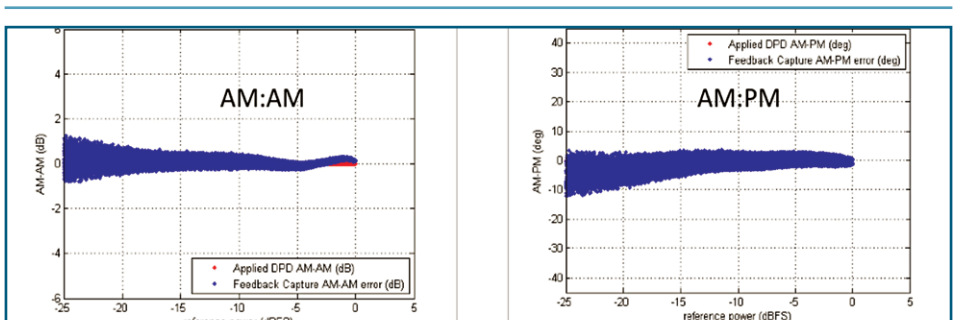


Figure 3: ET PA AM/AM and AM/PM after shaping table definition.

variable DC supply. However, this technique generally provides unsatisfactory results for ET PAs. Thermal effects, ranging errors, drift in phase measurements mean that it is not possible to capture accurate enough data. It is also far too slow to allow load-pull techniques to be used.

Instead of continuous-wave techniques, a pulse characterization solution could be implemented using ATE controlled standard test equipment. This avoids the need for a high bandwidth, low impedance supply; and it's sufficiently fast to make load pull viable. However, a critical drawback of the pulse testing approach is that it is difficult to make accurate phase measurements.

This leaves no alternative but to use real waveforms, varying the shaping table to allow all combinations of input power and supply voltage to be measured. This introduces the cost and complexity of a power supply modulator, but is very fast and enables accurate phase information to be gathered. A further advantage is that it can also be used to characterize memory effects.

A practical setup emulates transceiver signals by generating synchronised RF and envelope waveforms. An ET modulator is used to supply the PA under test, and a high precision current probe is used to capture instantaneous voltage and current, while the PA supply voltage is being dynamically modulated using real ET waveforms.

Fast RF power meters are connected to the input and output of the PA, allowing the system to compute instantaneous power amplifier efficiency.

'Basic' ET PA characterization can be used to create a quasi-static (i.e. memoryless) data model of the PA having output power, phase and efficiency as outputs and input power and supply voltage as inputs. Application software running in MATLAB allows the shaping table to be defined, and the model can then be used to predict PA system performance parameters such as adjacent channel power ratio (ACPR), error vector magnitude (EVM) and instantaneous efficiency for standard test waveforms.

In addition to being used for PA device level characterization, the same hardware can be used for direct verification of PA system performance using the defined shaping table (see Figure 3). Such measurements can also be used to identify sources of non-linearity.

For example, with higher bandwidth waveforms PA memory effects can become significant. This is because PA output parameters such as efficiency, AM/AM and AM/PM distortion now depend on signal history, so time becomes a factor as well as instantaneous input power and supply voltage. Memory effects show up in the PA characterization as a 'broadening' of the AM/AM and AM/PM characteristics and can result from electrical time constants in input or output bias circuits and physical interconnects, thermal time constants associated with local die heating, or technology specific 'charge storage' effects.

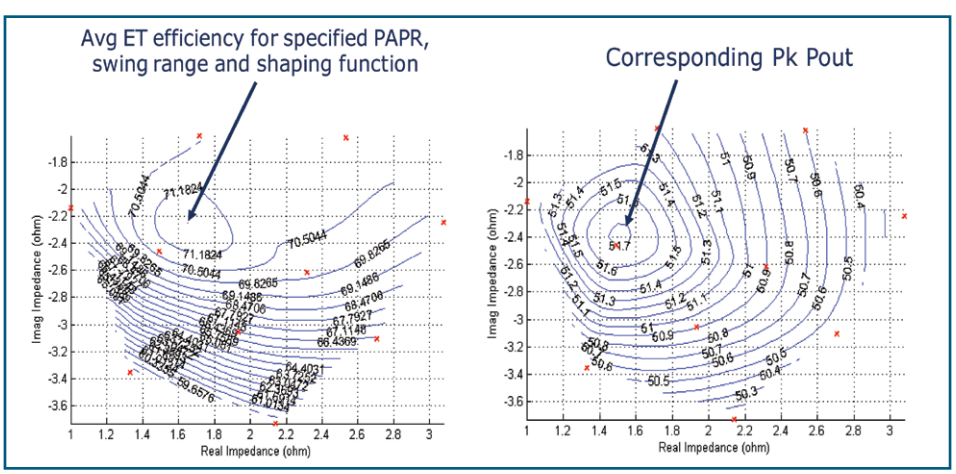
Efficiency Optimization

To fully optimize the efficiency of an envelope tracking PA, the device characterization can be extended to include sweeping the load impedance (fundamental or harmonic load-pull) in addition to input power and supply voltage. Analysis of the large dataset produced by such a characterization can be automated (e.g. using MATLAB) to predict the average PA efficiency when operating with a specific set of ET parameters. For example, using this characterization methodology it is possible to predict how a PA's average efficiency varies with shaping function, output voltage swing range, back off from maximum power and waveform statistics when operated in ET mode (see Figure 4).

Self linearization with ET

It is commonly expected that ET PA performance over temperature will vary more than with fixed supply counterparts. Characterisation using a modulated power supply shows that the reverse is true: unlike a fixed supply PA, an ET PA's performance is much less sensitive to changes in gain of the RF chain driving the PA than it is to changes in the supply voltage. As the characteristics of the supply voltage can be much better controlled over temperature than RF gain, little variation in PA linearity is observed for extreme temperature variations (See Figure 5).

Figure 4: ET average Efficiency and PA Output power load pull contours.



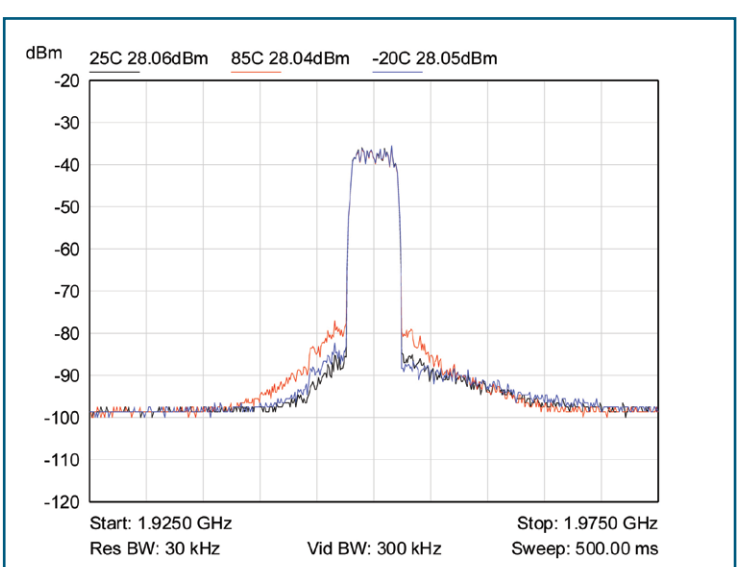


Figure 5: ET PA ACLR vs. Temperature over the extended -20-+85°C temperature range.

Another counter-intuitive characteristic of ET PAs is apparent when the test bench emulates a real-world handset environment, where the load impedance presented to the PA is poorly controlled owing to reflections from nearby objects. This can result in the PA having to work into load mismatches as high as 3:1 VSWR. The ET PA's 'self linearization' principle observed with temperature variations can also apply under high VSWR conditions, resulting in significantly improved EVM and ACPR performance compared with the same PA operated in fixed supply mode (see Figure 6).

In ways like this, the use of a test environment that sweeps supply voltage as well as input power can reliably predict system performance of envelope-tracking PAs. Collecting substantially more data than fixed-supply measurements demonstrates that, in contrast with fixed supply PAs, the performance of an ET PA is not 'self contained'. Using an appropriate 'system characterization' bench not only allows designers to optimise the system efficiency benefits of operating PAs in envelope tracking mode, but also quantify other useful system benefits, such as increased output power, improved operation into mismatched loads, and insensitivity to temperature variations.

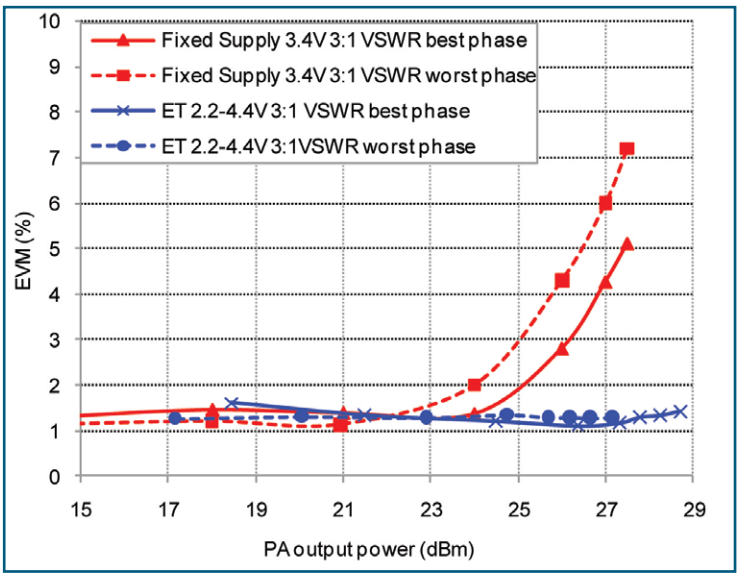


Figure 6: Comparison of EVM versus backoff for ET and fixed supply PAs operating into 3:1 VSWR load mismatch.

True global phone chip platform supports both WCDMA and TD-SCDMA

Marvell is claiming to be the first with a breakthrough global 3G chip platform supporting both WCDMA and the Chinese TD-SCDMA standards.

The single unified 3G platform features a single-chip application and communications processor System-on-Chips (SoCs) combined with Marvell's latest Wi-Fi + Bluetooth + FM radio + Near Field Communications (NFC) + GPS chip, RF transceivers and integrated PMIC solutions for both TD-SCDMA and WCDMA markets. With pin-to-pin compatibility, OEMs can use the same printed circuit board and ID designs, and operating system, application and multimedia software to address both the WCDMA and TD-SCDMA market. Engineering samples are available now.

Designed specifically for the China 3G TD-SCDMA market, the 1.2 GHz dual core ARM Cortex A9 PXA988 is the next generation of the highly ubiquitous PXA920 family of mobile processors that powers millions of smartphones in China. It is equipped with an integrated image signal processor (ISP), advanced graphics processing unit (GPU) that can achieve 192 million triangles per second (MT/s) and a breakthrough 533 MHz LPDDR2 memory architecture for enhanced CPU and system performance. The PXA988 features a TD-HSPA+ R8 modem which supports dual-carrier aggregation and represents the next-generation of TD-SCDMA technology. The new advanced modem also supports Dual SIM Dual Talk, which enables users to activate two services on a single smartphone, and Downlink Dual Carrier (DLDC).

The PXA986 1.2 GHz dual-core mobile processor was designed for WCDMA markets and is pin-to-pin compatible with the PXA988, effectively streamlining and reducing costs for OEM design cycles. Powered by the identical high-performance application processor subsystem as the PXA988, OEMs can seamlessly re-use their operating system and multimedia software across both mobile platforms to minimize design resources and decrease time to market. The PXA986 features a HSPA+ R7 modem, which supports 21.1 Mbps download data-rate and 5.76 Mbps upload data-rate, making it a viable solution for 4G smartphones.

www.marvell.com

3G RF chip with PAs...2.4 GHz transceiver draws under 10 mW...Radio chips for Smart Home evolution

By Jean-Pierre Joosting

Intel adds power amplifiers to 3G RF chip

Intel Corporation has announced the integration of a 3G HSPA radio frequency transceiver with power amplifiers on a single 65-nm die.

The chip is designed in a standard 65-nm foundry process as offered by GlobalFoundries, Taiwan Semiconductor Manufacturing Co. Ltd., and United Microelectronics Corp., said Stefan Wolff, vice president of the Intel Architecture Group.

The Smarti brand is used for all Intel mobile communications cellular RF transceiver products and was established more than 10 years ago by Infineon Technologies AG. The brand was acquired by Intel with the Infineon wireless business unit. The SMARTi UE2p integrates power management and sensors and allows direct connection to the battery. The chip supports multiple 3G dual-band configurations for use with Intel's HSPA modem chips.

"This will allow our customers to introduce lower-cost 3G handsets and support the transition of the machine-to-machine market segment toward 3G-based connected devices to help enable the Internet of things," said Wolff.

The Smarti UE2 is proven product that has shipped in various high end smartphones, UE2 stands for UMTS/EDGE 2nd generation. The p has been added for the integrated 3G power amplifiers.

A specification is available but only under a non-disclosure agreement and for selected customers, according to Wolff. The specification is not intended to be published.

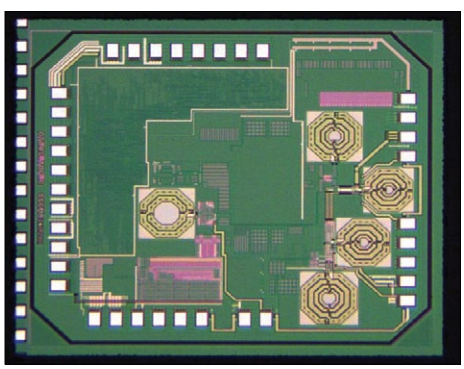
Intel said the Smarti UE2p chip would be available as samples in the fourth quarter of 2012.

www.intel.com

2.4 GHz transceiver platform draws less than 10 mW

The IcyTRX developed by CSEM is a new transceiver platform that consumes less than 10 mW and is well suited to ultra-low power RF applications such as Bluetooth low energy, WirelessHART, and IEEE802.15.4.

The IcyTRX platform has been designed with the goal of reducing power consumption well beyond the state of the art, as well as allowing the use of small coin cell batteries, thus extending battery life and miniaturization far beyond that obtainable today.



In addition to a market-leading power consumption of less than 8 mA at 1.2 V, IcyTRX offers a highly integrated design avoiding external matching components. With a footprint under 2mm^2, the chip supports a variable data rate of up to 2 MBits/s. Designed in a standard digital 90-nm CMOS process, the IC is available as a silicon-proven IP and under license for integration into RF SoCs. Samples are available now.

www.csem.ch

Radio chips target Smart Home evolution

GreenPeak Technologies is expanding the company's Smart Home RF communications semiconductor portfolio and customer target base by rolling out new radio chips that support the full range of ZigBee networking technologies. The technologies include ZigBee Pro, ZigBee IP, RF4CE and ZigBee Green Power. GreenPeak ZigBee chips are already integrated into leading cable industry set-top boxes to enable power saving and long range RF based connections for remote controls.

"Working closely with the leading operators and their suppliers, we will enable the Smart Home market – starting with Smart Home enabled set-top boxes/gateways and providing solutions for devices that will connect to it – including home security, home care, appliances, energy monitoring and control, etc.," said Cees Links, Founder and CEO of GreenPeak Technologies. "Once these systems are connected to the set-top box /gateway, operators will be enabled to provide the Fifth Play services for the Smart Home."

Wireless networks have existed in our homes for decades. Cordless phones and wireless data networks like Wi-Fi are commoditized applications in our daily lives. Today, a new wireless network of home applications is emerging and addresses low power consumption, low data rate sense and control applications like remote controls, energy efficiency, home security, access control, HVAC monitoring, lighting, home health care, etc.

"The first phase of the Smart Home has begun – proprietary stand-alone applications, like stand-alone thermostats, wired security devices, IR-remote controls, etc., but so far, few of them are connected to the internet," added Links. "The next phase is where these devices migrate to using the open ZigBee standard based communication technology and connect via the set-top box to the Internet. The final phase will arrive when these devices together create an environmental aware, safe and secure, and energy efficient home that can be managed via Smart Phones and mobile devices over the net, from any location."

For example, the company's GP510 communication controller chip supports all communication between ZigBee RF4CE enabled devices and the set-top box or gateway. It addresses the increasing market demand for making the set-top box the ZigBee RF4CE hub for the home. The GP510 is optimized for low cost BOM while providing superior range and reliability.

Superior Wi-Fi interference robustness in combination with patented antenna diversity technology results in approximately twice the reliable range (compared to similar systems with only one antenna) in a crowded wireless 2.4 GHz environment, enabling full home coverage. The integrated RF filtering simplifies the RF design complexity which enables low cost single layer applications using simple PCB antennas requiring no shielding and a minimum number of external components.

www.greenpeak.com

National Instruments launches true software instrument set to revolutionize RF test

By Jean-Pierre Joosting

Moore's law has been a driving force in electronics since the first integrated circuit. However, test and measurement has not benefitted to the same degree — largely dominated by vendor-specific test boxes and modules. Software-based instruments exist today but such instruments are still designed with a view to the vendor-specific test paradigm and remain programmable in a limited sense. Four key factors define the effect of Moore's law: smaller size, faster operation, lower power consumption and higher integration with increased functionality. This process is illustrated by the evolution of the first wireless handset through to today's smartphones. Ideally a software instrument comprises code that defines the instrument, which runs on a common silicon fabric. Such an instrument is completely programmable and can reuse common code blocks that represent certain functions. Other code blocks can be added to integrate other software instruments. Software instruments are the code and vice versa. Completely customizable, software instruments can be integrated and configured as needed to address a specific test scenario. Code is simply loaded onto the silicon as required.

Two key tends are also pushing for faster test, those of increasing complexity and data rates. Complexity increases the number of test scenarios that need to be covered thereby increasing test times. Faster data rates are making it harder to find anomalies such as glitches. The need for faster and more intelligent test is required to address these needs.

Standards are also posing problems. Firstly, there are too many of them and new standards keep emerging. Engineers are faced with maintaining interoperability with earlier standards while trying to deal with the latest and emerging standards. Further, engineers are being pushed to develop devices and systems while the standards are still being laid down. This parallel development requires test vendors to be ahead of the standards curve, a position that is extremely difficult to maintain. Designers still have to wait for test vendors to come out with a box or module to address their requirements. Some are forced to get into the business of building custom test instruments, a time consuming process that detracts from the core project goals.

With a true software instrument, engineers could customize the instruments needed to a specific task and load the code onto a silicon fabric. Software reuse would reduce the programming burden significantly and still allow test to be faster, take less space and be specific to the requirements of the design flow.

To address today's test bottlenecks in RF, National Instruments claim to offer the first true software instrument, the NI PXIe-5644R vector signal transceiver (VST). Not only does this instrument bring Moore's law to the test world but it can be customized down to firmware. Engineers can 'touch the pins' through code.

The instrument features a software-centric architecture and represents a new era in which engineers and scientists can use LabVIEW to tailor open, field-programmable gate array (FPGA)-based hardware for their specific needs.

The vector signal transceiver is a new class of instrumentation that combines a vector signal generator (VSG) and vector signal analyzer (VSA) with FPGA-based real-time signal processing and control into a single PXI modular instrument. A user-programmable FPGA allows custom algorithms to be implemented directly into the hardware design of the instrument. This software-designed approach allows a VST to have the flexibility of a software-defined-radio (SDR) architecture with RF instrument class performance. Figure 1 illustrates the difference between traditional approaches to RF instrumentation and a software-designed approach with a VST.

The NI PXIe-5644R vector signal transceiver.

Ideal for testing the latest wireless and cellular standards such as 802.11ac and LTE, the VST features up to 6.0 GHz frequency coverage and 80 MHz instantaneous RF bandwidth, more than 10 times faster measurements than comparable solutions, and can easily be expanded to support multiple input, multiple output (MIMO) configurations or parallel testing in a single PXI chassis. Further, engineers can transform the vector signal transceiver into a different instrument or enhance its existing functionality using LabVIEW system design software.

Testing 802.11ac

VSTs offer both the fast measurement speed and small form factor of a production test box combined with the flexibility and high-performance expectation of instrument-grade box instruments. The transmit, receive, baseband I/Q, and digital inputs and outputs all share a common user-programmable FPGA, which reduces complexity, boosts measurement speed and increases flexibility in how the instrument is used. This gives the VST the ability to test

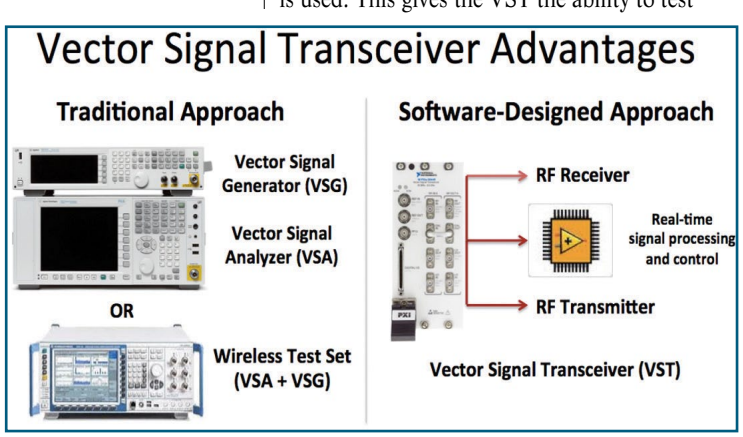


Figure 1: Software-designed approach of a VST versus traditional approaches.

standards such as 256 QAM 802.11ac with an error vector magnitude (EVM) of better than -45 dB (0.5%) at 5.8 GHz. Compared to the current industry 'gold standard' this represents an improvement of 3 db in EVM, along with an improvement in measurement speed by 20 fold.

Testing power amplifiers

To accurately calibrate a PA, a power-level servo feedback loop is used to determine the final gain. Power-level servoing captures the current output power with an analyzer and controls the generator power level until desired power is achieved, which can be a time-consuming process. In simplest terms, it uses a proportional control loop to swing back and forth in power levels until the output power-level converges with the desired power. A VST is ideal for power-level servoing because the process can be implemented directly on the user-programmable FPGA, resulting in a much faster convergence on the desired output power value (Figure 2).

The software instrument approach implemented in the VST reduces the test time of typically 5 seconds per measurement in this case to around 5 ms. This represents an improvement of three orders of magnitude by just moving the instrument into an FPGA (Figure 3).

2x2 MIMO channel emulation

In this test setup, engineers can now program fading models used to simulate air interference, reflections, moving users, and other naturally occurring phenomenon that can hamper an RF signal in a physical radio environment into the FPGA to implements a real-time radio channel emulator.

Figure 4 shows a 2x2 MIMO radio channel emulator implemented using two VSTs in LabVIEW. Settings for the fading models are shown on the left and in the center of the screen. The resulting RF output signals from the fading models were acquired with spectrum analyzers and are displayed on the right. These spectral graphs clearly show the spectral nulls that have resulted from the fading models.

Conclusion

VST software is built on LabVIEW FPGA and the NI RIO architecture, and features a multitude of starting points including application IP, reference designs, examples, and LabVIEW sample projects. These starting points all feature default LabVIEW FPGA personalities and prebuilt FPGA bit-files to get started quickly — bringing unprecedented levels of customization to high-end instrumentation.

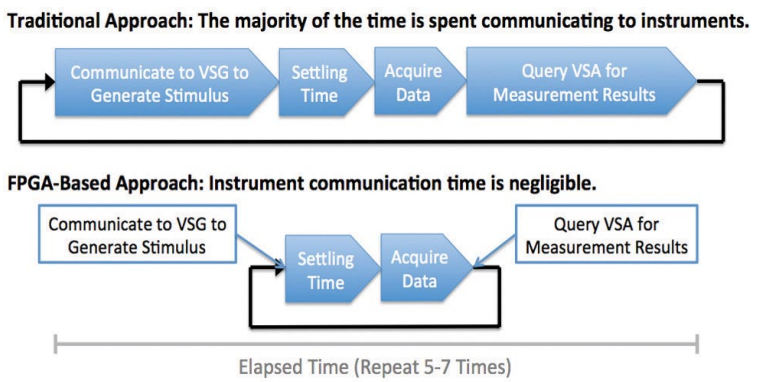


Figure 2: Power-level servoing with a VST results in much faster convergence on the desired output power.

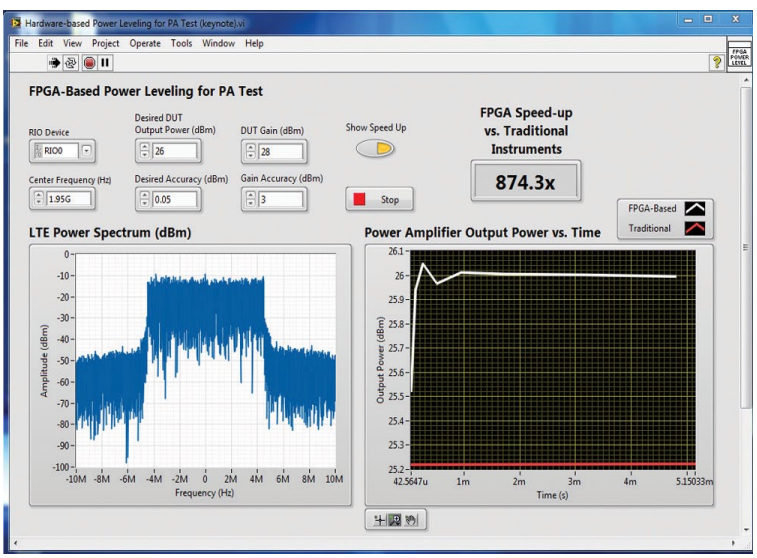


Figure 3: Screenshot showing the performance improvement achieved using a VST versus traditional test setup.

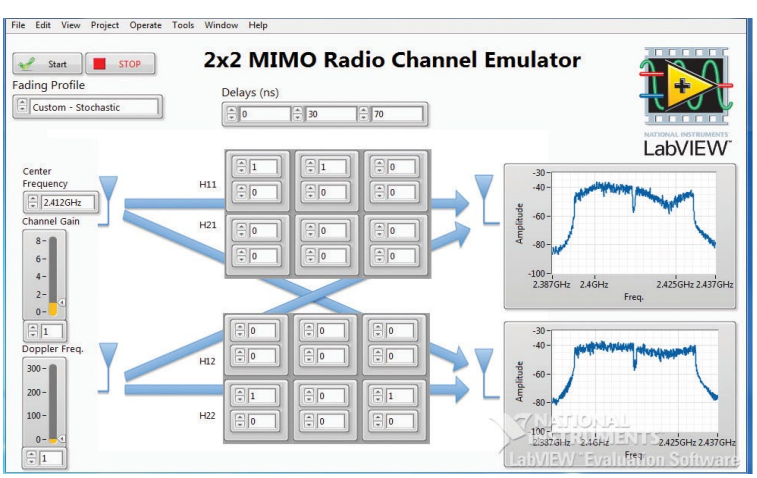


Figure 4: 2x2 MIMO radio channel emulator implemented using two VSTs.

LabVIEW is well suited for FPGA programming because it clearly represents parallelism and data flow, so users who are both experienced and inexperienced in traditional FPGA design can productively apply the power of reconfigurable hardware.

The VST represents a class of instrument that is truly software designed, with capabilities limited only by the user's application requirements—not the vendor's definition of what an instrument should be. As RF DUTs become more complex and time-to-market requirements become more challenging, this level of instrument functionality shifts control back to the RF designer and test engineer.

The PXIe-5644R delivers typically over 10 times faster measurements than comparable solutions and can replace multiple traditional instruments at a fraction of the cost and size, while consuming under 60 W of power. By bringing true software instrumentation to the market National Instruments has set off a revolution in how engineers approach test in the RF world.

Advanced radar systems design with Visual System Simulator

By AWR, www.awrcorp.com/vss

Modern radar systems are very complex and typically operate in challenging environments with unpredictable conditions such as clutter, noise, and jamming. These systems depend heavily on signal processing algorithms to mitigate the effects of noise and interference.

AWR's Visual System Simulator™ (VSS) radar offering provides advanced design capabilities that enable detailed behavioral modeling of the RF and signal processing of radar systems, as well as 3D antenna patterns derived from synthesis or measurement, to ensure optimal performance in real-word conditions. VSS for radar systems design also provides links to software for custom signal processing algorithms and to industry-leading test and measurement instrumentation for real-world analysis and verification.

Types of radar systems

VSS for radar systems design can be classified as ground-based, airborne, space-borne or ship-based. They can also be classified by frequency band, antenna type, or waveform type. Functionality varies from tracking to early warning, and to over-the-horizon and more. A variety of waveform options and environmental effects need to be considered when designing radar systems — shown in Table 1 and 2.

The signal processing algorithms required for mitigating these effects place heavy demands on the design tool chain. Algorithm creation requires a platform for simulation and verification and models are needed for signal processing and measurements. Algorithm modeling and the debug environment must support a variety of languages, including C++, LabVIEW, MATLAB, and Visual Basic for Applications (VBA).

RF models and modeling

VSS for radar systems design also provides a robust set of models that feature a new node on the element tree with dedicated signal processing models and updated antenna models for 3D patterns and multiple inputs:

Signal Processing Blocks:

- Moving Target Indicator (MTI)
- Moving Target Detection (MTD)
- Constant False Alarm Rate (CFAR) Antenna

Models:

Antenna Model:

- Accept gain pattern
- Phase array element

Channel Model:

- Doppler
- Clutter

Target Model:

- Radar cross section (RCS)

Radar Signal Generators

Additionally, VSS for radar systems design enables detailed modeling of the RF chains in radar systems to more accurate determine system performance. AWR's RF Architect™ (RFA) technology uses a frequency-domain engine to provide budget, or line-up analysis, similar to EXCEL, and spurious analysis based on mixer spur tables.

VSS for radar systems design provides accuracy and speed advantages because it accounts for impedance mismatch and frequency dependencies. And being schematic based, any arbitrary path can be subject to analysis: i.e., the local oscillator (LO) leakage through the mixer can be plotted component by component back through to the antenna port. Spurs arising from the mixing process, characterized by mixer intermodulation tables (IMTs), can be tracked through the system, and the heritage, order, and type of spur (signal, distortion, or interference) can also be tracked. This allows the designer to understand the problem and take effective action. Behavioral models can be replaced with extracted models from circuit simulation or measured data, as the project progresses.

Signal processing blocks

Target detection simulation, unfortunately, cannot be done effectively and realistically in the time domain because small moving targets are hidden by heavily cluttered environments. Thus, the detection of the

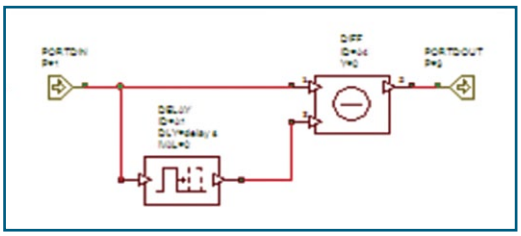
APPLICATION	CAPABILITIES
Continuous wave radar	I. No range detection
Continuous wave RM modulation	II. Linear frequency vs. time III. Beat frequency modulator IF-frequency varies with range IV. Require separate Tx/Rx antenna (e.g., aircraft altimeter)
Pulsed radar	1)Range detection 2)Single antenna switch Tx to Rx using duplexer 3)Minimum range = PW *C/2, maximum range = PRT *C/2 4)Difficult to design for long and short range 5)Resolution limited by pulse width
Pulsed FM chirp	I. Range detection and processing gain II. Matched filter allows pulse compression III. Overcomes limited resolution PW approx. 1/BW IV. Provides processing gain against noise-adds to radar equation

Table 1: VSS for radar systems design — waveform options.

Beam width and range	I. Line of sight depends on height above ground II. Maximum unambiguous range (MUR) III. Radar sensitivity and power of return-radar equation
Noise and interference	1)Thermal background, noise figure, spurs, group delay
Clutter	2)Unwanted targets: ground, sea, atmospherics, buildings 3)Multipath: moving "ghosts" of valid target 4)Constant false alarm rate (CFAR)
Jamming	I. Electronic warfare intentional jamming II. Equipment operating in the same band III. Not governed by radar equation – one-way travel

Table 2: VSS for radar systems design — environmental effects that need to be considered when designing radar systems.

Figure 1: Moving target indicator (MTI) linear filter applied to each row.



signal must occur in the frequency domain using Doppler frequency analysis. To extract the Doppler frequency (speed) and the target delay (range), 2D matrix signal processing is needed, with Doppler processing operating on each row of the matrix shown in Figure 2. There are two major processing functions: the moving target indicator (MTI) applies a linear filter to each row, as shown in Figure 2, and the moving target detector (MTD) applies a spectrum estimation to each row, as shown in Figure 1. The purpose for the MTI is to separate moving targets from stationary clutter. The single delay line canceller acts like a filter to reject the clutter at DC and at the pulse repetition frequency (PRF), yet keeps the spectrum at other regions.

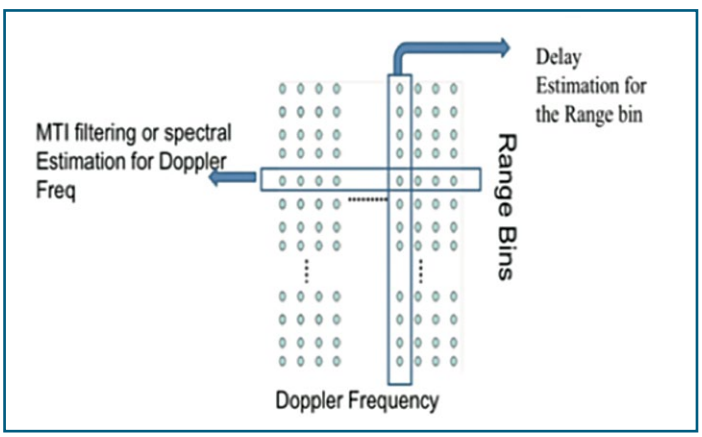


Figure 2: Moving target detector (MTD) matrix.

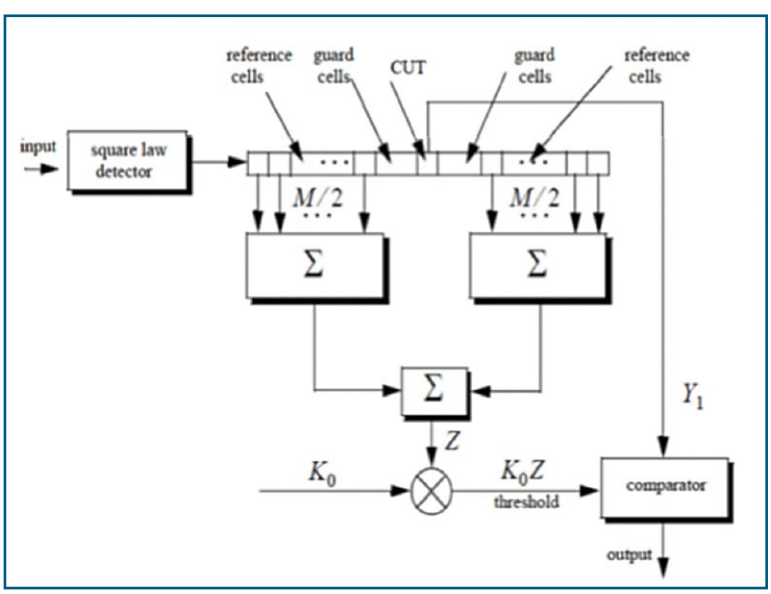


Figure 3: The constant false alarm rate (CFAR) processor.

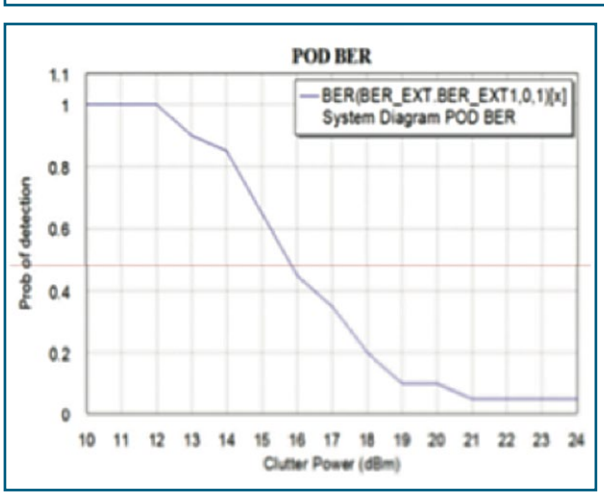


Figure 4: The CFAR processor output provides a measurement of POD.

Moving target detector

A bank of Doppler filters or Fast Fourier Transform (FFT) operators cover all possible expected target Doppler shifts. The input data is collected in a repetition period using a data bank. Then data points within the same range are correlated and processed using FFT until all data is processed in the data bank.

Constant False Alarm Rate (CFAR)

The CFAR computes a detection threshold so that the receiver maintains a constant pre-determined probability of false alarm. Since noise is not constant, the threshold must be updated continually. The maximum values from the MTD are processed in a delay line and the threshold updated from the averaged noise power in the reference cells (Figure 3).

Probability of detection

The output of the CFAR processor provides a measurement of probability of detection (POD). VSS for radar systems design allows variable turning and also parameter sweeps, making it easy to plot, for example, POD versus clutter power or range to target (Figure 4).

Antenna and phased array models

VSS for radar systems design includes antenna models that allow ASCII file import of antenna patterns containing data versus theta, phi directions. This data may be obtained from EM simulation or range measurement. The receive antenna can then accept multiple inputs representing wanted signal, clutter, and jammers (all at arbitrary theta, phi). AWR Connected™ for Antenna Magus further improves the efficiency and effectiveness of antenna and microwave/RF circuit designers by eliminating the tedium of initial antenna design and model validation. It also provides the capability to export the layout to Microwave Office for final validation and optimization using EM tools. The antenna pattern can then be exported to VSS for system simulation, an ideal way to evaluate the performance of a phased array antenna in a radar system.

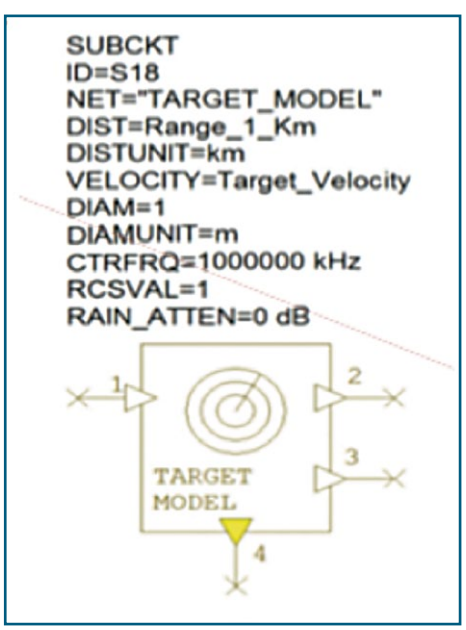
Target model with RCS and doppler

The target model implements the radar equation as two RF links (R^4 loss) and the radar cross section (RCS) can either be a 2D value for effective area (M^2) or an antenna pattern in theta, phi, which gives a 3D target model, as show in Figure 5. Noise statistics can be added to the RCS value and Doppler is computed from the target velocity, refer to Figure 6.

Connected solutions for radar system verification

VSS for radar systems design provides links to MATLAB and LabVIEW for custom signal processing algorithms and to industry-leading instrumentation for incorporation of real devices under test (DUTs) into the simulation, capturing real world signals, or synthesizing impaired signals from a point in the simulated system.

Figure 5: The target model implements the radar equation as two RF links.



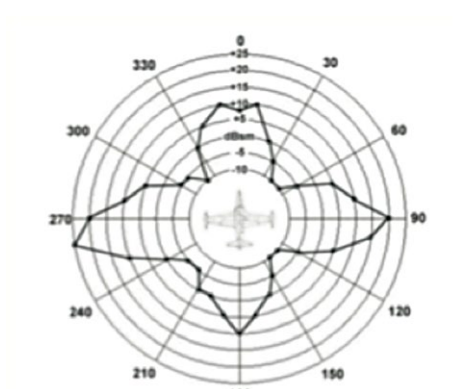


Figure 6: Noise statistics can be added to the RCS value and Doppler is computed from the target velocity.

LabVIEW integration

Designers have long used LabVIEW as a programming language to automate instrumentation. The AWR Design Environment™ provides a convenient plug-n-play interface to LabVIEW, adding a graphical programming environment for a broad range of signal processing and software-defined, virtual instrumentation.

For example, as seen in Figure 7, a VSS block can call LabVIEW directly via a virtual instrument (VI) server interface, which makes analysis easier within the AWR Design Environment and increases the designer's productivity. Simulated measurements within the LabVIEW environment can also be accessed for further domain-specific analyses.

Correlation of both simulated and actual measurements is acquired in the LabVIEW environment. VSS software can also provide a simulated version of the DUT, which allows LabVIEW to build test and validation cases earlier in the design flow, even before a prototype is fabricated.

LabVIEW FPGA

LabVIEW field programmable gate array (FPGA) allows users to graphically program

Figure 7: A VSS block can call LabVIEW directly via a VI server interface, which makes analysis easier within the AWR Design Environment.

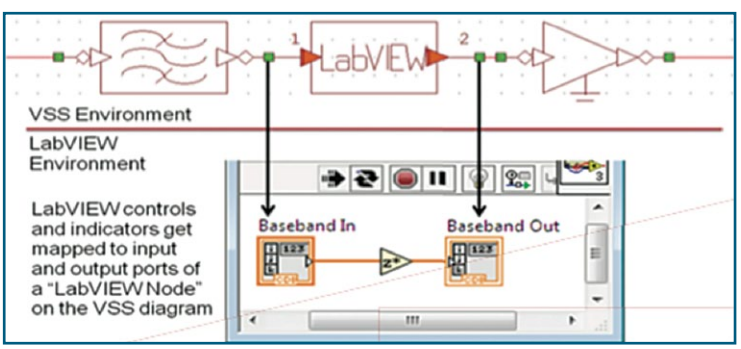
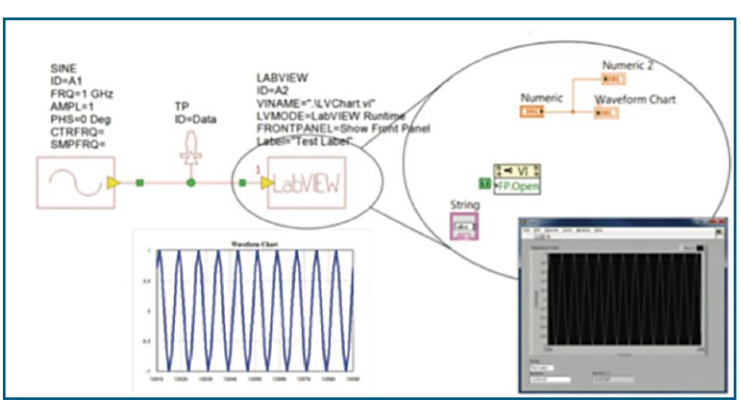


Figure 8: LabVIEW FPGA enables designers to graphically program algorithms and prototype a radar system with physical hardware.



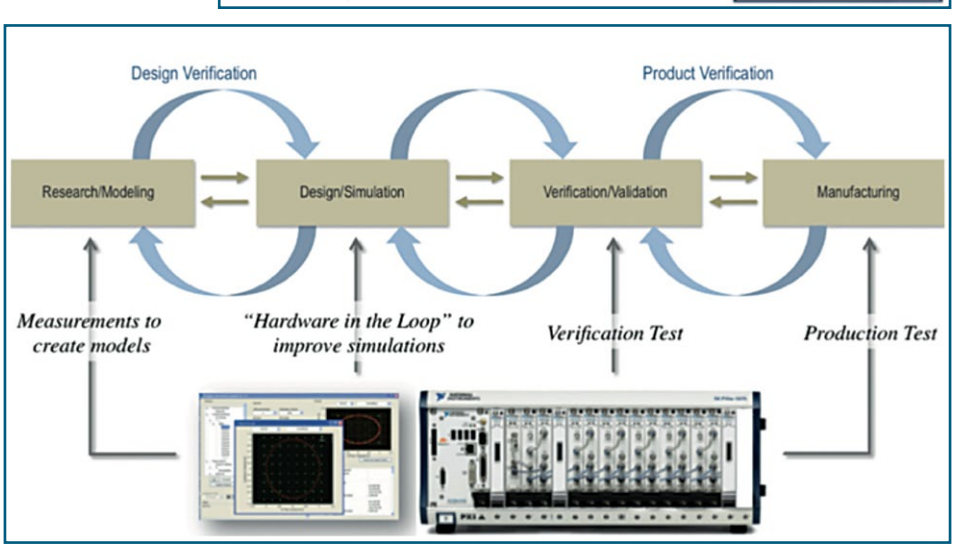


Figure 9: TestWave integrates VSS with T&M equipment to provide performance verification of communication systems and RF/microwave circuits.

algorithms that can be deployed to an FPGA so a radar system can be prototyped with physical hardware (Figure 8). This enables designers to verify their simulations in a real-world hardware environment.

MATLAB co-simulation for 3D graphing of range doppler processing

The MTD processor has a C-based model and a functionally equivalent MATLAB version, which, as well as offering documentation, gives access to 3D range Doppler plots. It also serves as a template for development of custom algorithms. If the editor is invoked from the MATLAB command shell associated with the running simulation, the algorithm can be edited on the fly while both VSS Radar and MATLAB are running. All the breakpoint capabilities of MATLAB are available.

VSS TestWave Solution

TestWave™ software integrates test and measurement (T&M) equipment with VSS to provide performance verification of communication systems and RF/microwave circuits (Figure 9). TestWave enables trade-off studies with "hardware in the loop." Measurements made with instruments such as modulation analyzers, vector signal analyzers (VSA), and vector network analyzers (VNA) can be integrated directly into the simulation and the design modified to enhance its performance. TestWave supports a wide range of manufacturers, including R&S, Agilent, TeK, and Anritsu.

Rohde & Schwarz K6 pulse sequencer software

Rohde & Schwarz K6 pulse sequencer software allows the flexible generation of complex pulses and pulse patterns on R&S signal generators. K6 can generate complex chirp and frequency hopping signals with impairments and modulation such as Barker codes (Figure 10). The resulting signals can be downloaded to instruments and also as a source in VSS Radar.

Design example: digital RF memory (DRFM) for radar jamming

This example, Figure 11, configures a DRFM for radar jamming. The retransmission of a perfect replica of the radar signal will generate a point target response in the radar. To generate false credible information in a high-resolution radar image though, a target or a scene with spatial extent must be created. This can be done in the time domain by a finite impulse response (FIR) filter. If the radar signal is the input sequence xn and the point targets are the filter coefficients in the impulse response hn, the output sequence yn is the convolution between sequence xn and hn. Sequence yn is then the desired jamming signal.

Summary

The VSS for radar systems provides an advanced simulation and verification platform that's required for the complex signal processing algorithms in today's radar systems, including the models needed for signal generation, transmission, antenna, T/R switching, clutter, noise, jamming, receiving, signal processing, and measurements. Through AWR Connected, VSS for radar systems also provides third party solutions for a robust algorithm modeling and debugging environment that supports a variety of languages such as C++, LabVIEW, MATLAB, and more.

More information can be found at: www.awrcorp.com/vss.

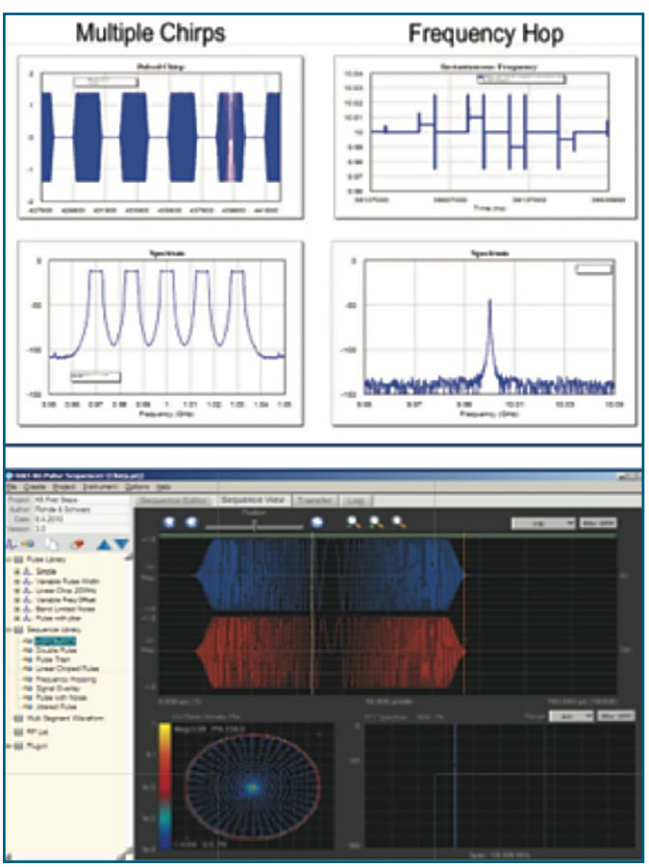


Figure 10: R&S K6 can generate complex chirp and frequency hopping signals with impairments and modulation.

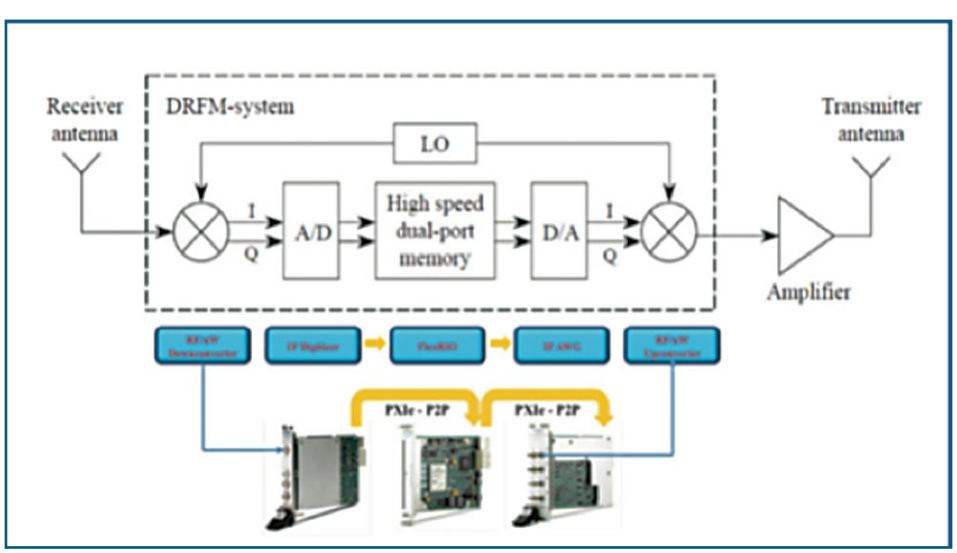


Figure 11: Example DRFM for radar jamming.

Lightning protection products

for RF communication networks

Times Microwave Systems has introduced the Times-Protect® LP-GTV-N series of DC pass RF lightning and surge protection products with an extended frequency operating band from DC to 7000 MHz.

This bidirectional design with N type female/female or female/male connectors handles up to 150 W of RF power and allows for up 72 V of DC voltage to be supplied on the center pin of the coaxial cable. The LP-GTV-N series is the perfect RF equipment protection solution for any application requiring DC voltage and current to power tower top mounted electronics.

The LP-GTV-N product family is IP67 rated, suitable for outdoor as well as indoor installations and its white bronze plated housing ensures durability and long life.

www.timesmicrowave.com

180 degree power divider

covers 1.2 to 8 GHz

Q-par Angus has released a high performance 1.2 to 8 GHz, 180 degree power divider intended for use with high power wideband antennas requiring balanced feeds.

The 3-port loss-less device features an all metal construction plus high power 7/16 connectors. It can be used as a high power wideband balun for the design of antennas requiring balanced feeds in order to achieve precision squint-less beam patterns over a wide bandwidth. It may also be used as a component in the output stages of high power wideband amplifiers. The 187 x 94 x 60 mm power divider has a maximum transmission loss of better than 1 dB and operates over -55 to +85°C.

www.q-par.com

Voltage controlled oscillator

high linearity over 1662 to 1708 MHz

The CVCO33BE-1662-1708 VCO from Crystek operates from 1662 MHz to 1708 MHz with a control voltage range of 0.5V to 4.5 V. It features a typical phase noise of -106 dBc/Hz at 10 kHz offset and has excellent linearity.

Output power is typically +2 dBm. Input voltage is 5 V, with a maximum current consumption of 20 mA. Pulling and Pushing are minimized

to 5.0 MHz and 5.0 MHz/V, respectively. Second harmonic suppression is -15 dBc typical.

www.crystek.com

Cable-based antennas

target passenger in-flight wireless access

W. L. Gore & Associates has developed cable-based antennas (often referred to as leaky lines or leaky feeders) that improve signal propagation without increasing the amount of hardware required on an airplane. Ideal for both wide-body and single-aisle passenger aircraft, GORE® Cable-Based Antennas provide reliable access to different wireless protocols so passengers can easily connect to in-flight entertainment, Internet servers, and email accounts.

Unlike typical broadband technology that requires separate hardware for each type of wireless access, the GORE® Cable-Based Antenna reduces airline costs because the antenna requires only one set of hardware to service the entire aircraft, regardless of its size. This lightweight antenna

offers a single solution for providing connectivity for a variety of electronic devices. This antenna sends and receives signals in frequencies ranging from 400 MHz to 6 GHz.

Constructed with unique, engineered fluoropolymers in a lightweight coaxial cable, thea ntenna meets all shock, vibration and fire specifications, including AirBus ABD0031 and FAR Part 25.1359(d). In lengths of more than 65 meters, they require no maintenance for the lifetime of the aircraft.

www.gore.com/aerospace

Dual 14-bit A/D converter

saves space and power in wireless infrastructure

Analog Devices has introduced a two-channel, high-performance 14-bit, 125-MSample/s A/D converter for wireless infrastructure, instrumentation and medial applications. In addition to high speed and wide dynamic range at 22% lower power, the cost-effective and functionally flexible AD9645 A/D converter is available in a 5-× 5-mm package, which represents a 30 percent space savings over the nearest competitor. The converter meets the performance and size requirements of the latest 3G and 4G multi-standard cellular infrastructure equipment.

The dual AD9645 A/D converter consumes only 122 mW/channel at 125 MSPS and features SFDR (spurious-free dynamic range) performance of 91 dBc at 70 MHz. With an IF sampling range of up to of 200 MHz, the device is designed for use in multi-mode digital receiver architectures. A pin-compatible dual 12-bit version, the AD9635, is also available, enabling an easy migration path between 12-bit and 14-bit converters with sampling rates from 20 MSPS to 125 MSPS.

The AD9645 dual A/D converter features a multi-stage, differential pipelined architecture with integrated output-error-correction logic. It features a serial 1.8-V LVDS digital output with two lanes per channel.

www.analog.com/AD9645

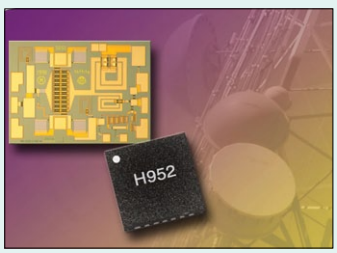
9 to 14 GHz power amplifiers

boast on chip power detectors

Hittite Microwave Corporation has introduced two 2-W GaAs pHEMT MMIC power amplifiers which cover the 9 to 14 GHz frequency range and are ideal for microwave radio, military and space, SATCOM and test and measurement applications.

The HMC952 (die) and the HMC952LP5GE (QFN) are four stage GaAs pHEMT MMIC 2-W medium power amplifiers with temperature compensated on chip power detectors which operate between 9 and 14 GHz. These amplifiers provide 33 dB of gain, +35 dBm of saturated output power, and 27% PAE (Power Added Efficiency) from a +6 V supply.

With up to +43 dBm output IP3 the HMC952LP5GE



is ideal for high linearity applications in military and space as well as high capacity point-to-point and point-to-multi-point radios. These powerful amplifiers also feature I/Os that are internally matched to 50 Ohms and require no external matching components which makes them ideal for use as drivers, or as the final power stage in a microwave transmitter chain.

www.hittite.com

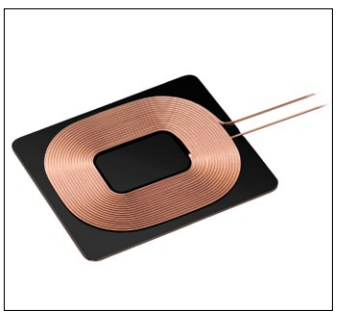
Thin receiving coil for wireless power transfer

ideal for applications in mobile devices

TDK Corporation developed a wireless power transfer coil unit designed for smartphones and other mobile devices, that features an industry-leading thickness of only 0.57 mm.

The development reflects the company's extensive expertise in fields such as magnetic materials technology and process technology, and involved the creation of a unique, extremely thin and flexible metal magnetic sheet. As a result, the coil unit not only is ultra thin and lightweight, it also is highly resistant to shock and therefore provides excellent reliability.

In spite of its 0.57 mm profile, the coil's design minimizes the tendency towards rising resistance and



achieves a power transfer efficiency that clears the requirements of the WPC "Qi" standard. At this point, output current is of the order of 0.5 to 0.6 A, but an even thinner 0.50 mm type with equal or better output current is already in development, with a view towards starting mass production in 2013.

www.global.tdk.com

A/D converters

target low power and wide bandwidth

Hittite Microwave Corporation has introduced two analog-to-digital converter (ADC) products which extend performance capabilities both in ultra low power consumption and in ultra high bandwidth applications.

The HMCAD1104 is a 10-bit octal channel ADC which offers an industry best combination of low power and high performance. Operating at 65 MSPS, it delivers a signal to noise ratio (SNR) of 61.6 dB, while dissipating only 30 mW of power per channel. This performance level represents a 50% improvement over the next closest competitor.

The HMCAD1104 is pin compatible with the company's family of 12-bit ADCs including the HMCAD1100, HMCAD1101, and HMCAD1102, all of which are compatible with the EasySuite™ Test and Evaluation Tool for analysis and system configuration. The ADC is specified for operation over the industrial temperature range of –40°C to +85°C while the serial LVDS output is designed to easily interface with FPGAs from several suppliers.

For high performance applications which require sampling speeds to 26 GSPS, the company has also released the HMCAD5831LP9BE 3-bit ADC. This wideband ADC is targeted to extreme applications in radar, radio astronomy, and test and measurement equipment. The combination of very wide input bandwidth up to 20 GHz, and a sampling rate up to 26 GSPS make this ADC unique in the industry. These features enable quantization of high bandwidth signals up to 20 GHz with good INL and DNL performance. The HMCAD5831LP9BE is designed in a full flash architecture and provides Data XOR and Inhibit functions to ease FPGA programming.

www.hittite.com

700 MHz to 2.8 GHz amplifiers

offer 25 W to 170 W P1 dB power levels

A Teseq company, Milmega has introduced the AS0728 product range of amplifiers designed to cover the test requirements within the wireless testing frequency bands.

These 700 MHz to 2.8 GHz amplifiers are available in 25 W, 50 W, 100 W and 170 W P1 dB power levels. The amplifiers feature high reliability, excellent linearity, industry leading power density, and class leading performance. All the amplifiers are covered by the industry's only Standard 5 year fully expensed warranty and are backed by an established Global Support network.

www.teseq.com

GLONASS/GPS combined module

targets the Russian and Eastern European markets

MSC now offers the L16 GLONASS/GPS module from Quectel, enabling simultaneous GPS and GLONASS open service L1 reception. It is the first module from Quectel developed especially for the Russian and Eastern European markets.

The L16 module is based on STMicroelectronics' Teseo II single-chip positioning device. With 2 fast acquisition channels and 32 tracking channels, it can acquire and track any mix of GPS and GLONASS signals. What's more, the L16 supports Self-Trained Assisted GPS (ST-AGPS) technology.

Through the simultaneous use of GPS and GLONASS signals, not only can the Time To First Fix (TTFF) be reduced, but the higher number of visible satellites allows the positioning accuracy to be increased to 1.5 m. With a current consumption of 110 mA during acquisition and 9 5mA in the tracking operation as well as a wide operating temperature range of -40 to +85 °C, the L16 GLONASS/GPS module is suited for use in a wide range of consumer, automotive and industrial applications.

Two UART interfaces and the support of active and passive antenna systems enable simple implementation of the module.

www.msc-ge.com

Frequency hopping module

added to the company's signal generator platform

IZT in Germany has added the S1000-FHS frequency hopping module to its S1000 signal generator platform, which combines 31 virtual signal generators for creating complex mixed signal RF test scenarios. The module is designed to reduce interference, increase transmission security and enhance the efficient use of available bandwidth. Using the full profile functionality of the S1000, the frequency hopping module efficiently generates hopping networks with a hop rate of >2,000 hops per second. Content comes from an analogue modulation tool or from the user as narrow band I/Q data.

One hopper requires one virtual signal generator (VSG) and can hop within a range of 120 MHz — two VSGs have a 240 MHz spread. The overall bandwidth required for frequency hopping is much wider than that required to transmit the same information using only one carrier frequency. Within the 120 MHz instantaneous bandwidth of the S1000, the user can continuously change the center frequency of each VSG.

www.izt-labs.de

Advanced die packaging technology

cuts RF module footprint by 75%

A new die packaging technology developed by Microsemi Corporation has passed an internal qualification regime typical for active implantable medical devices consisting of thermal and mechanical stressing to MIL-STD-883 test standards.

The die packaging technology is targeted at implantable medical devices such as pacemakers and cardiac defibrillators. It can also be used in wearable devices such hearing aids and intelligent patches, as well as nerve stimulators and drug delivery products.

Delivering a footprint reduction of approximately 75 percent over the company's currently available implantable radio modules, the small technology allows physicians to use less invasive procedures, enabling faster recovery times and improvements in patient comfort while concurrently lowering health care costs. Smaller, lighter weight wireless medical devices also afford patients greater mobility.

This packaging technology can also be paired with Microsemi's ultra low-power ZL70102 radio to enable wireless healthcare monitoring. The ZL70102 transceiver chip supports a very high data rate RF link for medical implantable communication applications in the 402-405 MHz MICS band.

www.microsemi.com

Waveform generators

deliver low jitter, harmonic and non-harmonic distortion

Agilent Technologies has introduced the 33500B Series waveform generators, comprising eight one- and two-channel models, which generate waveforms up to 30 MHz, and incorporate exclusive Trueform signal-generation technology. Trueform enables these models to offer unmatched capabilities for generating a full range of signals for the most demanding measurements required when designing electronic devices.

The 33500B waveform generators provide the lowest jitter and lowest total harmonic distortion in their class. With total harmonic distortion less than 0.04 percent and non-harmonic spurs less than 75 dBc, the waveform generators offer clean signals that don't introduce noise.

The 8.4-ns rise and fall times and low jitter allow engineers to set trigger points more accurately as well. Further, 16 bits of resolution allows engineers to make output changes down to 1 µV – giving them the ability to test today's low-voltage circuits and designs.

"Trueform technology offers a new alternative that blends the best of DDS and point-by-point architectures, giving engineers the benefits of both without the limitations of either," said Gary Whitman, vice president and general manager of Agilent's System Products Division.

www.agilent.com

Digital radio test system

with colour touch-screen targets land mobile radio

Aeroflex has launched the 3550 digital radio test system featuring an industry-first colour touch-screen and enhanced specifications to provide users with a lightweight, easy to use, and reliable digital radio test system. Designed for Professional Mobile Radio (PMR), public safety, and other land mobile radio applications, the test system quickly isolates problems and assesses performance in AM/FM radios, with options for P25, DMR, NXDN™, and dPMR radio systems.

The 3550 test system is lightweight (3.8 kg including battery) for field-testing of analogue, DMR, P25, NXDN, and dPMR systems, and features 4.5 hours of continuous operation with its internal battery. Further, it allows the user to test all aspects of the radio system — the transmitter, receiver, cables, and antennas — with powerful features typically found only in bench top equipment. It also meets MIL-PRF-28800A specifications for humidity, shock, and vibration, with an operating range of 0 to +50 ºC.

Typical specifications include phase noise of -95 dBc/Hz, RF signal generator level accuracy of ±1.5 dB, FM deviation meter accuracy of 4%, and -140 dBm spectrum analyzer.

www.aeroflex.com

RF front end building block

designed to ensure optimal connectivity

Ethertronics' chip division has leveraged its AIRFDC technology into the EtherChip 1.0 chip, the first in a series of building blocks for RF front-end modules used in smart phones. The company's Air InteRFace Digital Conditioning technology provides tuning capacitance to seamlessly adjust the characteristics of a cellular antenna to its dynamic requirements, such as retuning for frequency shift, hand or head effects, or more bandwidth.

EtherChip 1.0 supports the ability to compensate for the de-tuning of the antenna system due to hand and head effects. The range of de-tuning varies and the company claims its solution adapts to support high quality voice, video, or data. Ethertronics anticipates that with each year the space available for the RF front end decreases by 25 percent in systems and devices resulting eventually in the entire front end needing to reside in the space once occupied by the antenna.

The company's patented Isolated Magnetic Dipole (IMD) technology for both passive and active antennas designs is a method by which current is confined solely to the antenna element, which significantly reduces energy loss due to interference with surrounding components, thus delivering a much more efficient antenna.

www.ethertronics.com

RF/IF rackmount recorder

dual channels for ultra wideband signals

Pentek's ultra wide-band RF/IF rackmount recorder, the Talon RTS 2709, uses 12-bit, 3.6 GHz A/D converters and state-of-the-art solid state drive storage technology to sustain recording rates up to 3.2 Gbytes per second.

It can be configured as a one- or two-channel system and can record sampled data, packed as 8-bit or 16-bit wide consecutive samples. As a complete recording system, the Talon RTS 2709 recorder can be used for capturing high bandwidth RF/IF signals with frequencies up to 2.8 GHz. The built-in Windows 7 Professional workstation with an Intel Core i7 processor provides a platform which allows the user to install post-processing and analysis applications directly on the recorder itself.

Signal viewing and analysis tools are provided as part of the SystemFlow recording software for monitoring signals prior to,

during and after a recording session. The digitized data is streamed to files created on the recorder's built-in RAID array. These files include time stamping as well as recording parameters and optional GPS (global positioning system) information.

The recorder offers configuration options to support up to 20 Terabytes of storage. The drives are hot-swappable and can be configured in multiple NTFS RAID levels, including 0, 1, 5, 6, 10 and 50 to provide a choice for the required level of redundancy.

www.pentek.com

Precision low passive intermodulation adapters

target wireless infrastructure

Pasternack Enterprises has expanded its line of high performance, precision low passive intermodulation (PIM) adapters, providing PIM levels that are consistently less than -165 dBc with low VSWR levels up to 8 GHz.

The adapters suit portable PIM testing and sweep testing. Other low PIM adapter applications include installations in cellular/PCS, RF wireless infrastructure, OEM in-rack RF routing, in-building systems, and land mobile radio. The PIM adapters are fabricated with high machine tolerances providing an optimum electrical and mechanical interface. Each low PIM adapter body is plated with a tri-metal Abaloy coating that produces a very durable surface with good corrosion protection and abrasion resistance, while providing superior electrical contact properties.

The adapters come with between-series 7/16 DIN and Type N connectors. In-series low PIM adapters have various combinations of 7/16 DIN, N and SMA connector types. The company's latest precision adapters mate perfectly to their low PIM coaxial cable jumpers.

www.pasternack.com

6-bit serial-controlled digital step attenuators

offer high accuracy in 0.5 dB steps

RFMD's RFSA2644/2654 6-bit digital step attenuators (DSAs) feature high linearity over their entire 31.5 dB gain control range with excellent step accuracy in 0.5 dB steps.

They are programmed via a serial mode control interface that is both 3 V and 5 V compatible. They also offer a rugged Class 1C HBM ESD rating via on-chip ESD circuitry. The MCM package is footprint-compatible with most 24-pin, 4 x 4 mm QFN packages.

The RFSA2644 operates in the 50 MHz to 4000 MHz frequency range whilst the RFSA2654 is for use in the

5 MHz to 2000 MHz range, with an attenuation range of 31.5 dB in 0.5 dB steps and a step accuracy of ±0.1dB. The chips can be used in transceiver RF and IF applications including 2G, 3G, LTE, WiMax/WiFi and other wireless data terminals.

www.rfmd.com

Tiny gyroscope

targets advanced motion-sensing applications

ST has launched its smallest MEMS gyroscope, opening up new motion-sensing applications. The L3GD20H 3-axis sensor measures only 3- x 3-mm and 1-mm high, occupying little over half the volume of its predecessor, yet offering better resolution, higher accuracy, superior stability and faster response time. The device enables smaller sensing mechanisms in smart consumer electronics, including mobile phones and tablets, game consoles, digital cameras and industrial tools.

The smaller dimensions of this gyroscope also allow experimental projects such as wearable electronics to move closer towards practicality. One such application is the prototype smart suit that ST used to demonstrate inertial body-motion reconstruction early in 2012, which can help enhance applications such as augmented reality, sports training aids, or medical therapy.

In addition to enabling advanced product miniaturization, ST's L3GD20H also helps conserve battery power by drawing 25% lower current than the previous generation of devices. The L3GD20H is also ready in only one-fifth of the time after turn on, enabling the end-user application to deliver a better overall experience. Finally, the gyroscope's output has 60% lower noise, which can help to simplify hardware and software design and speed up communication with the host system leading to faster application performance.

www.st.com

Halogen-free five band antenna

delivers high efficiency in M2M applications

Antenova in Cambridge has added a five band cellular SMD antenna to its gigaNOVA range of surface mount standard antennas. Designed for ease of integration into wireless devices, the Rubra A10393 is suited for an extensive range of embedded cellular applications such tablets, tracking devices, femto base stations, remote monitoring and other M2M applications.

Rubra A10315 is a compact 40x10.4x3.2 mm^3 size antenna intended for surface mounting and requires minimal ground plane. As a high efficiency penta-band cellular SMD antenna it is suitable for GSM, GPRS and UMTS applications and covers the GSM850/900/1800/1900 and WCDMA frequencies. Rubra's Magnetic Dipole Antenna (MDA) structure provides excellent resistance to de-tuning and offers predictable performance in customer devices.

McCray, CEO of Antenova adds, "Rubra A10393 is a high performing cellular penta-band antenna incorporating Antenova's patented Magnetic Dipole Antenna (MDA) technology which provides robust and reliable performance across all device applications, which is particularly essential for many M2M devices which are typically in situ for 5 to 10 years."

Made from low cost halogen-free FR4 substrate material, Rubra is supplied in tape on reel and available for volume purchase through Antenova's global network of leading distributors and agents.

www.antenova.com

Smart proximity sensor

short-range human presence detection, SAR regulations

Semtech Corporation has introduced an ultra-low power capacitive proximity sensor with on-chip Specific Absorption Rate (SAR) engine for human body detection.

Semtech claims to be the first to provide a robust and cost effective proximity sensor with true discrimination between a human body and inert material. The feature enables mobile and tablet PC manufacturers to comply with SAR regulation for optimized data and voice communication quality of service.

The SX9300 platform is part of Semtech's touch Interface family. This high sensitivity-sensing device features a dual-channel design with built-in human body discrimination on two distinct sets of sensors. This configuration is optimized for multiple axis proximity detection with tiny sensor areas. SX9300 is intended for handheld connectivity devices requiring SAR regulation compliance such as mobile and tablet PC devices with 3G/4G/WCDMA mobile connectivity and Wi-Fi/mobile hotspots.

The SX9300 is offered in a space-saving 3 mm x 3 mm thin 20-QFN package. Semtech provides a variety of small form factor sensor reference designs especially adapted to tablet PCs. Semtech guarantees all of these devices to operate over the extended (-40 to +85°C) temperature range.

www.semtech.com

40 GHz cables

target rugged lab and environmental testing conditions

API Technologies has unveiled 40 GHz test cables that feature a low insertion loss and are available with armorized and weatherized protective coverings.

These features make them suitable for rugged lab, production, and environmental testing conditions. The cables are available in standard and custom lengths and as an individual assembly, pair, or phase matched set. A variety

of connector options, including passivated stainless steel connectors, are also available.

www.apitech.com

Enhancement mode LNAs

offer low noise figure and high linearity

Skyworks has introduced two GaAs, pHEMT, enhancement mode, low noise amplifiers (LNAs) that offer low noise figure, high linearity, and excellent return loss while drawing very low bias current. The advanced GaAs pHEMT enhancement mode process provides better performance compared to SiGe LNAs.

The SKY67012-396LF (0.3 to 0.6 GHz) and SKY67013-396LF (0.6 to 1.5 GHz) LNAs are ideal for ISM band and other high frequency applications. On-die active bias design ensures consistent performance, enables unconditional stability, and simplifies external matching.

These highly flexible and low power gallium arsenide pHEMT LNAs have a highly efficient linear design, low noise figure and small form factor. They feature low current draw (5 mA) and wide input voltage range (1.8 to 5 V) capability.

The SKY67012-396LF offers the designer the ability to externally adjust supply current between 5 to 15 mA. Noise figure of 0.85 dB, gain of 16.5 dB, and 24 dBm OIP3 are

achievable at 0.45 GHz with 3.3 V supply and 15 mA of bias current. The device can also be biased from 1.8 to 5 V and will still achieve an OIP3 of 18 dBm, and 15 dBm OP1dB with only 5 mA of bias current from 3.3 V supply.

For the SKY67013-396LF a noise figure of 0.85 dB, gain of 14.0dB, and 26 dBm OIP3 are achievable at 0.9 GHz with 3.3 V supply and 15 mA of bias current. The device can also be biased from 1.8 to 5 V and will still achieve a OIP3 of 22 dBm, and 15 dBm OP1dB with only 5 mA of bias current from 3.3 V supply.

Both LNAs are ideal for use in battery powered wireless transceivers. Evaluation boards optimized for different voltages and frequencies are available upon request.

www.skyworksinc.com

CALENDAR

ICUWB2012 - 2012 IEEE International Conference on Ultra-Wideband
17th - 20th Sept 2012
Syracuse, New York, USA
www.icuwb2012.org

9th Annual Military Antennas Summit
24th - 27th Sept 2012
Hilton Alexandria Mark Center
Washington DC
www.militaryantennasevent.com

MM Live, MEMS Live & NANO Live
25th - 26th Sept 2012
NEC, Birmingham
United Kingdom
www.mmliveuk.com

AMTA 2012 - Antenna Measurement Techniques Association
21st Oct - 26th Oct 2012
Hyatt Regency
Bellevue, WA, USA
www.amta.org

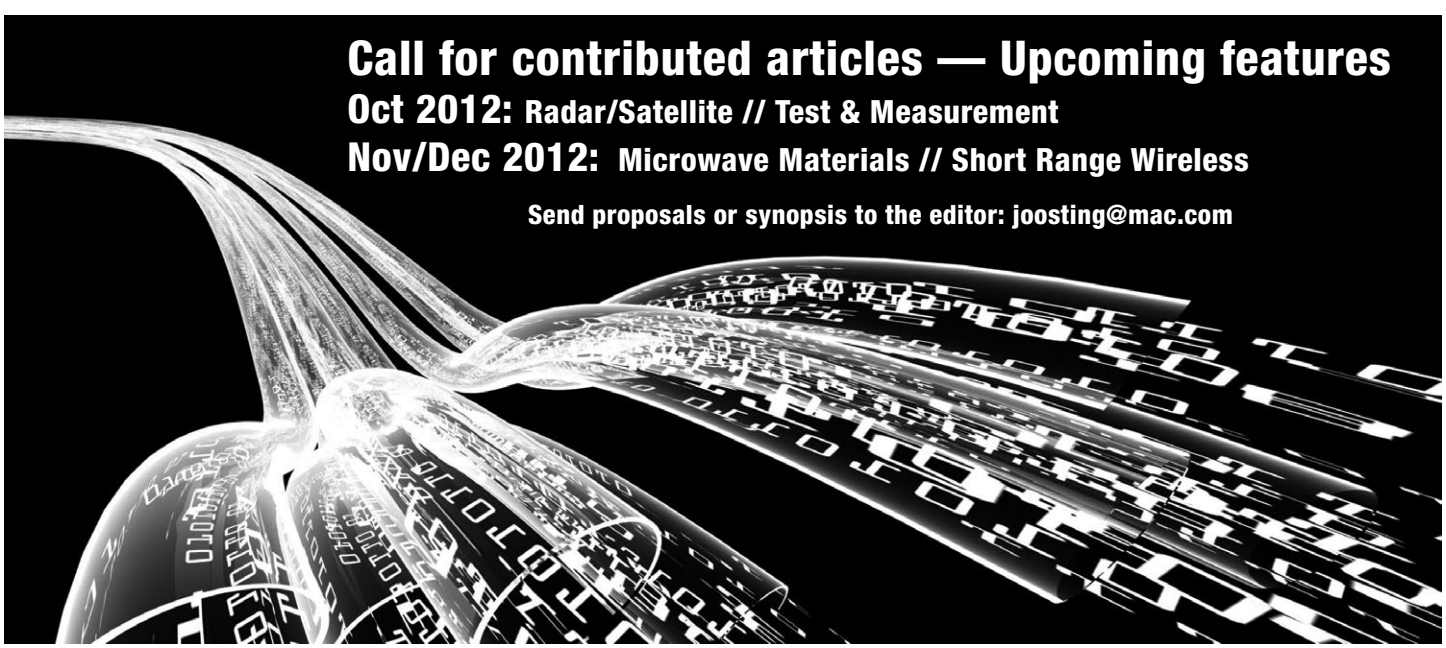
European Microwave Week
28th Oct - 2nd Nov 2012
RAI Amsterdam
The Netherlands
www.eumweek.com

2012 Military Communications Conference (MILCOM)
29th Oct - 01st Nov 2012
Orlando, Florida, USA
www.milcom.org

International RFID Congress 2012 RFID/NFC in Health-Care
5th - 7th Nov 2012
Palais de la Méditerranée
Nice, France
www.rfid-congress.com/2012/en

The 7th China International Conference & Exhibition on Microwave and Antenna
5th - 7th Nov 2012
Shanghai Everbright Convention and Exhibition Center
www.imwexpo.com

Electronica 2012
13th - 16th Nov 2012
Messe München, Munich, Germany
www.electronica.de



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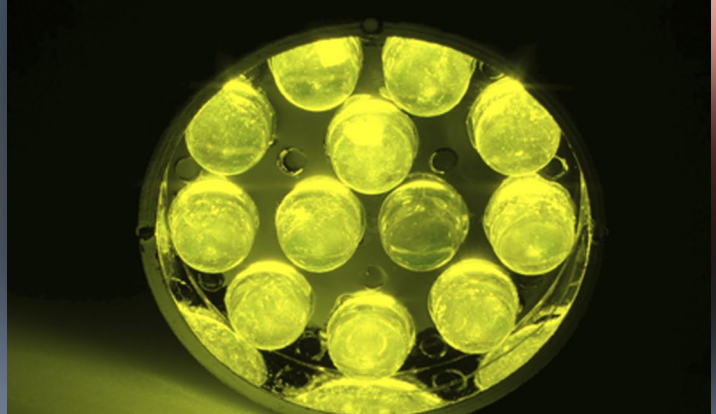

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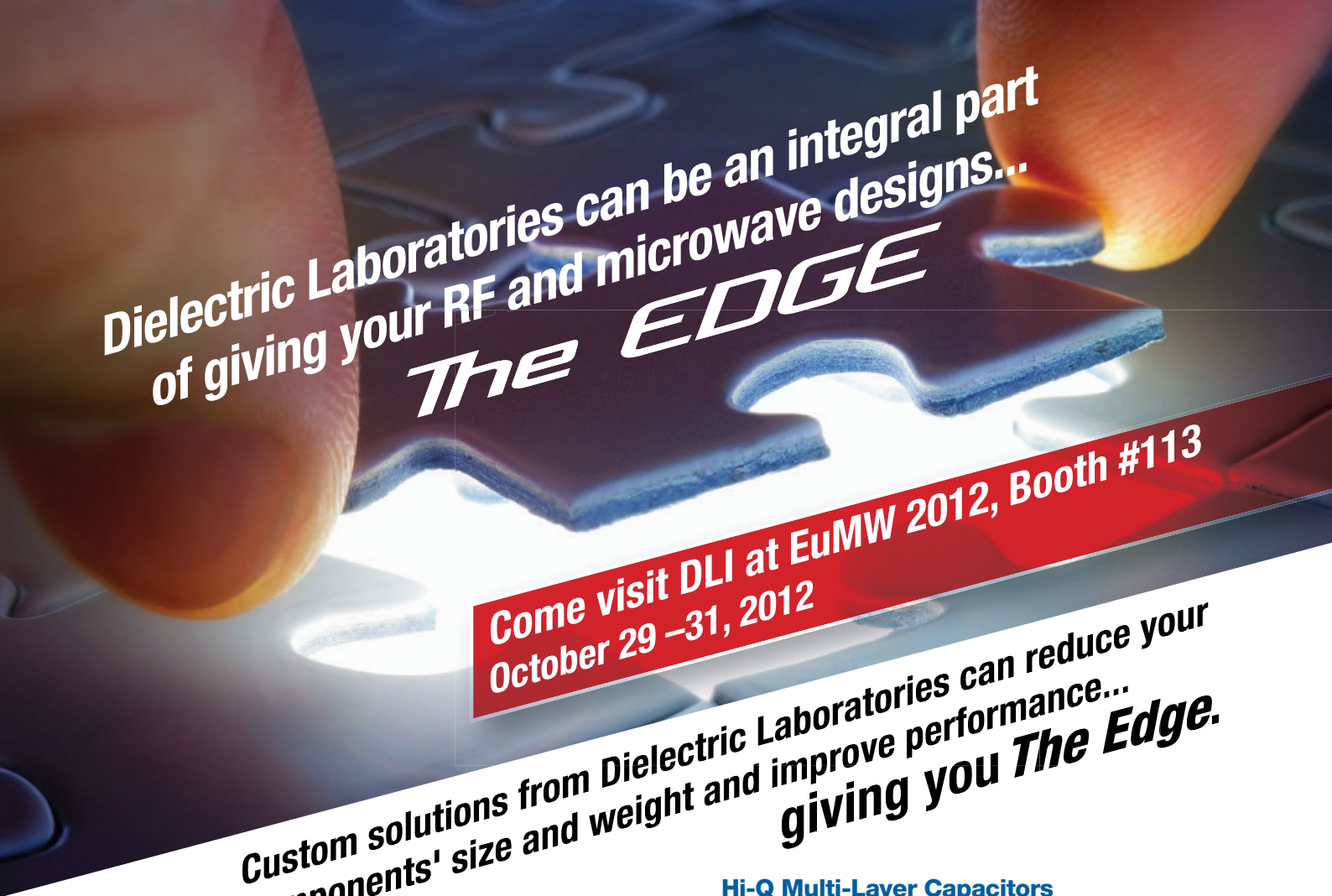

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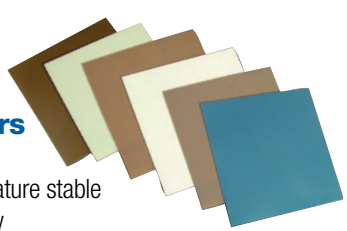

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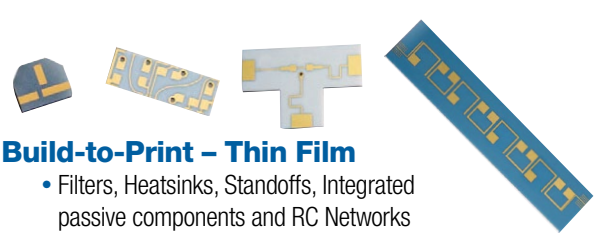

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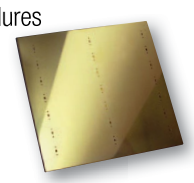

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