November/December 2012

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Short Range Wireless

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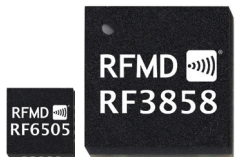

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Reference Designs materials for TI, Atmel, Freescale, Ember and SiLabs can be found at www.rfmd.com/ZRG0611.

SPECIFICATIONS

Architecture	Freq Range (MHz)	Gain (dB)	Avg P_{OUT} (dBm)	V_{CC} (V)	Current at P_{OUT} (mA)	Package	Part Number
PA, SP2T, DP2T, LNA	2400 to 2500	28.0	27.0	3.6	500	3.5 x 3.5 x 0.6	RF6505
PA, DP2T, LNA	902 to 928, 868	30.0	31.5*	3.6	950	8.0 x 8.0 x 1.2	RF3858

*At PA OUT

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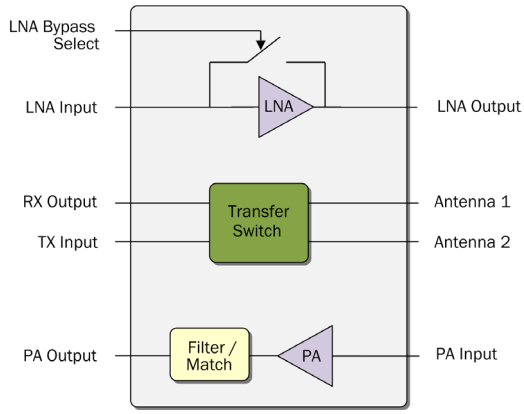
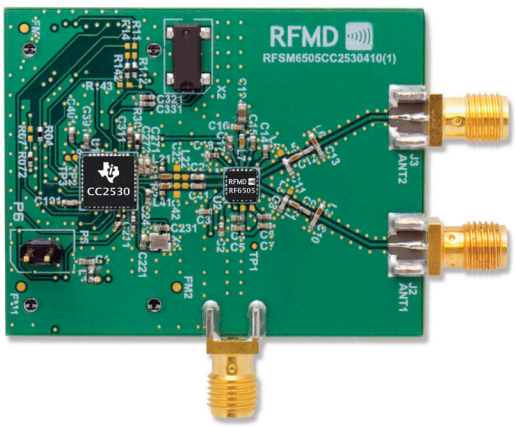
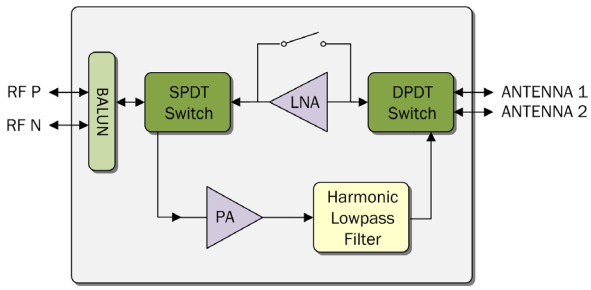




RF6505 BLOCK DIAGRAM



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IN BRIEF

NI and TU-Dresden collaborate on 5G

National Instruments has announced its collaboration with TU-Dresden on the exploration of new technologies for 5G wireless systems using NI LabVIEW system design software.

Research on 5G wireless systems is in its infancy as 3.5G and 4G systems are still largely in development. TU-Dresden previously pioneered 3G systems research in conjunction with the Vodafone Chair Mobile Communications Systems, which is dedicated to cutting-edge research in wireless communication technology.

"National Instruments RF and communications tools will enable us to design OFDM prototyping systems within a single software design flow," said Dr. Gerhard Fettweis, head of the Vodafone Chair Mobile Communications Systems. "With the modular NI PXI system, we can start with a SISO link and expand to complex MIMO configuration with limited modifications to the code, exceeding an 8x8 setup, as our research evolves."

www.ni.com

UK startup ramps up 60 GHz development

A UK start-up is ramping up its 60 GHz development for multi gigabit WiFi and 4G MetroCell wireless backhaul markets after changing its business model and closing a series of deals.

Blu Wireless Technology has moved from being a fabless company to supply System IP (SIP) for gigabit communication applications using the unlicensed 60 GHz band. This has converted what had previously been Blu Wirelesses' competitors into potential customers for its Hybrid Defined Radio Architecture (HYDRA) massively parallel baseband technology and resulted in multiple contracts, says CEO Henry Nurser. The company has applied for 15 patents and its customers are already developing chips for wireless data and video links.

www.bluwirelesstechnology.com

Agilent and the University of Leeds open terahertz measurement research lab

Agilent Technologies has announced the opening, at the University of Leeds, of the first Agilent-equipped terahertz measurement laboratory in Europe. The laboratory will enable research on devices, components, circuits and systems at much higher frequencies than any other institution in the region has been able to do before.

The lab is set up in memory of professor Roger Pollard, former dean of engineering at the University of Leeds and a long-time friend of Agilent, who passed away at the end of last year. The Agilent 1.1-THz PNA network analyzer is the centrepiece of the lab. Peter Jimack, dean of engineering at the university, and Greg Peters, general manager of Agilent's component test division, formally opened the laboratory. Featured guest speaker professor Giles Davies delivered a keynote presentation on terahertz technology.

The PNA THz network analyser supports a broad range of projects in nanoelectronics, complemented by a new electron-beam lithography facility. In the new field of graphene, the network analyser will allow the university staff to perform on-wafer terahertz measurements of transistors, THz biosensors, magnetic storage elements, THz spin-switches and novel acoustoelectric devices.

www.agilent.com

In-car Wi-Fi expected to increase eight fold over the next seven years

IMS Research forecasts the market for Wi-Fi in OEM automotive applications will increase eight fold over the next seven years in North America and Western Europe. While the Wi-Fi attach rates in North America and Western Europe are still relatively low with only a small number of manufacturers announcing the inclusion of Wi-Fi as a standard, it is likely that Wi-Fi will follow a similar trend to Bluetooth.

Historically, Wi-Fi was not considered for in-car applications, however, several factors have come into play which are creating a significant opportunity for Wi-Fi automotive applications. First, Wi-Fi has transitioned from being primarily a PC networking technology to a more ubiquitous connectivity solution with a strong presence in a broad range of consumer electronics.

Secondly, Bluetooth high speed never materialised. This left a gap in the automotive industry. But it wasn't until 100 percent attach rates in smartphones and Wi-Fi Direct, that Wi-Fi was considered to fill the void that Bluetooth high speed left. The introduction of Wi-Fi Direct (Wi-Fi with the ability to make a peer-to-peer connection) has helped the industry realise Wi-Fi can be used for much more than just networking.

www.ihs.com

Low-cost smartphone shipments to double every year from 2010 to 2016

The low-cost smartphone segment, defined as models with a selling price of less than $150, is a strong growth opportunity for the mobile phone industry, according to the latest NPD DisplaySearch Smartphones: Displays, Designs and Functionality report. Low-cost smartphone shipments are forecast to double every year from 2010 to 2016, increasing from 4.5 to 311.0 million.

"Most mobile phone subscribers around the world can't afford more than US$200 for a smartphone, on top of their service plans," noted Shawn Lee, Research Director at NPD DisplaySearch. "Low-cost smartphone manufacturers create these new products quickly without much investment, which has allowed them to extend their telecom subscriber base to emerging regions."

Most of the demand (60%) is from the Asia Pacific region, where a large majority of component suppliers and manufacturing factories are located—providing both time and cost savings.

www.displaysearch.com

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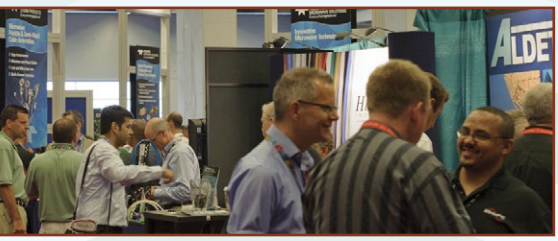

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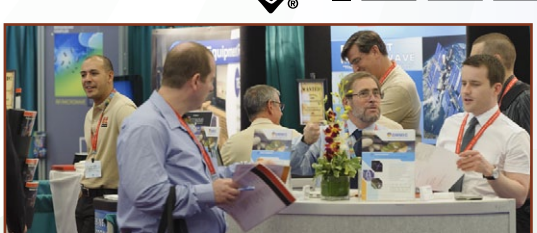
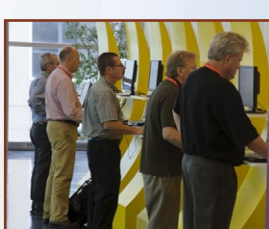

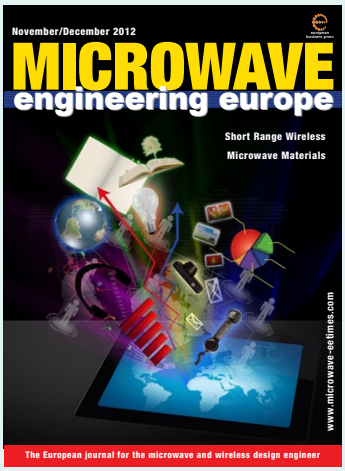

This month's cover depicts the world of short range wireless technology. Growth in this area is expected to be strong, with a key future driver being the Internet-of-Things in the near future. One area that will impact our lives soon is that of intelligent metering — see page 12.

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THz technology — the final frontier

Terahertz radiation lies between the far infrared and microwave worlds, covering 100 GHz to 30 THz. However, for practical reasons most activity rests between the 100 GHz through to 3 THz. The region above 3 GHz remains quiet, with little or no activity.

One big area that THz holds a lot of promise in is that of medical imaging as well as detection systems that can pick up compounds on people or in a room. THz spectroscopy and imaging offer a lot of potential in the study of DNA, biomolecules and detection of cancer. The absorption of THz waves is sensitive to polar molecules such as water, and cancer tissue which is characterized by different levels of hydration with respect to normal tissue, exhibits a different reflection pattern.

Other applications for THz that are emerging can be found in materials science and quality control. Once again the absorption characteristics of THz waves allows researchers to investigate materials with unprecedented accuracy and detail. Once this field reaches the commercial world, it could change not only the way things are made but also find defects quickly and easily. Failure might not be optional in the near future?

Security might be the biggest beneficiary of THz technology. Every explosive and narcotic has a distinct signature under THz spectroscopy. Further the technology can be applied to objects as well large open spaces.

Today wireless communications is struggling to keep up with data demand even with LTE, LTE-Advanced and 5G. The possibility of using THz systems in point-to-point links has huge potential. Today, mm-wave links are commercially available, but 120 GHz systems are being tested and will soon available. For example, NTT Microsystem Integration Laboratories has described a compact, low-power, 120-GHz-band wireless link for 10-Gbit/s data transmission and tested it already in January 2007. Field testing at 10 Gbit/s was successful over a distance of 800 m. Could this be the wireless complementary answer to fibre optic links.

Needless to say this field holds a lot of promise for the future and will enable the wireless world to continue its rapid progress. In addition, we might still invent the medical scanner in Star Trek?

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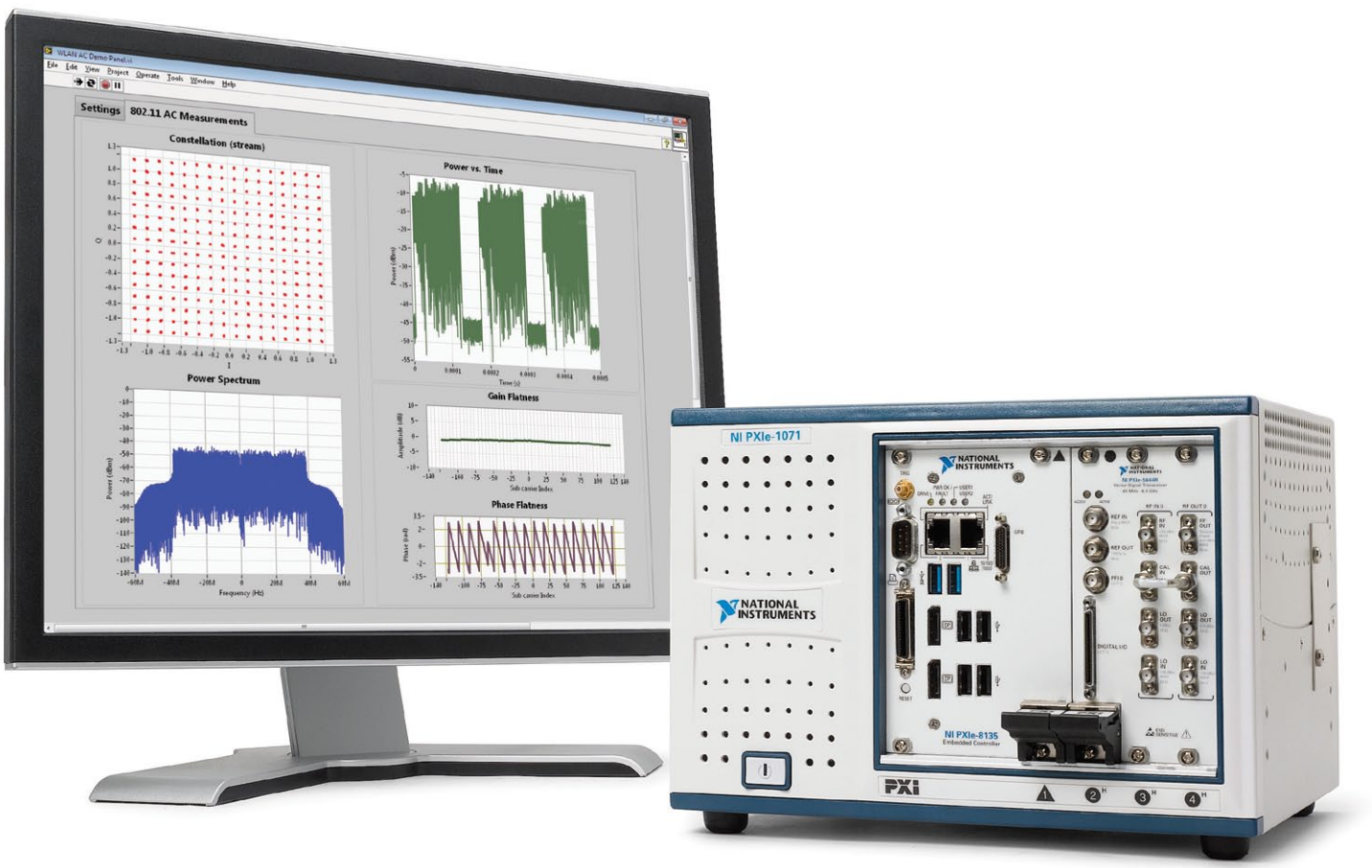

Combining a vector signal analyser and a vector signal generator with a user-programmable FPGA for real-time signal processing and control, this vector signal transceiver is a fraction of the size and cost of a traditional solution. More importantly, the NI PXIe-5644R is the first software-designed instrument. With NI LabVIEW system design software, you can modify its software and firmware to create an instrument that meets your exact needs.

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IN BRIEF

SatixFy licenses CEVA-XC DSP for satellite

CEVA has announced that SatixFy, a fabless semiconductor company specializing in the development of cost–effective SoCs for satellite communications, has licensed the CEVA-XC DSP to power its latest satellite baseband SoC aimed at bringing affordable, high performance satellite communications to the fixed and mobile broadband markets.

Historically, the costs associated with VSAT devices has resulted in a low adoption rate of broadband satellite products. Focusing on reducing the cost of these devices SatixFy has leveraged the flexibility and programmability of the CEVA-XC DSP to develop a single SoC capable of addressing multiple markets, namely fixed broadband, consumer satellite broadband, mobile broadband and mobile TV and radio. The SoC can be upgraded over the air via software running on the CEVA-XC,

www.ceva-dsp.com
www.satixfy.com

Anritsu chosen by UL for commercial LTE test facility

UL (Underwriters Laboratories) has chosen Anritsu as its provider for Long Term Evolution (LTE) telecoms equipment, becoming the first commercial independent LTE conformance test facility in the UK. Over the past 6 months UL has invested over $4 million at its Basingstoke base to create the most complete LTE test facility in the country.

UL's choice of Anritsu ME7873L and ME7834L platforms allows customers to have access to the maximum coverage of validated test cases across the highest number of bands. UL now offers the necessary conformance requirements for the GCF, is a primary laboratory for PTCRB and can offer network operator approvals for Europe, North America and beyond.

www.anritsu.com
UL.com

Wireless-Life Sciences Alliance announces 'Connected Health World'

The Wireless-Life Sciences Alliance (WLSA) has announced the launch of Connected Health World, an online portal through which healthcare industry and government representatives, clinicians, academics and others can share and obtain timely information about products, services and opportunities in the wireless health ecosystem.

Connected Health World is a resource to facilitate global collaboration and learning among the public and participants from industry, academia, clinical practice and government. Companies such as QualcommLife and Sotera Wireless have listed products in the portal, while other companies are registered and will log products in the coming weeks.

Connected Health World will include a community-sourced database of products, services, applications, organizations, funding opportunities and research abstracts in the connected health arena. Site listings enable users to connect with each other to discuss and collaborate on opportunities.

www.wirelesslifesciences.org

Princeton researchers claim quantum computing breakthrough using micowaves

Researchers from Princeton University have developed a technique to read spintronic information off electrons, a potential step on the road to quantum computing.

Spintronics—a concept in which information is passed by the spin on electronics rather than their charge— promises to revolutionize the computing industry with smaller, faster and more energy efficient data storage and processing.

The Princeton team, headed by physicist Jason Petta, used a stream of microwave photons to analyze a pair of electrons trapped in a tiny cage called a quantum dot. The microwave stream allowed the scientists to read the spin state of the electrons.

"We create a cavity with mirrors on both ends—that reflect microwave radiation," Petta said. "Then we send microwaves in one end, and we look at the microwaves as they come out the other end. The microwaves are affected by the spin states of the electrons in the cavity, and we can read that change."

The apparatus created by Petta's team operates over a little more than one centimeter. But, on a subatomic scale, this distance is vast—the team likened the project to coordinating the motion of a top spinning on the moon with another on the surface of the earth.

www.princeton.edu

LSI and 6WIND to accelerate mobile infrastructure and network performance

Chip designer LSI has teamed up with French embedded software developer 6WIND to allow network OEMs to benefit from performance-optimised software that reduces time-to-market and lowers development costs.

The 6WINDGate packet processing software running on LSI's Axxia 3400 communication processor family provides network OEMs with a pre-integrated solution for the deterministic, reliable performance and low power consumption required by data-intensive mobile, cloud and enterprise networks. The collaboration between LSI and Paris-based 6WIND benefits network OEMs on several fronts, from the pre-integrated software to easy migration to the Axxia platform for OEMs that already use the 6WINDGate software and simplified system creation and deployment for OEMs by combining the switching, control and transport functions of the Axxia platform.

www.lsi.com

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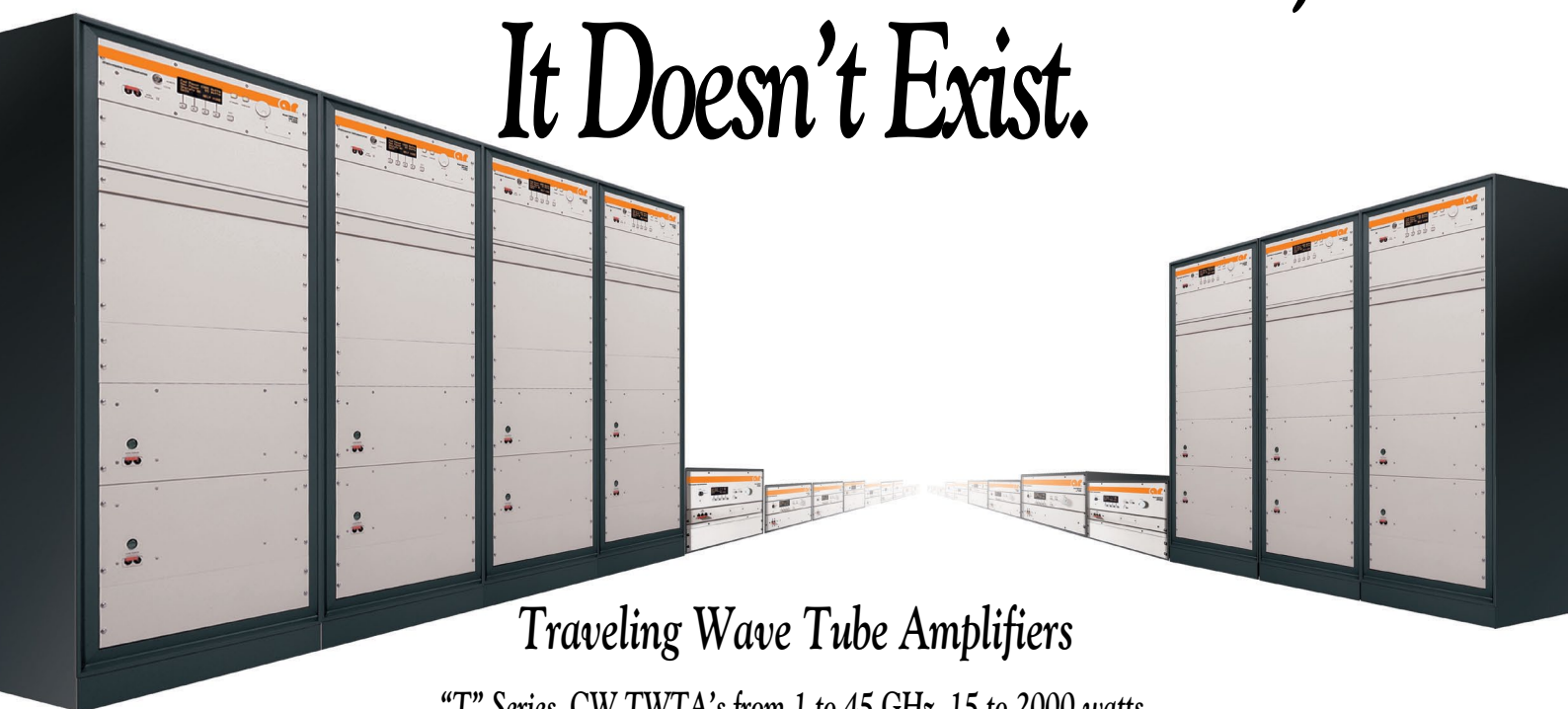

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Near-field communications power utility transactions

By Luděk Šlosarčík, Freescale Semiconductor

In the area of power metering, especially in some regions, the following trend is obvious these days: Utilities require a more sophisticated payment infrastructure to facilitate the payment process for energy. This process also reflects the recent trends in improving the security in these systems, including theft prevention.

There is an appreciable trend to transition from a fixed-rate billing to a time-of-use billing. Secure prepaid meters may be used for this purpose. These types of electricity meters give the customer a greater control over their electricity bills. The target regions for using the prepaid meters are mainly the UK, Eastern Europe, Latin America, South Africa and Asia. These types of meters are suitable for installation in landlords' flats, in shops, stores and sporting facilities, etc.

The basic and common principle of prepayment in energy meters is to buy energy credit in advance and to inform the prepaid meter in some manner. This means that customers decide how much energy they need and want to consume. This solution gives the customer greater control over their energy usage. After the prepaid amount of electricity is consumed, the user is automatically disconnected from the mains unless he/she makes a further prepayment for electricity. This is the main difference in comparison to traditional power meters (based on fixed-rate billing transactions), where the customer consumes electricity continuously.

For the prepaid metering market, there is the need to build that payment infrastructure. Generally, a bank account, an ATM, vending stations or shops are required to reload the energy credit. The main parts of the typical prepaid meter are: the metering part that measures the accumulated energy, a contactor used for disconnecting the meter (consumer) from the mains, and a prepaid sensing element which is used for loading the energy balance onto the meter itself. According to the prepaid sensing element, we may differentiate several types of prepaid meter solutions:

- Based on an electromechanical system – prepayment is done simply by coins;
- Using a meter's integrated keypad – users buy energy credit at the vendor company which generates a unique PIN which is assigned to the meter through the keypad;
- Using a token - plastic key or magnetic strip card (may be obtained from a vending machine);
- Using a memory card which is refreshed at a vending station and finally put into the prepaid meter by the user;
- Using a smart card which offers the same behavior as memory cards, but with improved security (mutual authentication, etc.) - these smart cards may be contact or contactless;
- Wirelessly (using a mobile phone) – mostly based on GPRS, ZigBee or NFC communication - these technologies may be used not only for loading the energy balance, but also for wirelessly reading the smart meters' data or valuable information by authorized utilities in real-time.

The following text is focused on describing in detail the prepayment solution based on the Near Field Communication technology (NFC). NFC is a special, low range (a few centimeters), wireless technology that enables devices such as smartphones to securely connect with other NFC-enabled devices, such as prepaid meters. This technology has already been proven in the banking industry, combining it with a secure microcontroller. A typical prepaid meter reference design, based on this technology, has been jointly introduced by two companies, Freescale Semiconductor (U.S.) and Inside Secure (France). This reference design, which has been developed thanks to the cooperation between both companies, provides the NFC-based prepaid meter with the ability to securely reload energy balances. This reference design uses three key parts: the Freescale MK30X microcontroller (MCU), a part of the recently introduced Kinetis series, and the secure element, the ATVaultIC460, together with the NFC (Microread 3.4) chipset, both from the Freescale partner company, Inside Secure.

The meter is driven by the Freescale MK30X256 32-bit MCU, which is the heart of the metering engine. This MCU is built on the popular ARM Cortex-M4 core. The main function of this MCU, coupled with an integrated Analog Front-End (AFE), is to periodically read data from external voltage and current sensors and compute other values consecutively, mainly the powers and accumulated energies. As the main computing technique is based on the Fast Fourier Transform (FFT), the meter can measure energy precisely in all four quadrants (import/export energy, active/reactive energy). Thanks to this, the meter can perform a complete frequency analysis of the mains. The next MCU

function is to communicate with on-board AMR communication interfaces, such as an optically-isolated RS232 interface, energy LEDs pulse output interface, an infrared IEC1107 interface, and an I2C/SPI interface for communication with RF/ZigBee daughter cards. The MCU also cooperates with on-board human-machine interfaces (HMI), such as an LCD, which is used for showing the demand values, and with a built-in push-button used for menu item selection.

The next important part of this reference design is a stand-alone RF daughter card, which incorporates two main functions: security and NFC communication. The secure element is the basis for implementing end-to-end security between the prepaid meter and the utility and its distributors who sell energy credits. The referred to RF daughter card features Inside Secure's ATVaultIC460 and an NFC (Microread 3.4) chipset. The ATVaultIC460 security module provides comprehensive security functions, such as mutual authentication, verification and generation of certificates, encryption/decryption and managing the secure storage of cryptographic keys. Additionally, the controller is EAL4+ ready and can also support FIPS 140-2 Level 3 and other certification and standards.

Combining all these cryptographic services and an 8/16-bit RISC processor, the ATVaultIC460 delivers a secure control solution not only for metering applications. The NFC connectivity integrated in this design allows users to upload energy credits using contactless smart card technology or through an NFC phone. NFC connectivity on this daughter card is implemented using the Microread 3.4 controller and the Open NFC protocol stack. Both the RF/NFC daughter card with security functions and the MK30 MCU are connected through an I2C interface, with communication based on the standard Host Communication Interface (HCI) protocol.

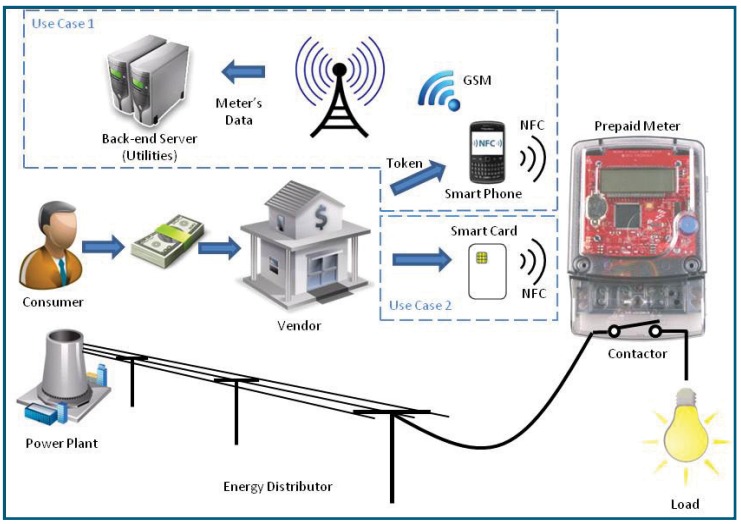
The firmware for this reference design is based on Freescale's MQX real-time operating system (RTOS), which helps to improve the code structure and is ideal for advanced markets. This RTOS is designed to allow the users to configure and balance code size with performance requirements. Freescale's MQX RTOS provides the developer a faster development time by relieving engineers of the burden of creating or maintaining an efficient scheduling system and interrupt handling. This RTOS also provides a framework, with a simple API, to build and organize those features across Freescale's broad portfolio of embedded processors.

The key benefits of the described MK30 single-phase secure, prepaid meter are:

- End-to-End security between the meter and the utility and its energy credit distributors;
- Physically secure – a sealed meter casing thanks to NFC technology (NFC energy balance reload);
- Metering engine based on the popular ARM Cortex–M4 Core;
- Fully 4-quadrant measurement – the ability to measure import/export, active/reactive energy;
- Ability to compute the Total Harmonics Distortion (THD) and frequency analysis of the mains;
- Secure data exchange between the meter and the utility through a smart phone – the ability to reload the meter's balance and perform an anti-counterfeiting check;
- MQXTM RTOS enabled.

To better understand how this secure prepaid meter works in a real application, refer to the working scheme in Figure 1. Firstly, the user must recharge the energy balance inside the prepaid meter. To do that, the user must refresh the energy credit on his/her mobile phone by the vendor who debits an adequate amount of money from the user's bank account. Alternatively, or for cost effective markets, the smartphones may simply be substituted by cheaper smart cards. Using an NFC enabled smart phone or contactless smart card doesn't have any impact on the meter's hardware or firmware. In this case, the users buy a smart card at vendors (shops, etc.). Then, the user must approach the smartphone or smart card to the meter. At that moment, the meter's NFC interface recognizes a new balance request and after doing a mutual authentication it starts transferring the new energy credit from the smart card or smartphone to the meter. After that, the received data and digital signature of the whole message must be verified. After successful verification, the meter activates its contactor (power latch relay), which connects the meter (load) to the mains. The meter continuously measures the accumulated energy. The received credit is deducted depending on energy usage and when this credit reaches zero, the meter disconnects the load from the mains. If the user wants to use further energy from the mains, he/she must carry out a further prepayment.

Figure 1: Working scheme for secure prepaid working meters.



The end-to-end secure, prepaid meter reference design, described in this issue, provides a solid, safe and powerful solution for prepaid meter developers. For more information about this reference design, visit the link www.freescale.com/metering at Reference Designs section.

About the author

Ludek Slosarcik received his M.Sc. degree in electrical engineering from the VSB-Technical University of Ostrava in 1992 and 1997. His early career experience includes two different R&D companies focused on designing of equipment for measurement and control and power engineering. Since 2008, he has been employed by Freescale Semiconductor, Czech System Center (Roznov pR), as a Systems Application Engineer with a focus in sensor and metering applications.

Nujira samples low noise second-generation Envelope Tracking chip for smartphones

The second product in the company's Coolteq.L ET product family, Nujira's NCT-L1200 has already been delivered to several key platform chipset vendors, and claims to be the only product currently available on the market that supports the maximum 20 MHz channel bandwidth of LTE.

Nujira's Coolteq.L family of ET power modulators for handsets reduces wasted energy from PAs in mobile handsets by more than 50%, cutting heat dissipation and extending battery life. Earlier in September 2012 Nujira raised a further $12 million in its latest funding round, securing the rollout of its Coolteq.L IC technology and supporting the ramp to volume production.

"Our latest Coolteq.L chip meets stringent industry noise requirements, and continues to deliver significant technical advantages over competitive solutions. Critically Nujira's patented ET architecture is the only configuration that supports 20 MHz bandwidths for LTE now, and is also scalable to support the future bandwidth expansions required for LTE-Advanced," commented Tim Haynes, CEO of Nujira.

Reducing the power consumption of PAs is one of the key challenges facing 3G and 4G smartphone OEMs as demand for higher data rates continues to drive network standards. The improved spectral efficiency of the 4G LTE standard enables higher data bandwidth, but comes at the price of reduced energy efficiency in the RF PA. Further penalties come from an increase in the average RF power transmitted from the handset, and the need to support an increasing number of frequency bands in the phone to support global roaming. This not only impacts on battery life, but also on handset temperature - a growing problem for smartphone designers. Unaddressed, these issues will degrade the user experience and delay the adoption of 4G smartphones.

Nujira announced the first commercial IC in its Coolteq.L product family of ET power supply modulators for mobile handsets, the NCT-L1100, in February 2012 at Mobile World Congress.

The company is currently engaged with 16 major smartphone chipset suppliers to embed its ET technology into their reference platforms and expects its Coolteq.L technology to be designed into 4G smartphones in 2013.

The company's patented High Accuracy Tracking (HAT) architecture combines high efficiency switch mode power supply technology with high bandwidth linear elements, and has been proven from power levels of 0.5 W to 10,000 W and beyond. The HAT architecture is at the heart of all of Nujira's products for basestation, digital TV and mobile handset applications.

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Deciphering datasheets for high-frequency circuit materials

By John Coonrod, Rogers Corporation

Data sheets for printed-circuit-board (PCB) materials carry a great deal of information. Understandably, these materials are the foundations for many circuits, and they are characterized by many different parameters, some related to applications, some to fabrication issues, some to environmental and mechanical concerns. Having a good understanding of different PCB material properties can certainly ease the task of choosing a material for a given set of circuit performance requirements. What better place to learn more about key PCB material parameters than starting with a PCB product data sheet?

Figure 1 is an example of a data sheet for a high-frequency PCB material. It lists numerous material properties, typical values for those properties, conditions under which those values were determined and even applicable measurement methods. The first two parameters pertain to the relative dielectric constant, ε_r. Two different values are given through the thickness or z direction of the material, process and design values. These values differ and are determined in different ways. Process ε_r is measured for raw substrate material clamped in a fixture described in test method IPC-TM-650 2.5.5.5, a test procedure established by IPC.® While this is an excellent gauge for PCB material process control and quality assurance, it has several attributes, such as entrapped air, which are not representative of the material's use in a PCB application. The design ε_r value is better suited as a reference for circuit design and modeling. It is determined by fabricating a microstrip transmission line of precisely controlled dimensions on a material under test.

Next on the data sheet is dissipation factor or tangent delta (tan δ), a parameter mainly responsible for dielectric losses in high-frequency circuits. It is determined by means of the same test method as used for process ε_r, although it is often listed with multiple values for different test frequencies. In general, a PCB material's dissipation factor will increase with increasing frequency; knowing values at different frequencies provides insight into the broadband loss performance of that material.

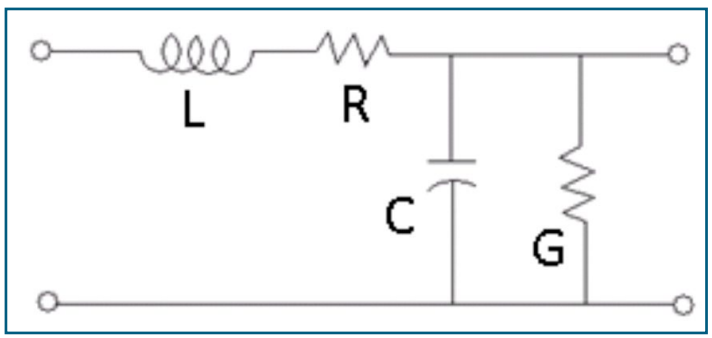
Since high-frequency circuits must often perform across a range of operating temperatures, a critical material parameter not always properly considered is thermal coefficient of ε_r. It is an indicator of how much ε_r will change as a function of temperature. The thermal coefficient of dielectric constant, or TcDk for short, is generally considered acceptable when its absolute value is less than 80 ppm/°C, with ideal behavior being a value of zero, or no change with temperature. Better performance for this parameter is needed for high-frequency circuit designs that are particularly sensitive to fluctuations in ε_r. TcDk values can be either positive or negative, with positive values denoting an increase in the ε_r value for positive changes in temperature, and negative values representing materials having a decrease in ε_r value with a positive change in temperature.

As the name implies, volume resistivity is the amount of resistance exhibited by a material in a volume measurement, or how strongly that material opposes the flow of current. Resistivity is a material property, different than resistance, with a unique value for each material. It is often thought of as the resistivity of a material between two copper planes. Volume resistivity is related to conductance, as can be shown with the schematic representation of the microstrip transmission-line segment in Figure 2. The volume resistivity is the inverse of conductance G, with the inductance, resistance, and capacitance of this simple schematic represented by L, R, and C, respectively. Most high-frequency PCB materials

Figure 1: Example datasheet for a common high-frequency circuit material.

Property	Typical Value	Direction	Units	Conditions	Test Method
Dielectric Constant, ε_r Process	3.38 ± 0.05	Z	--	10 GHz/23°C	IPC-TM-650 2.5.5.5 Clamped Stripline
(1) Dielectric Constant, ε_r Design	3.55	Z	--	8 to 40 GHz	Differential Phase Length Method
Dissipation Factor tan, δ	0.0027 0.0021	Z	--	10 GHz/23°C 2.5 GHz/23°C	IPC-TM-650 2.5.5.5
Thermal Coefficient of ε_r	+40	Z	ppm/°C	-50°C to 150°C	IPC-TM-650 2.5.5.5
Volume Resistivity	1.7 X 10^{10}		MΩ•cm	COND A	IPC-TM-650 2.5.17.1
Electrical Strength	31.2 (780)	Z	KV/mm (V/mil)	0.51mm (0.020")	IPC-TM-650 2.5.6.2
Tensile Modulus	26,889 (3900)	Y	MPa (kpsi)	RT	ASTM D638
Tensile Strength	141 (20.4)	Y	MPa (kpsi)	RT	ASTM D638
Dimensional Stability	<0.3	X,Y	mm/m (mils/inch)	after etch +E2/150°C	IPC-TM-650 2.4.39A
Coefficient of Thermal Expansion	11 14 46	X Y Z	ppm/°C	-55 to 288°C	IPC-TM-650 2.4.41
Tg	>280		°C DSC	A	IPC-TM-650 2.4.24
Td	425		°C TGA		ASTM D3850
Thermal Conductivity	0.71		W/m/°K	80°C	ASTM C518
Moisture Absorption	0.06		%	48 hrs immersion 0.060" sample Temperature 50°C	ASTM D570
Copper Peel Strength	1.05 (6.0)		N/mm (pli)	after solder float 1 oz. EDC Foil	IPC-TM-650 2.4.8
Lead-Free Process Compatible	Yes				

Figure 2: This schematic diagram represents a microstrip transmission-line segment, with values of inductance (L), resistance (R), capacitance (C), and conductance (G).



have relatively high volume resistivity, so that leakage losses are typically not significant. Leakage losses can be a concern for RF/microwave applications using circuit materials having lower volume resistivity, such as those found in semiconductor-grade materials.

Electrical strength is associated with the dielectric strength of a circuit material. This parameter is presented in units of voltage per unit length of material, such as KV/mm or V/mil, with values based on an IPC measurement method that assumes a set thickness of the circuit material being tested. The test method measures for the dielectric breakdown point of a material with voltage applied as DC. Although this property may not be critical for lower-power circuits, it can be important for high-power applications or RF/microwave circuits employing very high DC bias.

Some of the properties listed on a PCB material data sheet are mechanical in nature, such as tensile modulus and tensile strength. Tensile modulus indicates the stiffness of the material, with higher modulus values denoting stiffer materials. Tensile strength provides a measure of how much a material can be stretched before suffering permanent damage. Both of these mechanical properties can be of concern for circuit fabrication and end-user applications. For example, non-glass-woven PTFE circuit substrates are sometimes formed into different shapes as part of an end-product; knowing more about a circuit material's mechanical properties can help a circuit designer decide on a suitable material and just how much strain can be applied without causing damage to the final circuit.

Dimensional stability, given in terms of the width and length (x and y) dimensions of the PCB material, can be a concern in some cases of circuit fabrication. This parameter gauges the tendency of a circuit material to change x and y dimensions when copper is etched away from the dielectric material (such as when forming a circuit) or in some cases when the circuit material is exposed to temperature extremes. Copper tends to add rigidity and stability to a dielectric-based PCB material but, due to how copper-clad laminates are made, some stresses are built into the material. As copper is etched away, these stresses can relax and result in dimensional changes in a circuit laminate. This is a concern for any application where circuit dimensions must be precisely controlled. Testing for this circuit-material property is usually by means of a bake just after copper removal. The bake is performed as part of a worst-case scenario, where the elevated temperature will cause the stress relaxation to occur quicker and sometimes to a higher degree.

The next four data-sheet parameters cover the thermal properties of circuit-board materials. The coefficient of thermal expansion (CTE), for example, indicates how

a circuit material expands and contracts with temperature. It is typically of greatest concern in the z direction or thickness of a circuit material because of the use of plated through holes (PTHs) for electrical connections from one side of a PCB to the other and in multilayer constructions. Excessive z-axis CTE during thermal cycling can damage the PTHs. As a general rule of thumb, a z-axis CTE of less than 70 ppm/°C is considered acceptable. The optimum CTE value is closely matched to the CTE of copper, at 17 ppm/°C.

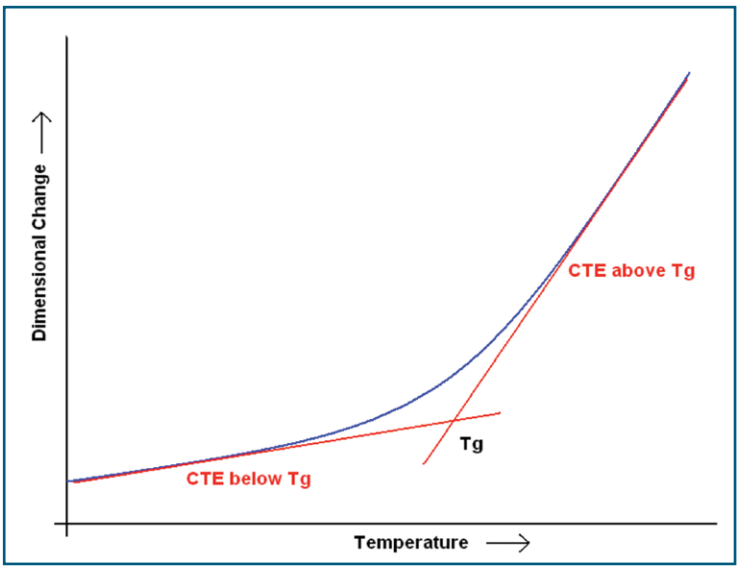
The CTE of a circuit material in the x and y directions can also be a concern, especially when placing surface-mount devices on the PCB material. If the x-y plane CTE of the material is significantly mismatched from the CTE of a surface-mount device, the expansion and contraction of the circuit material will differ than that of the surface-mount device. With thermal cycling over time, the differences in CTE can cause a work-hardening to occur at the solder joints between the PCB and the surface mount device, potentially harming long-term reliability.

A circuit material's glass transition temperature, Tg, is the temperature at which the material exhibits a modulus change or transition in its physical characteristics. Most high-frequency PCB materials have different CTE below the Tg temperature than above it. This is sometimes referenced as alpha1 CTE for the CTE below Tg and alpha2 for the CTE above Tg. For most circuit materials, the CTE value is much greater above Tg than below it, and this can be a concern when soldering or performing other operations at elevated temperatures. Figure 3 provides a graphical depiction of changes in CTE above and below a material's Tg.

The highest-temperature parameter listed in the thermal section of a PCB material's data sheet is the thermal decomposition temperature (Td). This is the temperature at which a material starts to decompose. More about the importance of this parameter shortly.

A circuit material's thermal conductivity is its tendency to act like a thermal conductor or resistor. This parameter is given in terms of power per distance per temperature (W/m/K), and most PCB materials exhibit thermal conductivity like that of a thermal insulator or resistor. FR-4 circuit materials, for example, have thermal conductivity values in the range of 0.25 to 0.35 W/m/K. Many PTFE-based substrates have thermal conductivity values in the same range. When ceramic is used as filler for those PTFE circuit materials, however, the thermal conductivity can be increased to the range of 0.5 W/m/K. Although this may not seem significant, it is double the thermal conductivity of those earlier examples. In general, a circuit material with thermal conductivity of greater than 0.5 W/m/K is considered good.

Figure 3: This CTE chart represents the behavior of a typical PCB substrate.



Water has a high value of ε_r and suffers excessive loss at RF/microwave frequencies, so that water absorption should be minimized for any circuit material intended for high-frequency use. A high value of ε_r in itself is not bad, and some circuit materials are available with relatively high ε_r values. But when a circuit is designed and tuned for performance at a particular ε_r value, and environmental changes such as moisture can change ε_r which in turn changes the impedance of fabricated circuits, that circuit will no longer perform as designed. For high-frequency designs, circuit materials with less than 0.2% moisture absorption are considered good.

Copper peel strength, which is typically denoted in units of force per length of material (N/mm), is a mechanical material parameter that is often misunderstood relative to some of the other material parameters. Alone, it would be intuitive to think that a material with higher copper peel strength is better than one with a lower value. But tradeoffs among a circuit material's various other properties must also be considered. For example, some materials with good copper peel strength cannot survive lead-free soldering because of other material attributes like CTE or Tg. Also, materials with lower modulus (softer materials) will typically exhibit higher peel strength numbers: during testing, the soft materials elongate and hold together longer, increasing the bond-fracture area and raising the peel strength number. In contrast, a more rigid material which has just as good bond will yield a clean break in the bond-fracture area during peel strength testing, lowering the peel strength value.

Lead-free soldering has received a great deal of attention due to environmental concerns. There are numerous ways to test a circuit's lead-free soldering quality, including by running a material under test through a conveyor-belt-based, lead-free-solder reflow oven multiple times and checking for changes in mechanical attributes. The lead-free soldering temperature can vary, but is typically around +260°C. Some materials will perform well in multiple lead-free soldering cycles when making a simple single-layer PCB, but will perform poorly when the same approach is used for a multilayer construction. The fabrication process can have an impact on the capabilities of some materials to withstand the lead-free soldering process. In general, materials that do best in multiple lead-free soldering cycle testing are materials with high Tg, low CTE, and high Td. Reinforced hydrocarbon/ceramic RO4350BTM circuit material from Rogers Corporation (www.rogerscorp.com) is an example of an extremely robust lead-free-capable RF/microwave PCB material. It handles lead-free processing effectively due to a CTE of 50 ppm/°C, Tg of greater than +280°C, and Td of +390°C. The material represents an unusual combination of low-loss RF/microwave properties and the ability to effectively handle lead-free processing.

Design engineers often compare high-frequency PCB materials by referring to their data sheets. But data sheets are not always uniform in their presentation and information, and some key concerns in comparing PCB material data sheets have been outlined here. Of course, when in doubt, a designer is encouraged to consult the manufacturer of the high frequency circuit material while in the process of determining the proper material for their application.

Human hotspots – wireless for your body

By Sylvie Barak, EE Times

Wireless connectivity is already fairly ubiquitous, but with ever more devices getting hooked up to the net, will the final frontier become the human body?

According to Iboun Sylla, business development manager at Texas Instrument's wireless medical unit, Body Area Networks (BAN) will soon be the norm, turning humans into walking hotspots.

Of course, hooking ourselves up to the grid on such an personal level isn't to allow others to check emails as we walk past, but to transmit a host of biometric data directly from our bodies to our doctors in real-time.

The concept of telehealth is not a new one. As telecommunications technologies and wearable or embeddable sensors become more advanced, however, the possibilities of beaming our blood pressure, glucose levels, temperature, weight, heart rate and more over to a health professional for monitoring becomes not just easy, but worthwhile.

Consider the fact that by 2019, 32 percent more people in the US will be over 65 years old, while in2025 1.2 billion people worldwide will be over 50 years old. Our population is aging fast, and the pressure this would put on our existing healthcare model would be unbearable.

U.S. healthcare spending is already more than 17 percent of GDP and those costs are expected to grow from $2.5 trillion in 2009 to $4.5 trillion in 2019.

Research shows, however, that wearable devices could significantly cut down on healthcare costs by adding to preventative care and cutting down on unnecessary visits to a physician. Indeed it's believed remote monitoring of individuals with chronic conditions could result in a 35-56 percent reduction in mortality, a 47 percent reduction in risk of hospitalization, six day reduction in length of hospital admissions and 65 percent reduction in office visits. In addition, remote monitoring could provide a 40-64 percent reduction in Physician time for checks and a 63 percent reduction in transport costs.

While the benefits of telemonitoring may be clear, however, business models and interoperability are still massive hurdles the industry needs to overcome in order to turn body connectivity into a reality.

Organizations like the Continua health alliance are gathering various partners into a consortium, but there is still the question of which wireless technologies are best suited to the purpose, with Bluetooth, Bluetooth Low Energy (BLE), ANT, Zigbee, GPRS, EDGE, GSM and Ethernet all under the microscope.

Of course the uses for BAN are almost as diverse as the choices for which technology to use, with everything from cardiac implants to wireless pacemakers, blood glucose monitors, implantable insulin pumps and pill cameras under development, not to mention an entire industry of health fitness monitoring.

Indeed, the current definition for a body area network is "a communications technology that is optimized for low power consumption and operates in, on or around the human body to enable a variety of applications including medical, consumer electronics and personal entertainment."

Speaking at TI's technology day in San Jose last week, Sylla noted that the basic requirements for any such BAN would have to include criteria such as a range of equal of over three meters, data rates of 100 kbs – Mbps, peak power consumption of under 3 mA and the ability to operate in multiple frequency bands.

It also needs to be robust in noisy and interference-limited environments and able to coexist with legacy devices and primary users of spectrum.

On the usage side, anything to do with BAN must be easy to set up, with short access times, efficient power management, have strong security, include support for alarms and continuous and aperiodic data.

Currently, even technologies like Zigbee and Bluetooth are not considered low power enough, with Bluetooth optimized for voice links and ZigBee optimized for industrial sensors and smart grids. Meanwhile, Wi-Fi is optimized for data networks while BLE or ANT can be used but the peak current is still high.

That leaves the industry with the option to modify existing standards to support medical BAN applications but existing standards already carry significant overhead and were designed with other applications in mind.

In addition, none of the existing standards meet the peak-power consumption requirements, power savings modes are not optimized and various bits and pieces of security in existing standards are broken.

But while the thought of embedding wireless into our person may be a little creepy, it's clear that the medical industry is highly focused on achieving it to alleviate some of the challenges it faces - sooner rather than later. It's just that there's still a long way to go before digital human connectivity becomes a standard reality.

2.5 GS/s high definition oscilloscope

equipped with true 12-bit ADC

Teledyne LeCroy's HDO4000 and HDO6000 high definition oscilloscopes are the company's first instruments to operate with the so-called HD4096 high definition technology (4096 levels of quantization thanks to a 12-bit ADC).

Designed with a new SiGe front-end and a new hardware platform to improve signal to noise ratio, especially by further eliminating noise from the power supply, the instruments acquire waveforms that are cleaner and crisper with 16 times more vertical resolution than traditional 8-bit instruments. Waveform details which were previously difficult to see can now be easily distinguished and measured.

The HDO4000 oscilloscopes feature a sample rate of 2.5 GS/s with up to 25 Mpts/channel of memory (up to 50 Mpts/ch when interleaved) in two- and four-channel models from 200 MHz to 1 GHz. The HDO6000 oscilloscopes available in four-channel models deliver sample rates of 2.5 GS/s; a maximum 250 Mpts/channel memory, and bandwidths of 350 MHz, 500 MHz, and 1 GHz. All HDO models have a 12.1" touch display that gives users an easy means of controlling channels, trigger

settings, and math and measurement functions.

These tools include WaveScan search and find, history mode waveform playback, sequence acquisition mode, and LabNotebook report generation. Spectrum-analysis and power-measurement software packages extend the oscilloscopes' capabilities while leveraging their 12-bit architecture with its wider dynamic range and improved measurement precision.

In addition to HD4096 technology, the HDO features Teledyne LeCroy's ERES (Enhanced Resolution) filtering, which enables users to gain up to three additional bits of resolution for 15-bit vertical resolution.

www.teledynelecroy.com

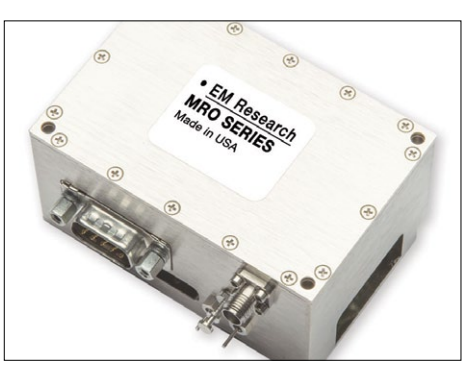
Microwave radio oscillator

extends battery life in T1/E1 microwave radios

The MRO Series is designed to extend the life of legacy analog and digital (T1/E1) microwave radios by replacing cavity-tuned oscillators which have been discontinued, obsoleted, or are otherwise no longer supported by original equipment manufacturers.

The MRO operates in the S, C and X frequency bands and features form-fit-function compatibility with older, manually-tuned cavity oscillators.

Unlike the cavity-tuned oscillators, the MRO has no warm-up time and no frequency drift since it is a phase-locked oscillator. Also, the MRO is serially-programmable to within 1 KHz of desired frequency which can then be manually tuned to a precise desired frequency of operation. The device includes an internal reference and non-volatile memory.



Custom units are available in 200 MHz bandwidths in the S, C and X-Band frequency ranges (2 to 8 GHz) in a connectorized package of just 3.05 x 2.02 x 1.62 inches. A customized mounting plate is available for easy drop-in replacement of old cavity-tuned oscillators.

www.emresearch.com

Wireless Combination Module
in a 24.6 x 18.0 x 3.0 mm package

The LBEL6Z2TXC wireless combination module from Murata is aimed at automotive applications and uses an AEC-Q100 compliant chipset.

Providing support for wireless LAN, Bluetooth, Bluetooth Low Energy (BLE) communications in addition to providing an FM radio receiver and GPS receiver the module measures just 24.6 x 18.0 x 3.0 mm. The WLAN feature is IEEE 802.11 b, g and n compliant and also supports WiFi Direct. Bluetooth 4.0 class 2 compliant support and H4 protocol is standard. By combining the five wireless functions into a single package allows designers to simplify their end-designs, save valuable board space in addition to easing the burden of procurement.

Module interfaces include a UART, PCM, SDIO, I2S and audio.

www.murata.eu

SMT GPS RF antenna modules
embedded GPS, M2M applications

Antenova Ltd has added two surface mount GPS RF antenna modules to its market leading RADIONOVA® range of GPS radio antenna modules for embedded GPS and M2M applications. Both the M10477 and M10478 are low profile, fully optimized, complete GPS receiver modules comprising a CSR SiRFstarIV™ low-power navigation processor, all front-end RF components and Antenova's high performing GPS antenna. Designed as a convenient drop in solution, both modules benefit from the company's external matching for greater design flexibility.

www.antenova.com

EMC horn antennas with waveguide to connector adaptors

Q-par Angus Limited has launched a family of wideband waveguide horns and high power waveguide adaptors. Two waveguide horn antennas operate at 2.5 to 7.5 GHz and 7.5 to 18 GHz meeting the requirement for EMC horn antennas across the WRD250 and WRD750 bands. The two antennas have been designed to meet the demands of the EMC testing market and their low VSWR performance makes them ideal for high power applications such as reverb or free field EMC; the antennas are able to handle power of 2-kW CW (2.5 to 7.5 GHz) and 1-kW CW (7.5 to 18 GHz).

Two compatible waveguide to connector adaptors, QST250NHP and QST750NHP provide high power handling of 500-W CW at their designated frequencies.

www.q-par.com

Remote radio head test solution

adds 3 GHz support

Signalion has announced that its RHT100 compact remote radio head (RRH) test solution supports the frequency range of 3.3 to 3.9 GHz beside the existing range of 200 MHz to 2.7 GHz. Consequently, the 3GPP LTE TDD bands 42 and 43 are supported. All LTE bands specified by 3GPP are covered by the RHT100 with this extension.

Mobile network infrastructure is changing. Traditionally, long RF feeder cables were used for the connection between the base station and the antenna. The new approach uses optical cable connections between the base station and the RRH, which is normally mounted on the top of the tower close the antenna. The idea behind this is to avoid the attenuation of the long RF feeder cables and to reduce the number of cables from the ground to the top of the mast.

The company's RHT100 covers the radio and the optical interfaces of an RRH and serves as a compact test solution for these RRHs. It can be used in R&D as well as in production lines to substantially reduce the testing time. Due to the integration of all necessary equipment the tester can easily be controlled over an API. This simplifies integration into existing test environments.

www.signalion.com

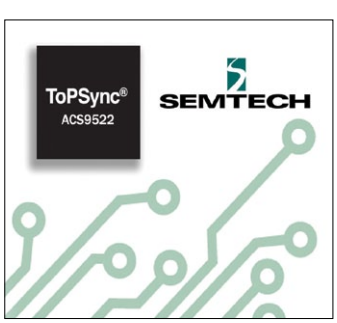
One-chip synchronization system

for all telecom timing standards

The ACS9522T is a single-chip synchronization system for all telecom timing standards including SyncE and IEEE1588.

The ToPSync synchronization system-on-a-chip supports IEEE1588 master, slave and boundary clock, at the same time as SyncE, SONET and SDH. Uniquely, Semtech provides everything internally; all the CPU processing power and algorithms; RAM and ROM, Ethernet interfaces and timestampers, GPS in/out, clocks in/out along with hardware synthesizers and PLLs.

The ACS9522T brings specific benefits in PCB real-estate savings along with power and cost reductions. Delivering highly stable time alignment to the base station is now simpler than ever as the ACS9522T will support Semtech's latest time recovery algorithm. This



algorithm runs on an internal CPU, which is specifically tailored to handling PTP, leaving the rest of the base station free from any real-time processing associated with synchronization.

ToPSync is totally self-contained with no mandatory external software control required and provides the system designer with a multitude of statistics and network performance measures to aid in debugging and system testing.

www.semtech.com

Fixed frequency synthesizer

features low phase noise

Z-Communications has announced an RoHS compliant fixed frequency synthesizer model SFS4000C-LF for satellite communications and test equipment.

The SFS4000C-LF is a single frequency synthesizer that is phase locked at 4000 MHz while using a 10 MHz reference. This coaxial resonator PLL features low phase noise of -102 dBc/Hz at 10 kHz offset and typical sideband spurs of -65 dBc.

The SFS4000C-LF is designed to deliver a typical output power of 0 dBm into a 50 Ω load while operating off a VCO voltage supply of 5 Vdc and PLL chip voltage of 3.3 Vdc, each drawing 30 mA and 11 mA, respectively. The innovative, low phase noise device is designed to operate over the extended commercial temperature range of -25 to 90°C. The SFS4000C-LF features typical 2nd harmonic suppression of -15 dBc and comes in the company's industry standard PLL-V12C package measuring 0.60 x 0.60 x 0.22 inches.

www.zcomm.com

Analog communications processor

provides digital benefits to analog two-way radios

CML Microcircuits has launched the ACE (Analog Communications Enhancements) processor which is specifically targeted at providing the digital advantage to analog two-way radios and walkie-talkies, serving both licence-free and licensed two-way radio market sectors. The CMX188 offers the combination of an embedded low bit-rate vocoder, audio-band modem and digital voice.

The migration from analog to digital two-way radio is proving to be slow, with the majority of two-way radios in the field still being analog. The slow transition is associated with the complexity and implementation cost of modern digital radio systems together with the need to provide backward compatible operating modes. The CMX188 ACE Processor solves these problems, bringing new life to analog PMR radios by working alongside the radio's existing analog baseband processing

and providing the digital advantage.

The plug and play solution provided by the CMX188 ACE Processor provides a new approach by enabling digital voice features and functionality not normally found on analog two-way radio. These include: secure digital voice encryption, digital voice storage/retrieval including step back feature, instant voice capture to eliminate PTT clipping, auto-adaptive VOX and packet data.

Built into the CMX188 is CML's RALCWI (Robust Advanced Low Complexity Waveform Interpolation) vocoder providing near toll quality speech at a low bit-rate.

www.cmlmicro.com

GAN-based amplifiers

ideal for cable applications

RF Micro Devices has unveiled multiple leading-edge GaN-based CATV amplifiers which include the RFPD2940 – a best-in-class, high-power GaN-based CATV power-doubler amplifier, as well as a new family of GaN-based push-pull CATV amplifiers, led by the RFPP2870 and RFCM3080.

RFMD's RFPD2940 GaN-based CATV power-doubler amplifier delivers +63 dBmV output power without compromising the critical linearity performance requirements of CATV applications. The superior output power of the RFPD2940 enables CATV network operators to upgrade existing systems to wider bandwidths, enabling higher data throughput while also reducing operating expenses.

The RFPD2940 CATV power-doubler amplifier operates from 45 MHz to 1000 MHz, has 23 dB gain at 1000 MHz, features superior input and output return loss of -20 dB, and delivers better than -73 dB CTB and CSO performance. The RFPD2940 is housed in an industry-standard SOT-115J package and is available today for immediate sampling.

The RFPP2870 and RFCM3080 GaN-based push-pull amplifiers are ideally suited to drive GaN-based final stage CATV power-doubler amplifiers. They feature 28 dB gain at 1003 MHz, have -20 dB typical input and output return loss, and deliver low distortion levels of -68 dBc CTB and -75 dBc CSO. The RFPP2870 is housed in an industry-standard SOT-115 package, and the RFCM3080 is housed in a miniature 11 mm x 8.5 mm MCM surface mount package.

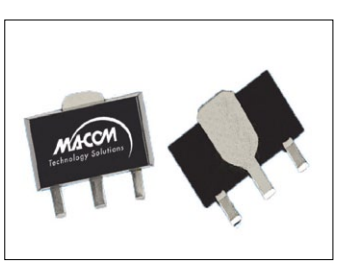
www.rfmd.com

Broadband CATV amplifier

exhibits low distortion and high gain

M/A-COM Technology Solutions has introduced a broadband amplifier for CATV applications. The MAAM-010373 is a GaAs MMIC amplifier that exhibits low distortion and high gain in a lead-free surface mount package. The amplifier employs a monolithic single stage design, featuring convenient 75 Ω input/output impedance which minimizes the number of external components required.

The MAAM-010373 is fabricated using a pHEMT process to realize low noise and low distortion. The process features full passivation for robust performance and reliability. Operating between



the 50 MHz to1100 MHz frequency range, the amplifier exhibits a high gain of 22 dB and low noise figure of 2.2 dB.

Other features include ±0.5 dB gain flatness, 18 dB input return loss, 20 dB output return loss, 25 dB reverse isolation, 25 dBm P1dB at 403.25 MHz, -62 dBc CSO, and -74 dB CTB.

www.macomtech.com

Solid State Amplifier

covers the 1 to 6 GHz frequency band

Solid-state amplifiers that cover the 1 to 6 GHz frequency band are not unusual. But they all require dual bands (two separate amplifiers) to provide high output power and good gain flatness to provide one with a useable instrument.

That is, until AR RF/Microwave Instrumentation created the single band Models 15S1G6 and 50S1G6. They provide 15 and 50 W of linear output power across the 1 to 6 GHz frequency band with excellent gain flatness.

The ability to use one band instead of two means you use less power, and don't require the amplifiers to be switched from one band to the other to perform the

required tests. Along with excellent performance, it has a remote interface standard (a feature that is an extra with competitive amplifiers), a lower noise figure than other amplifiers, and it has an exceptional output VSWR of 1.5:1.

www.arworld.us

Configurable dual PLL clock generator

with less than 200 fs phase jitter

The SM803xxx family of highly configurable dual PLL clock generators from Micrel is optimized for ultra-low jitter, excellent crosstalk isolation and enhanced power supply noise rejection.

The device achieves less than 200 femto-second (fs) RMS phase jitter with twelve differential or single-end outputs for frequencies up to 850 MHz. FLEX2 supports very demanding applications requiring numerous frequencies, high fan-out, and ultra-low jitter on a single IC. This includes 10/40/100 Gigabit Ethernet, SONET/SDH, CPRI/OBSAI, Fibre Channel, SAS/SATA, and high speed clocking for FPGA and SerDes.

Factory configurable thanks to a fuse-based one-time programmable (OTP) memory, FLEX2 delivers a customized, quick turn and high performance clocking solution that shortens prototyping time and end system design cycle. The SM803xxx is currently available in production quantities and sampling to customers.

www.micrel.com

Low-cost signal analyzer

adds frequency options up to 26.5 GHz

Agilent Technologies has announced two frequency options for the N9000A CXA X-Series signal analyzers. The options provide a low-cost solution for essential microwave signal characterization up to 13.6 GHz and 26.5 GHz.

"Traditionally, value-priced signal analyzers have only provided a basic level of functionality," said Brian LeMay, general manager of Agilent's Chengdu Instruments Division. "Adding microwave frequency options for the CXA goes beyond the norm and provides essential signal characterization. These options also provide a foundation for cost-effective testing and seamless integration with other X-Series models, which reduces capital expenditures."

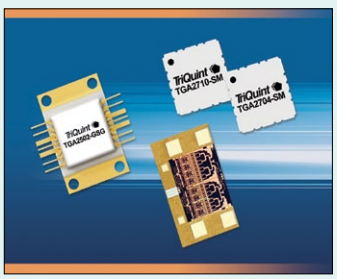
To help customers meet tighter test requirements and enhance test margins, the N9000A CXA signal analyzer capabilities include: -163 dBm displayed average noise level (DANL) at 1 GHz, -147 dBm at 26.5 GHz with preamplifier on; and -102 dBc/Hz phase noise at 10 kHz offset, 1 GHz carrier. Third-order intermodulation (TOI) is +15 dBm at 1 GHz, +14 dBm at 26.5 GHz.

Other features include quick measurement of spurs and harmonics due to the CXA's speed and DANL performance; one-button measurements such as channel power, adjacent channel power and occupied bandwidth provided with PowerSuite; easy-to-configure measurement applications such as phase noise and noise figure; and upgradable CPU module.

www.agilent.com

RF power amplifier modules

feature innovative packaging that simplifies assembly



TriQuint Semiconductor has released four packaged GaAs pHEMT RF power amplifier modules that deliver high output power, gain and efficiency with coverage from 6 to 38 GHz. Each amplifier is packaged for easier assembly including designs that support multi-layer PCB layouts.

The amplifiers are excellent choices for use in commercial applications such as point-to-point microwave radios, very small aperture terminals (VSATs) and defense systems such as communications, radar and electronic warfare (EW).

The four amplifiers include: the TGA2502-GSG, which provides 3.6-W, CW from 13 to 16 GHz for VSAT systems; the TGA2575-TS, which offers 3-W CW from 32 to 38 GHz for communications and defense radar systems; the TGA2704-SM, which covers 7-W CW from 9 to 11 GHz for microwave radio and radar; and the TGA2710-SM, which delivers 7-W CW from 9.5 to 12 GHz also for microwave radio and radar.

The TGA2575-TS is the latest addition to TriQuint's Die-on-Tab product family, which makes it easier for manufacturers to handle die-level devices and assemble components by placing semiconductor FETs or MMIC amplifiers on thermal spreaders. A vacuum reflow process creates bonds between dies and bases. These bonds are virtually void-free and have high thermal stability. The TGA2575-TS and all die-on-tab products are inspected in the factory for thorough quality assurance and higher effective yields.

www.triquint.com

30 W DC to 6 GHz GaN on SiC RF transistors

commercial and military apllications

Richardson RFPD is stocking and offering full design support capabilities for a 30-W (P3dB), DC to 6 GHz, discrete GaN on SiC high electron mobility transistor (HEMT) from TriQuint Semiconductor.

The T1G6003028-FS is constructed with TriQuint's 0.25 µm process, which features advanced field plate techniques to optimize power and efficiency at high drain bias operating conditions. This optimization can potentially lower system costs in terms of fewer amplifier line-ups and lower thermal management costs. The device is ideal for radar, radio communications, test instrumentation, wideband or narrowband amplifiers, and jammer applications. The transistors have a linear gain greater than 14 dB at 6 GHz and operate from 28 V.

www.richardsonrfpd.com

Vector signal generator for test systems

supports frequencies up to 12.75 GHz

Rohde & Schwarz has enhanced its fully integrated SGS100A by adding a model for I/Q modulated signals from 80 MHz to 12.75 GHz.

Combined with an I/Q baseband generator, the instrument can be used to generate test signals for all radio standards in this frequency range. As a result, the SGS100A is ideal for X-band signals from 8 GHz to 12 GHz for radar and satellite communications. The I/Q modulator's wide RF bandwidth of 1 GHz makes it possible to generate pulses with high chirp bandwidths and steep pulse edges.

Designed for use in automatic test systems, the smallest vector signal generator on the market delivers excellent performance across the entire frequency range up to 12.75 GHz. Only one unit high and ½ 19 inches wide, the compact SGS100A saves space in the rack. And it is also extremely fast.

All models can switch between the wanted frequency and level settings in only 280 µs typical. They offer a very high output level of +22 dBm typical as standard and have an electronic step attenuator covering the entire frequency range. The generator boasts high reference frequencies of 100 MHz and 1 GHz, which ensures excellent phase stability for phase-coupled applications involving multiple signal generators. This means higher production test throughput in addition to significantly reduced space requirements.

www.rohde-schwarz.com

Low power sub-GHz radio

in compact chip scale package

Microsemi Corporation has introduced an ultra low power (ULP) RF transceiver for short-range wireless applications where power consumption is of utmost importance. The ZL70250 sets the bar in terms of low power consumption with 2 mA of current required to transmit and receive data, enabling extremely long battery life and miniaturization. These two features are particularly important for applications using energy harvesting and battery-powered wireless sensor networks.

The ULP radio operates in unlicensed frequency bands between 795 and 965 MHz and delivers a data rate of 186 kbps to support a wide variety of sensor applications. All components are integrated into a single chip scale package (CSP) with the exception of a bias resistor and a supply decoupling capacitor.

Due to the ZL70250 radio's low peak current and voltage supply (1.1 V to 1.9 V) system vendors developing low power sensor nodes can target a variety of short-range wireless sensor networks across several industry segments.

Microsemi is providing development support tools for the ZL70250 CSP solution. Included in the tools are Application Development Kits (ADK), a low power wireless communication software code starter for point to point connections and reference designs of wireless sensors based on CR-2032 coin cell batteries.

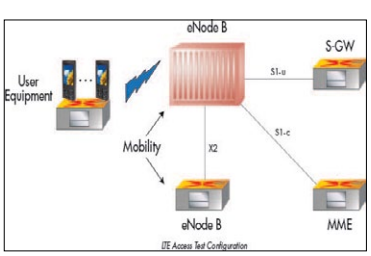
www.microsemi.com

Comprehensive test system to validate and optimise LTE performance

As the first 4G LTE network rolls out in the UK, test vendor Ixia has launched a system that allows engineers to validate LTE base station performance for enhanced network quality.

XAir creates mobile user behaviour to provide operators with performance insight to make informed equipment selection, design resilient mobile networks, accurately plan capacity and quickly troubleshoot problems. It supports three critical dimensions of LTE network validation, realistic subscriber and service modelling, massive scalability, and comprehensive QoE measurements. Support of all three elements is critical to properly evaluate LTE base stations. XAir provides realistic subscriber modelling, supporting web, voice and video applications, all LTE mobility types, and modelling of radio characteristics — cell edge, cell centre and user movements. With support for more than 1,000 emulated user equipment's per sector and more than 6,000 per chassis, XAir is a highly scalable solution.

Using XAir carriers can optimise voice quality, including voice over LTE (VoLTE) and video quality by stressing the infrastructure with real-world traffic and measuring QoE. Other features include complete end-to-end LTE network testing from the LTE base station, through the mobile backhaul and core networks, all the way to the datacenter, QoE analysis and scoring of each traffic stream and mobility over multiple sectors. A built-in high-accuracy 10 MHz clock allows eNB synchronisation and XAir is fully compatible with the Ixia XM and XG chassis and load modules for seamless testing with other Ixia hardware and test applications.



LTE is the fastest-growing mobile technology ever, with the LTE infrastructure market projected to grow to $17.5 billion by 2016, according to leading research firm Infonetics. But before operators spend billions of dollars on LTE equipment and deployments, they must evaluate and validate the network QoE before it is deployed live to subscribers. LTE base stations are at the heart of LTE networks, and as such, their performance, capacity and quality significantly affect the perceived network QoE. The XAir solution provides operators with actionable insight into LTE network performance to pinpoint and address issues end users will face, allowing them to maintain a high QoE. As the industry competes by introducing more and more LTE-based services, the XAir allows operators to accurately manage the performance of LTE base stations and bring these products to market faster.

www.ixiacom.com

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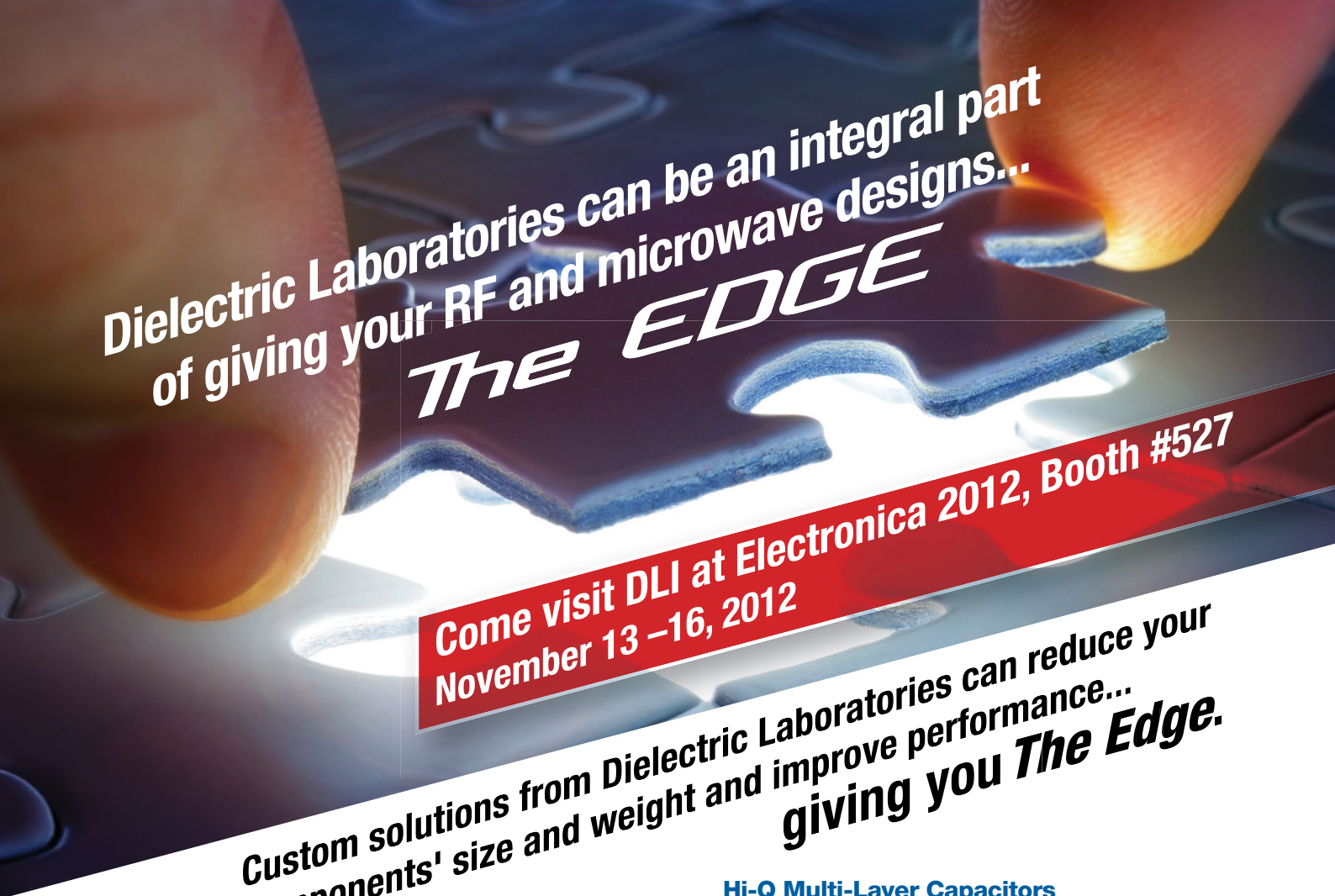

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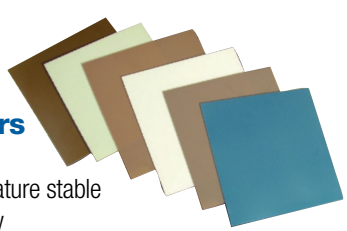

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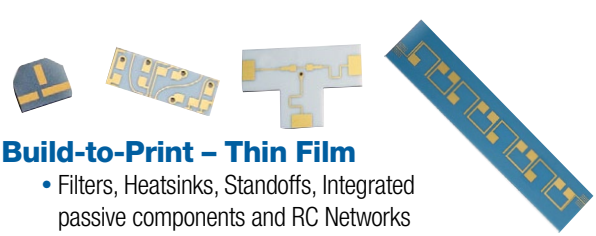

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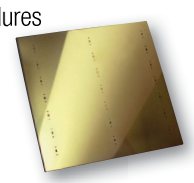

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