November/December 2011

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World needs over 10 million small cells by 2015

Chicago will need approximately 84,500 small cells to deliver truly high-speed LTE by 2015, with acceptable coverage and speeds, according to analysis from Picochip. To provide LTE everywhere in the US around 1.8 million small cells would be required, based on estimations on data growth and usage across the country. This is in addition to residential femtocells and Wi-Fi.

The analysis models what will be required to deliver the advertised data rates consistently to users wherever they are. The capacity per cell is based on extensive simulations of traffic from projected device populations and traffic service types in 2015, incorporating propagation models and calculations of network efficiency and loading. Around 20,000 of the small cells needed for Chicago would be installed in malls and retail premises where demand for data is often highest. Other sites include airports, stations, office buildings and outdoor sites providing wider coverage in busy street areas.

The report was put together by Picochip's CTO Dr Pulley, who also concluded that worldwide there would need to be in excess of ten million small cells to deliver comparable performance.

The US is already seeing widespread deployment of LTE, with basestations being deployed now to deliver next generation services. However, with relatively few users at present the networks are very lightly loaded, making it easy to demonstrate good data rates. In time, as there are more users, with a wider range of devices, the networks will become fuller and there will be a pressing need for many more cells.

www.picochip.com

NFC chip shipments to surpass 1.2 billion by 2015

As the number of mobile payment users grows to over 375 million in 2015, the demand for devices with near field communications (NFC) grows as well. The latest research from In-Stat forecasts that adoption of this technology will push global annual shipments of NFC chips to over 1.2 billion by 2015.

"As the costs of NFC chips decline, and NFC radios are combined with other chip functions, the cost to integrate NFC into handsets will be outweighed by the benefits," says Allen Nogee, Research Director. "The growth of combo chips will also allow NFC radios to piggyback on technology that already has significant penetration in the market. For example, Bluetooth radios can be integrated with NFC radios, making the choice to include NFC easy for OEMs."

Today, the focus of the NFC market is shifting from payment applications that can be enabled by NFC, to marketing applications. With this focus shift, we expect retailers to begin pilot programs in the latter part of 2011 and into 2012 that incorporate smart posters into their signage and outdoor advertising strategies.

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IN BRIEF

NXP claims Google phone design win

Google's recently launched Galaxy Nexus smartphone includes NXP Semiconductors NV's PN65N integrated near field communication (NFC) solution, according to NXP.

The PN65N, which features an NFC radio controller and an embedded secure element, is fully validated on the latest release of the Android operating system, Android 4.0, also known as Ice Cream Sandwich, according to NXP.

NXP said that the availability of its open-source NFC software on Ice Cream Sandwich enables mobile phone and now also tablet manufacturers to design NFC-enabled, Android-based mobile devices. For application developers, Android support for NXP's complete NFC solution provides an opportunity to create new applications for mobile payment/secure card emulation, tag read/write and peer-to-peer communication, according to NXP.

www.nxp.com

Sony to buy Ericsson's stake in handset JV

Sony said it has signed a deal to acquire Telefonaktiebolaget LM Ericsson's 50 percent stake in the mobile handset joint venture between the two companies, Sony Ericsson, for 1.05 billion euro (about $1.49 billion).

Sony Ericsson will become a wholly owned subsidiary of Sony (Tokyo), the company said. The deal also includes a broad IP cross-licensing agreement and ownership of key patents, Sony said.

According to Sony, the company has about 11 percent market share in Android phones and 80 percent of its revenue is derived from smartphones.

Howard Stringer, Sony's president, chairman and CEO, said in a statement that the deal was a logical step for Sony and would enable the company to integrate smartphones into its product portfolio, giving customers seamless connectivity and access to content on a broader range of devices.

www.sonyericsson.com

Motorola Mobility highlights some challenges in NFC, Wi-Fi, DLNA

A handful of standards will drive new smartphone uses and interoperability, but some pose challenges. In addition, it could take four to six months before Android 4.0, aka Ice Cream Sandwich, becomes widely available in handsets, said a Motorola Mobility executive.

Bluetooth low-energy (BLE), near-field communications (NFC), Wi-Fi Direct, Wi-Fi Display and the DLNA standards hold great potential—and some potential pitfalls--for developers, said Ruth Hennigar, vice president of software product management at Motorola Mobility in a keynote at the Android Developer Conference.

For example, one of the most interesting but complicated applications for NFC is mobile payments. "The banks, carriers and merchants all want to be in control [of mobile payments] and customers are still nervous about using it," Hennigar said.

"Right now you can only have one payment model in your phone at one time because of the carriers, and merchants don't want to deploy multiple scanning devices—so it will take a while to work out who gets the money and how," she said.

Separately, the Wi-Fi Alliance is expected to ratify by the end of the year the specification for Wi-Fi Display, a technique for streaming video from handsets to TVs. Many TV makers are expected to support the wireless link in 2012 sets but "TV manufacturers have a tendency to do their own thing, so there will be lots of interoperability challenges to make it all work," she said.

A related technology, Wi-Fi Direct, is just now being rolled out in handsets as a peer-to-peer method for sharing data and media, she said.

The interoperability specifications defined by the Digital Living Network Alliance could be baked into as many as a billion systems by 2014. But the DLNA specs still leave something to be desired, Hennigar said.

"It's fairly hard to set up and discover devices on DNLA," she said. "It doesn't work consistently across devices, so if someone can crack the code on making DLNA more useable and discoverable, there should be an app for that," she quipped.

For its part, BLE will be supported on next-generation Motorola Razr phones. The technology will open the door to Bluetooth peripherals beyond today's headsets and keyboards, including medical and fitness devices and a wide range of other possible products.

www.motorola.com

Android visual radar smartphone app keeps drivers safe

In a recent example of leaving your driving to your smartphone, consumer marketer Picitup has launched a visual radar app for high-end Android handsets, which when attached to a car's windshield, warns the driver of potential collisions.

The iOnRoad app uses the smartphone's native camera and sensors to detect vehicles in front of the vehicle, alerting drivers when they are in danger. iOnRoad's VisualRadar maps objects in front of the driver in real time, and sensors calculate the user's current speed. As the vehicle approaches danger, an audio-visual warning pops up to warn the driver of a possible collision.

iOnRoad uses a visual radar by combining real-time day/night machine vision with sensor fusion and then calculates the time gap and collision potential with other vehicles and warns of high risk events.

The iOnRoad app allows drivers to share their driving achievements with others through Facebook and Twitter, such as taking a snapshot of a hazard or reckless driver and automatically posting it to Facebook.

Further, it also allows users to improve their driving skills by viewing their latest drives and alerts. The iOnRoad app can run in a "background mode," allowing users to use the navigation app or take phone calls, while driving.

"This launch is just the beginning of an entirely new user experience being enabled with smartphone technology, sensors and accelerometers," said Roger C. Lanctot, senior analyst, global automotive practice, Strategy Analytics, in a statement.

www.picitup.com

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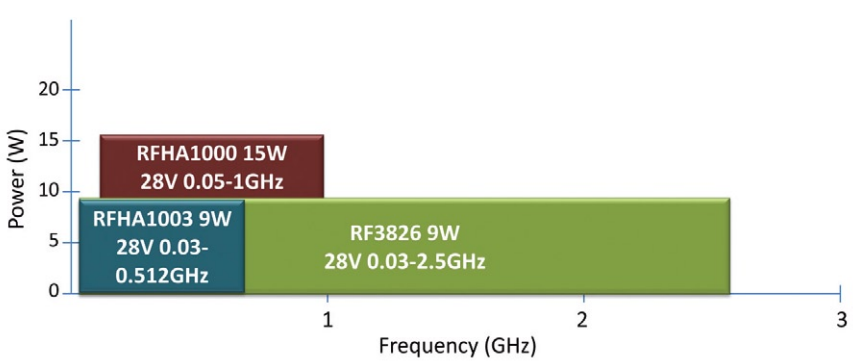

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IN BRIEF

ST-Ericsson tips Nokia Windows Phone win

Wireless chip vendor ST-Ericsson NV has announced that leading mobile phone company Nokia, previously a long-term partner, has selected the company as a supplier of chips for its Windows Phone mobile phones.

The move was expected and is important for ST-Ericsson (Geneva, Switzerland) where profitability has suffered due to business turmoil at Nokia and elsewhere in the mobile phone sector over the previous quarters. ST-Ericsson has also made efforts to gain design wins in China and recently announced its NovaThor chipset is designed-in with HTC for a smartphone to be distributed by China Mobile.

www.stericsson.com

Toyota, Ford lead vehicle phone app integration

Toyota and Ford have the most successful integration of car infotainment systems with mobile devices like smartphones, according to a recent IHS iSuppli Automotive Research report.

A study of five production-ready applications for vehicles in the model years 2011 and 2012 showed that both the Toyota Entune and Ford Sync AppLink apps achieved industry-leading performance on at least four criteria, including content variety, level of integration, daily relevance and implementation.

Also doing well on some performance metrics in the evaluation were the BMW/Mini Connected, GM My Link/IntelliLink and Hyundai Blue Link.

Next-generation automotive infotainment systems will derive their functionality from motorists' mobile devices as opposed to using their vehicle's built-in capabilities to provide entertainment and information systems, according to Mark Boyadjis, IHS Senior Analyst and Regional Manager, North American Automotive Research.

www.ihs.com

Huawei proposes video server standard for wireless carriers

To keep up with mobile and video traffic, wireless carriers will need a new class of high-end systems by 2015, according to a Huawei executive who sketched out a concept he is proposing to other vendors and industry groups.

The next-generation system will need to carry data rates of 200 to 400 Gbits/s. To do that, it should include boards that can handle 500 to 1000 W. They could be as much as twice the size of today's boards based on the Advanced TCA standard and probably will need liquid cooling.

"We could see 50x growth in network traffic over five years driven by mobile video—that definitely calls for new high-end servers," said Staffan Skogby, a senior Huawei product manager, speaking in a keynote at the recent Advanced TCA Summit.

Skogby said he presented his concept at a May workshop of the Scope Alliance, a group of telecom system makers. A handful of other vendors liked the concept, including Emerson Network Power, he said.

Huawei is in the early stages of formally proposing the concept to the alliance. If the proposal is approved, it would likely go to an industry standards group such as the PCI Industrial Computer Manufacturers Group (PICMG) that supervises the Advanced TCA (ATCA) standards for boards and chassis used by network carriers and others.

Skogby said he has talked informally about the concept with the Scope board on which he serves as well as with PICMG members. "I would like to create some impact in the industry to go forward with a standard specification in this direction," said Skogby.

Carriers have a variety of seemingly conflicting requirements for different parts of their networks. For example, many carriers are rolling out 4G wireless networks using many micro base stations rather than the few, full-sized base stations they used for 3G nets. In other parts of their networks, carriers are asking systems companies to converge multiple functions into a single ATCA chassis to save cost.

"We have adopted ATCA for server apps where we see a good fit, and will continue to go that way, adding more applications to the platform," Skogby said. "At the same time, we see the new challenge from number of mobile devices on the Net and new services driven by mobile access and video, and to meet those challenges we have concluded we need this new platform for the media and user plane," he said.

The high-end server concept could be a high-end addition to today's ATCA chassis standards which need to continue to evolve in parallel, said Skogby. At Huawei "we've had research on this for several years, part of it we are implementing, parts are already in commercial use and other parts are still evolving," he added.

www.huawei.com

Canonical preps Ubuntu for mobile devcies

Canonical Ltd., is working on versions of its Ubuntu version of Linux for smartphones, tablets and intelligent embedded devices.

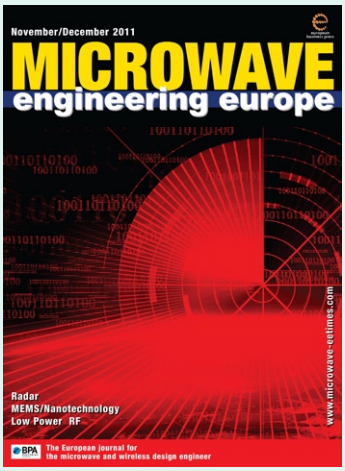
Canonical's chief executive Mark Shuttleworth said Ubuntu version 14.04 "will power tablets, phones, TVs and smart screens from the car to the office kitchen, and it will connect those devices cleanly and seamlessly to the desktop, the server and the cloud." Mobile versions of Ubuntu will run on Intel, AMD and ARM processors, he said. It will support multi-touch interfaces and displays of various sizes, he added.

To date Ubuntu has mainly focused on x86 servers, however it is also available in a version for desktops and more recently netbooks. Canonical's controversial Unity interface is said to be a key piece of the company's move into mobile devices.

Canonical will have to show how it can develop a base of support for mobile systems and applications, perhaps by porting existing code and programs from Android or other mobile Linux variants.

Some mobile systems developers expressed concerns about the patent wars surrounding Android and Google's bid to acquire systems maker Motorola Mobility, largely for its patent portfolio. If the patent wars sour enthusiasm for Android, OEMs could see Ubuntu as an alternative platform.

www.canonical.com



This month's cover shows a high end radar image. Advances in technology are resulting in better systems that offer higher resolution with the ability to detect slower moving objects such as people and vehicles for both civilian and military use, and all at a lower cost.

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Reconfigurable radar systems employ digital technology in the form of FPGAs and DSPs, which is then combined with RF technology. Traditionally, the baseband engineering team has used different design methods and a different set of test tools than has the RF team. The combined use of these different technologies has created significant system integration testing challenges. This article describes an approach for addressing these challenges by means of a single measurement platform.

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18 Low Power RF: UWB to revolutionise car manufacturing with real-time location identification system
A agreement has been forged between BMW, IBS and Ubisense, extending the deployment of a real-time Location Identification System (LIS) across the global vehicle manufacturer's production facilities. The LIS system comprises a communication platform from IBS and identification tags and sensors from Ubisense.

19 Low Power RF: IMEC brings back low power ultrawideband
Ultrawideband is back. Imec and Holst Centre are demonstrating a fully chip-integrated ultralow-power IR-UWB (impulse-radio ultra-wideband) solution for use in the 6 to 10 GHz band, available worldwide and which opens the door to relatively small antennas that do not need antenna filters.

20 Improving the output accuracy over temperature for RMS power detectors
Stable temperature performance is extremely important in basestation designs, as the ambient temperature can vary widely depending on the surroundings and the location. Using high accuracy over temperature, RMS detectors can improve the power efficiency of basestation designs.

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IN BRIEF

Tektelic and Picochip collaborate on small cell LTE devices

Picochip and TEKTELIC have announced that they are collaborating on a phased development of a new small cell LTE micro eNodeB platform. The collaboration will incorporate Picochip's fully featured LTE development system for small cells, the PC9608, into a real world, carrier-class device ready for deployment that will deliver the highest output power in the smallest form factor available on the market today.

The development will take place in two phases. The first phase will see the PC9608 system incorporated into a complete, single board, small cell LTE solution ready for immediate deployment. The second phase will see the two companies collaborate to deliver a next generation multi-standard small cell device, encompassing support for 20 MHz, dual-mode LTE and HSPA+, as well as 'metro Wi-Fi'.

www.picochip.com

Qualcomm describes Snapdragon S4

Qualcomm has released a white paper on its next-generation Snapdragon S4 mobile applications processor, giving a few additional details of the 28-nm chip expected to ship before June 2012. The S4 includes up to four custom Krait cores based on Qualcomm extensions to the ARM Cortex A9.

The cores and their L2 caches can run at separate voltages and clock rates, a feature which can help lower power 25 to 40 percent, according to the company. The chip also contains an upgraded Qualcomm graphics core, the Adreno 225. It provides 50 percent greater performance and twice the memory bandwidth of the current graphics core.

The chip supports LTE and 3G radios as well as Bluetooth 4.0, FM, GPS, Glonass, NFC and 802.11n Wi-Fi.

www.qualcomm.com

Growing free femtocell offers driven by competitive markets

Informa Telecoms & Media has issued its latest femtocell market status report for the Femto Forum, which highlights the growing number of competitive femtocell deployments globally and the associated rise in free femtocell offers. Femtocell services are currently available in 23 countries around the world, 43% of which have multiple operators offering the technology.

This growth in markets with multiple femtocell offerings was also found to be driving free femtocell offers from operators. The majority of countries with competitive consumer femtocell offerings include at least one operator who offers the devices free of charge. Currently, subscribers in France, Japan, Russia and the United States have access to free femtocells.

The growth in free femtocell offers is being driven by the falling costs of femtocell technology as economies of scale and competition increase.

Over the past quarter, important progress has been made in the evolution of femtocell chipsets with new launches from Cavium, Freescale, Qualcomm and Texas Instruments. These join existing chipset vendors – Broadcom, DesignArt, Picochip and Mindspeed.

www.femtoforum.org

OpenET Alliance announces Envelope Tracking interface spec for 4G handsets

The OpenET Alliance, the not-for-profit organisation that promotes energy efficient wireless transmission through Envelope Tracking, has announced that it has released a new API specification for 4G handsets to support further industry collaboration. Envelope Tracking is the most effective wide-band power optimisation technology for the RF front end of 3G and 4G handsets.

Envelope Tracking is a key enabler for compact, power efficient 4G handsets. Without it, using traditional power supply architectures, 4G RF PAs will use up to 65 percent more energy than today's 3G PAs. Using Envelope Tracking technology based on the new OpenET API, manufacturers can rapidly develop 4G handsets that require 30 to 50 percent less energy and support a larger number of LTE frequency bands.

The release of this API aims to simplify collaboration among semiconductor vendors, OEMs and EDA providers through the complete development lifecycle of Envelope Tracking solutions for 3G and 4G handsets, from early design and prototyping through to mass production.

www.open-et.org

ESA selects GreenPeak's radio comms controller chip for aerospace applications

The European Space Center, ESA/ESTEC, has selected a radio communication controller chip from GreenPeak Technologies for use in aerospace applications and has endorsed the device for its superior RF performance, ultra-low power requirement and interference robustness.

"In our effort to reduce the complexity of harnesses onboard satellites and in ground tests, ESA has been searching for commercial wireless communication technologies for sensors," said Jean-Francois Dufour, Computer and Data Handling Engineer with ESA. "GreenPeak's IEEE802.15.4-2006 silicon was evaluated for its extremely low current consumption characteristics, which are needed for long-duration maintenance-free missions, and for its antenna diversity feature providing robust links within satellite systems."

The selection requirements are based on high reliability, extreme battery life time (+15 years) and robustness against interference.

www.greenpeak.com

LTE evolved packet core spending to pass 500 million USD in 2012

Mobile operator spending for wireless core gateways will exceed $1 billion this year. The growing deployment of LTE networks is the main driver for increased spending on gateways, which in turn are driving Evolved Packet Core (EPC) spend. Wireless core gateway spend is expected to be $1.1 billion in 2012, of which LTE EPC spend will be $588 million.

"There are approximately 35 LTE networks in commercial service today and that number will grow to more than 100 next year," says Aditya Kaul, practice director, mobile networks. "This growth in LTE networks has almost doubled total mobile gateway network spend between 2006 and 2011."

The LTE EPC spend consists of P-Gateway, S-Gateway, MME, and eHRPD equipment, which account for LTE EPC deployments in both WCDMA and CDMA networks. The vendors benefiting from the increase in EPC spend include the five major wireless network equipment vendors (Alcatel-Lucent, Ericsson, Huawei, Nokia Siemens Networks, and ZTE) as well as router vendors including Cisco Systems, Juniper Networks, and Tellabs.

According to Jim Eller, principal analyst, wireless infrastructure, "Although some operators are able to upgrade their 3G core networks to EPC networks to support LTE, the majority are installing new EPC networks. Operators' existing core networks are stretched to capacity by dramatic increases in mobile broadband data traffic and most view LTE deployment as an opportunity to install the latest core network technologies for improved network operations."

www.abiresearch.com

Traffic monitoring system uses Bluetooth sensors over ZigBee

The Vehicle Traffic Monitoring Platform from Libelium is capable of sensing the flow of Bluetooth devices in a given street, roadway or passageway while differentiating hands-free car kits from pedestrian phones. Sensor data is then transferred by a multi-hop ZigBee radio, via an internet gateway, to a server. The traffic measurements can then be analysed to address congestion of either vehicle or pedestrian traffic.

Part of Libelium's Smart Cities solution, the Platform allows system integrators to create real time systems for monitoring vehicular and pedestrian traffic in cities by using the new "Bluetooth — ZigBee" double radio feature available in the Waspmote sensor board.

Understanding the flow and congestion of vehicular traffic is essential for efficient road systems in cities. Smooth vehicle flows reduce journey times, reduce emissions and save energy. Similarly the efficient flow of pedestrians in an airport, stadium or shopping centre saves time and can make the difference between a good and a bad visit.

Libelium's CTO David Gascón says, "With widespread use of Bluetooth devices both vehicular and pedestrian traffic can be monitored anonymously by detecting and tracking the MAC addresses of such devices".

The Platform uses the Expansion Radio Board for Waspmote which allows two different types of radio to be connected at the same time. In this case a Bluetooth radio is used as a sensor to make inquiries and to detect nearby devices, while the ZigBee radio sends the information collected using its multi-hop capabilities.

Six power levels allow sensor operators to set an "inquiry zone" from between 10 and 50 metres. Although Bluetooth, ZigBee and WiFi all operate in the 2.4 GHz ISM band, Waspmote uses Adaptive Frequency Hopping (AFH) to enable the Bluetooth radio to identify channels already in use by ZigBee and WiFi devices and thus avoid interference.

www.libelium.com

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Small cells and/or WiFi to alleviate data crunch

According to ABI Research there are approximately 35 LTE networks in commercial service today and that number will grow to more than 100 next year. Small cells enable network operators to create an underlay network to augment the macrocellular nework. By creating small cells that can co-operate with the larger macrocells, operators essentially increase capacity and spectral efficiency.

Femtocells are touted for the job, and although they work well there are issues with respect to backhaul associated with these cells. Many femtocells will probably be put in places where they can piggy-back existing infrastructure, for example, using a wireline associated with a building the femtocell finds itself attached to. Or home owners could be convinced to provide their ADSL lines for backhaul.

Another approach is to create a box with radio backhaul built in, along with all the required switching and power needs. Enter, Dragonwave's Avenue Platform, which does this in a 'zoning-friendly' box that already meets municipal requirements for mounting on steet lamps, traffic light poles and building walls, enabling operators to quickly scale capacity and optimize spectrum usage. Avenue's features are detailed on page 25.

Recently, Nokia and Spectrum Interactive, delivered a scheme offering free WiFi on the streets of London via a series of hotspots. The scheme, however requires consumers to register in order to gain access. Home users already use WiFi to off-load data intensive tasks from the 3G network, mainly for speed and to save money, by leveraging a relatively cheap ADSL or DSL resource already paid for.

Could operators do the same and off-load data to provide subscribers with uninterrupted data access on the street and in buildings. The user would see a seamless crossover between 3G, WiFi and 4G. WiFi could evolve further to meet these needs, with all the advantages of a mass market, mature technology, and low cost. Eventually, WiFi could be part of the operator network, where a user's phone merely picked the strongest signal with an app to authenticate the smartphone as needed.

As LTE networks still have relatively few users, capacity is not yet an issue, but as more LTE networks roll out, and more users sign up, the need for a small cell approach is vital. Maybe WiFi will surprise everyone again?

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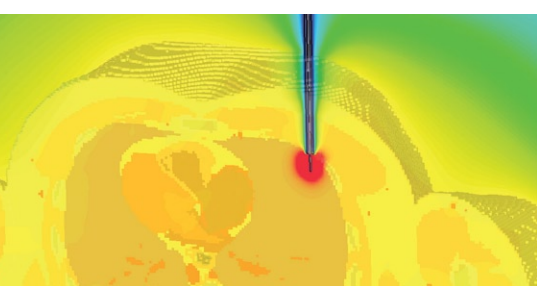

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CHANGING THE STANDARDS

Testing across digital baseband and RF domains — addressing integration challenges in reconfigurable radar systems

By Brad Frieden, Applications Specialist, Agilent Technologies

Reconfigurable radar systems employ digital technology in the form of FPGAs and DSPs. That digital technology is combined with RF technology to achieve a high level of flexibility which is required to move between different types of waveforms and configurations found in today's demanding radar applications. It is no surprise that the baseband engineering team has traditionally used different design methods and a different set of test tools than has the RF team. The combined use of these different technologies has created significant system integration testing challenges.

This article describes an approach for addressing these challenges by means of a single measurement platform. Such a platform can help radar systems integrators successfully and easily validate and debug their design. This approach allows Vector Signal Analyzer (VSA) measurements to be made all along the radar transmitter or receiver paths. Measurements can be performed with logic analyzers on FPGA hardware, with oscilloscopes at the analog IF or RF level, and with signal (spectrum) analyzers along the RF exciter and receiver chains. All three types of instruments can export captured signals into the common analysis environment of VSA software to help designers pinpoint issues that might exist at any point along the mixed signal chain, ultimately speeding successful system integration.

A chirp radar example design

One of the methods to extend range and increase resolution in a radar system is to apply pulse compression. The pulse gets frequency or phase-modulated, which in turn causes each part of the pulse to have a unique frequency or phase coding. This means that reflections from a target, which normally might have had overlapping return signals in the frequency domain, now can be more easily and completely separated due to the unique frequency and phase components at hand. This enables lower peak power required for the pulse and lower probability of being detected. One type of pulse compression occurs when the frequency modulation happens in a "linear" fashion across the pulse width. This "linear" frequency modulation is also called a "chirp radar" frequency modulation.

The baseband portion of the design was created at a high level through the use of an Agilent tool called SystemVue, with a resultant design as shown in Figure 1. I and Q vector modulation chirp radar signals are created, up-sampled by a factor of four, Root-Raised-Cosine filtered, and then up-converted to digital IF.

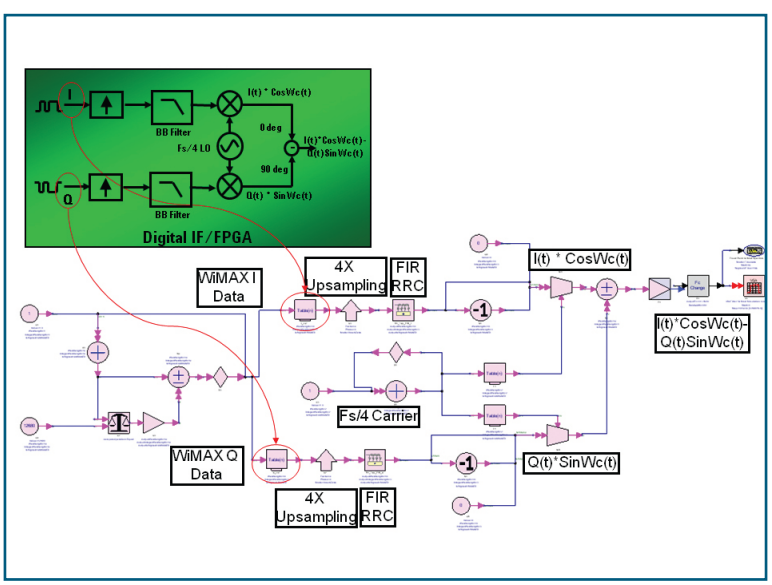


Figure 1: Chirp radar transmitter section with digital baseband functions.

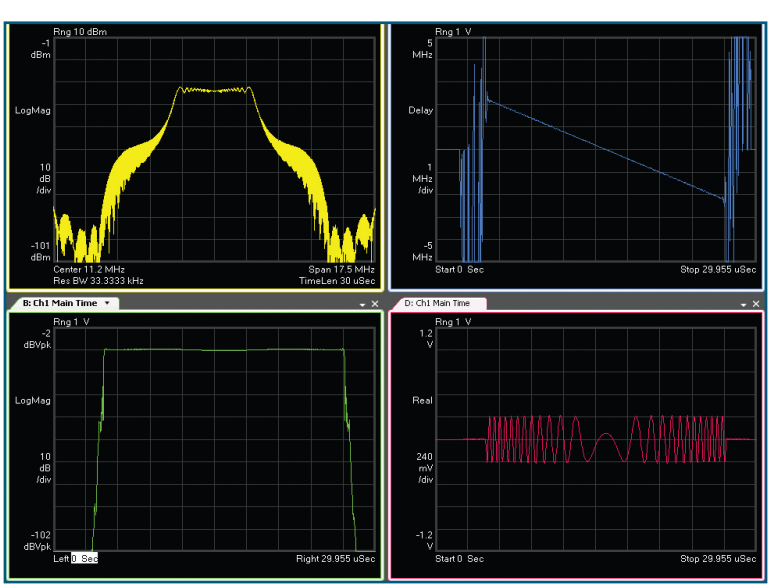
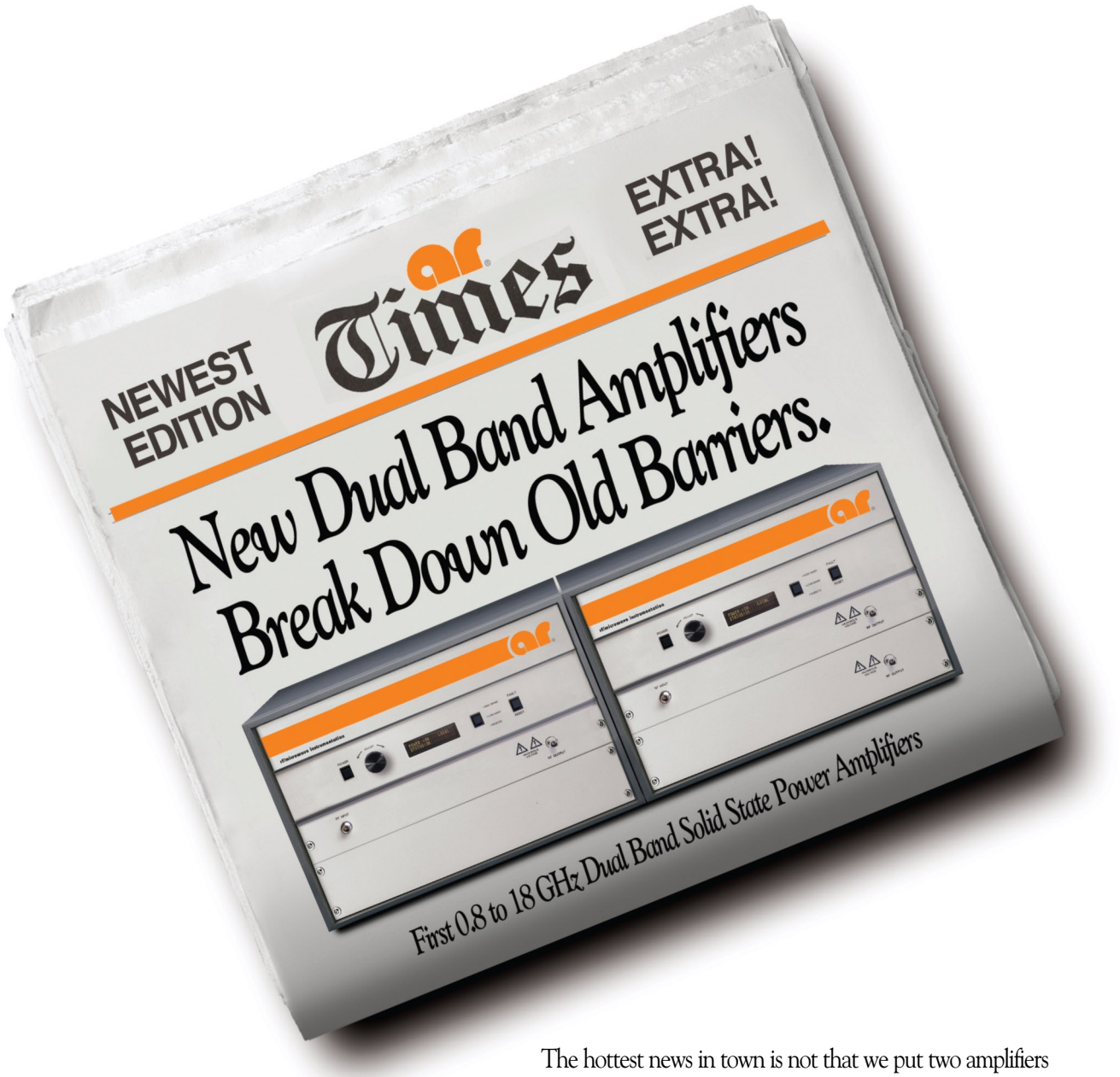


Figure 2: Simulated digital IF signal demodulated in the VSA application.



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From SystemVue, hardware description language (HDL) code was generated that in turn could drive an FPGA implementation of the baseband design in a Xilinx Virtex-4 FPGA.

The digital IF signal then comes off chip and drives the input of a D/A converter. Finally, the resultant analog IF signal is up-converted to RF where it ultimately feeds a power amplifier and drives the antenna

Simulation of the high level design

Through the use of SystemVue, the design can be simulated at a high level prior to FPGA implementation. The resultant digital IF signals can be input to a software package called the 89601 Vector Signal Analysis (VSA) tool, with results as shown in Figure 2. This example shows the desired frequency spectral content in the upper left panel, the linear frequency shift across the width of the radar pulse in the upper right panel, the time domain view of the radar pulse amplitude in the lower left panel, and then the classic view of the real part of the digital vector modulation in the lower right panel. These four views become our "golden standard" for comparison of measured signals on real hardware.

Taking a look across the signal path

Since the baseband portion of the design is implemented in an FPGA, it is possible to probe inside the FPGA by feeding various signals along the vector modulation path to a logic analyzer. The test setup is shown in Figure 3. The logic analyzer is on the left and has "flying lead" probes connected to 0.1 inch header pins that are on the Digitech ExtremeDSP Xilinx Virtex-4 based platform seen in the middle of the picture. Flying lead probes provide an individual coax connection for each digital data signal. A number of ground connections are made to preserve good signal integrity on the probed signals.

An oscilloscope is shown on the right, and the analog IF signal that comes out of a D/A converter on the DigiTech platform via an SMB connector is brought over to the scope with a single coax cable. Notice a Xilinx USB JTAG Programming Cable that is used to connect to the JTAG chain where the Virtex-4 FPGA is located. Ultimately, this JTAG connection will be used to switch a multiplexer inside the FPGA to reach signals of interest via internal FPGA routing resources.

In this example, the Xilinx application ChipScope Pro "Core Inserter" is used to define the probe points via an internal FPGA multiplexer measurement core and via internal routing resources of the FPGA. First, the tool allows the user to define the type of measurement core, number of signal banks, how many pins will be used for debug signals, and exactly which FPGA I/O pins will be used to bring out debug signals.

FPGA signals are probed at the up-converted and filtered I and Q signal level, and also at the digital IF level where the signal drives the input to the D/A converter. Then a logic analyzer tool called the "FPGA Dynamic Probe" works with the FPGA measurement core to allow the designer to make meaningful measurements.

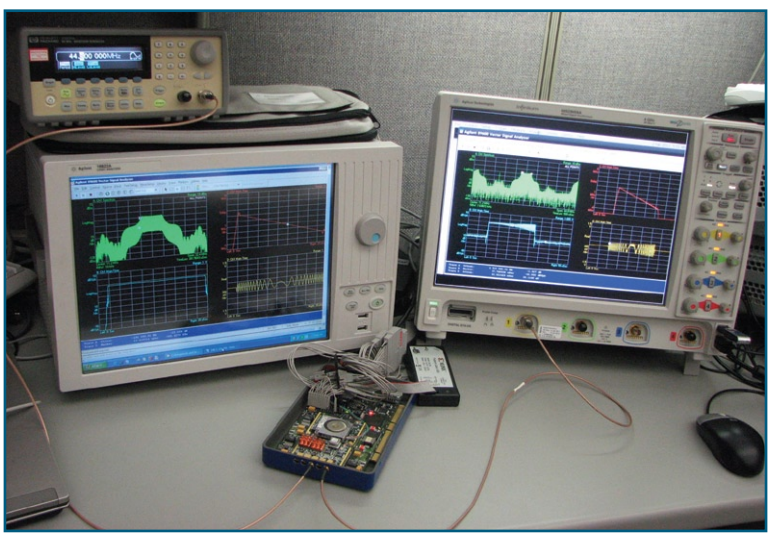

Figure 3: Logic analyzer probing internal FPGA signals (L) and scope probing D/A output analog IF (R), both running VSA software.

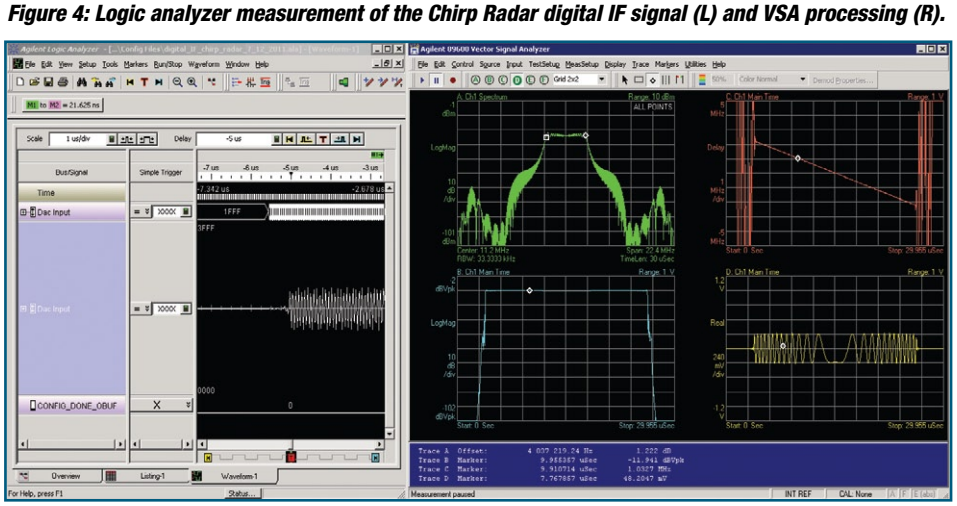

Figure 4: Logic analyzer measurement of the Chirp Radar digital IF signal (L) and VSA processing (R).

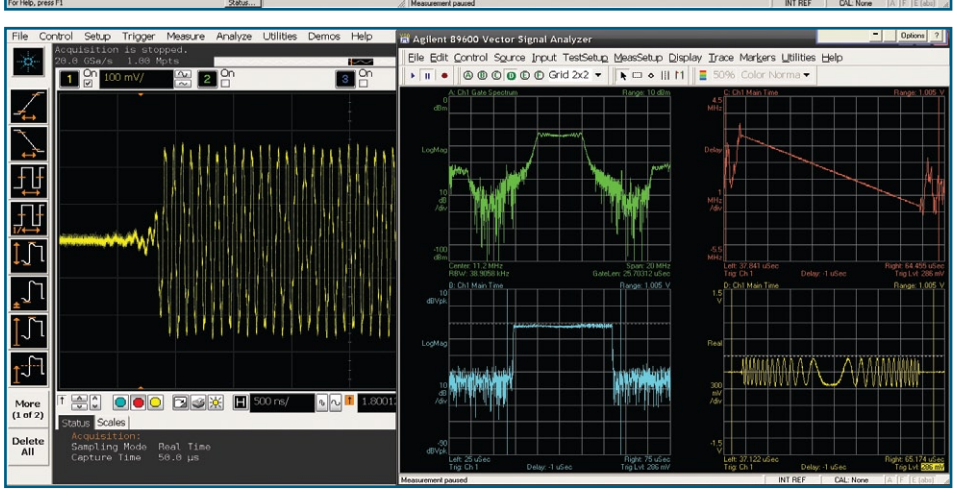

Figure 5: Oscilloscope measurement of the Chirp Radar analog IF signal (L) and VSA processing (R).

This logic analyzer FPGA probing tool greatly simplifies the process of making measurements. First, this tool allows the user to download the ".bit" file for the FPGA design into the FPGA directly from the logic analyzer interface via a JTAG connection.

Next, the internally-probed FPGA bus and signal names are imported from a Xilinx-generated file called a .cdc file that was created by the Xilinx ChipScope Pro Core Inserter application. Then a process called "automatic pin mapping" takes place where debug signals on output pins of the FPGA are discovered by the logic analyzer and "mapped" to the logic analyzer input channels automatically. The logic analyzer is set up to have the proper clock input defined, threshold levels set to match the FPGA output voltage levels, and the logic analyzer capture mode set to match the FPGA debug signal output. Designers can select which signal bank they want to look at. In this case, it is the DAC input.

Now a trace can be taken with a logic analyzer as seen in the left side of Figure 4. The logic analyzer is displaying in "chart" mode, where hex values of the bus are converted into a waveform. We see the beginning of a digital IF pulse. A common tool, shared between the digital baseband team and the analog/RF team, called Vector Signal Analysis (VSA) software, imports digital signals just captured on the logic analyzer, and processes this data into a format helpful to the designer as shown in the right side of Figure 4. But what we see now is a clear display of the linear frequency chirp modulation across the pulse, pictured in the upper right-hand side panel of the VSA software. We also see the spectral content of this digital IF signal in the upper left-hand panel. Notice these VSA panel views closely match those seen originally from "golden standard" VSA processing of simulated baseband signals back in Figure 2.

Comparing the digital IF to the analog IF with the help of VSA software

The digital IF signal that the baseband team is working with can be easily compared to the analog signal that the analog/RF team is working with. The DAC output signal is probed with a real-time oscilloscope and this analog signal can be seen in the left side of Figure 5. This signal can be imported by the VSA software as well. The VSA software presents useful information about this analog IF signal, as shown in the VSA-processed view of that signal in the right side of Figure 5. Notice in this case, where the system is operating properly, we have a very similar set of data in the VSA view of processed digital IF signals seen in the four VSA panels in the right side of Figure 4, compared to the VSA view of processed analog IF signals seen in the right side of Figure 5. This side-by-side analysis can be very useful when an undesired waveform is seen along the path, and one can trace the signal back in the signal path to find the root cause of the problem.

Coordinated debug and validation

We have seen how the digital and analog analysis process can involve a common analysis tool called VSA that allows baseband and analog/RF teams to better work together and identify the root cause of problems in design. Whether there is an FPGA designer working with the digital baseband signals, or an RF designer focused on analog and RF stages in the system, they can jointly use one tool to pinpoint sources of error or build confidence that their radar design is ready for production.

About the author

Brad Frieden is a logic and protocol analyzer applications specialist in Agilent's Digital Debug Solutions team. He has specialized in FPGA measurements with the FPGA Dynamic Probe and written a variety of articles on this topic and other logic analyzer applications.

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IBM transistor achieves 280-GHz cutoff...Packaging and testing MEMS for space... Graphene within boron nitride layers targets next generation chips...

IBM researchers to report carbon feats at IEDM including record RF performance

A couple of late submissions to the upcoming IEEE International Electron Devices Meeting will detail record-breaking performance in transistors made from carbon and its derivatives.

IBM researchers will describe record RF performance from transistors made from synthesized grapheme. The researchers achieved a 280-GHz cutoff frequency in a 40-nm gate-length FET, the fastest ever reported from synthesized grapheme, according to IBM.

The second research paper from IBM outlines the first experimental demonstration of sub-10-nm transistors made from carbon nanotubes. The researchers built devices that achieved more than four times the current density (2.41 mA/μm) of the best competing silicon device, at a low operating voltage of 0.5 V. The researchers speculate that theoretical predictions were exceeded because the transistor gate modulates the charge not only in the channel but in the contact regions as well, which had not been considered previously.

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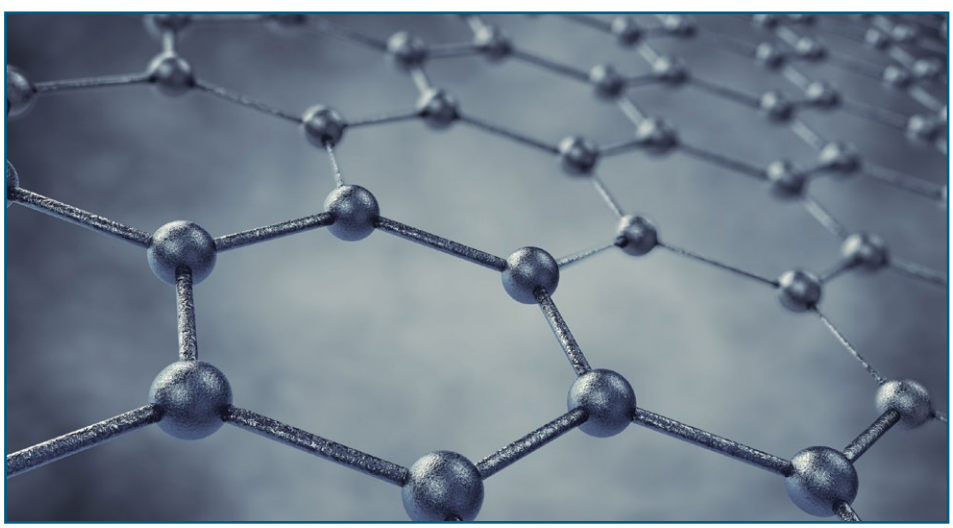
Packaging and testing MEMS used in space

The Heterogeneous Technology Alliance (HTA), a team of leading European technology institutes including CEA-Leti, CEA-Liten, CSEM, Fraunhofer Group for Microelectronics and VTT, is developing new methods for packaging and testing microelectromechanical system (MEMS) devices to meet performance requirements of space missions.

As part of the Wafer-Level Encapsulation in Microsystems (WALES) project, HTA members are studying how wafer-level packaging (WLP) can be used to connect and protect MEMS devices in hermetically sealed structures to withstand extreme weather and radiation conditions encountered in space. The project also will provide the European Space Agency (ESA), which is funding the project, a simple and fast standardized test to evaluate the suitability of MEMS for space missions.

Graphene could replace silicon in the next generation of chips.



Led by CSEM, the project is developing procedures for sealing and testing MEMS WLP for a piezo-electrically actuated resonator from CSEM and a capacitively actuated resonator from CEA-Leti. Fraunhofer Institute for Electronic Nano Systems ENAS is applying special measuring and testing processes to guarantee the reliability of these MEMS systems. VTT, the Technical Research Centre of Finland, will join the project consortium; negotiations are currently under way.

Reliability is a major issue for MEMS in space applications, and establishing new, proven and reliable packaging concepts can dramatically extend the lifetime of MEMS devices and therefore expand their suitability for space missions. Moreover, MEMS in space will benefit Europe's space industry by increasing overall flight-and-exploration reliability through the use of more sensing devices, and reducing costs through smaller payloads.

The combined technological infrastructure of the members offers business and industrial partners a one-stop shop for complete system solutions for a variety of markets, including automotive, healthcare and wellness, information and communication, home automation, energy, security, consumer, space and industrial process control.

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Encapsulating graphene within boron nitride layers for the next generation of chips

Writing in the journal Nature Physics, a team of researchers from the University of Manchester has demonstrated how graphene could be encapsulated, sandwiching two sheets of graphene with another two-dimensional material, boron nitride. The four-layered structure they obtained could be the key to replacing the silicon chip in computers.

Because there are two layers of graphene completely surrounded by the boron nitride, this has allowed the researchers for the first time to observe how graphene behaves when unaffected by the environment. Dr Leonid Ponomarenko, the leading author on the paper, said: "Creating the multilayer structure has allowed us to isolate graphene from negative influence of the environment and control graphene's electronic properties in a way it was impossible before.

"So far people have never seen graphene as an insulator unless it has been purposefully damaged, but here high-quality graphene becomes an insulator for the first time."

The two layers of boron nitrate are used not only to separate two graphene layers but also to see how graphene reacts when it is completely encapsulated by another material.

"Leaving the new physics we report aside, technologically important is our demonstration that graphene encapsulated within boron nitride offers the best and most advanced platform for future graphene electronics. It solves several nasty issues about graphene's stability and quality that were hanging for long time as dark clouds over the future road for graphene electronics."

"We did this on a small scale but the experience shows that everything with graphene can be scaled up."

"It could be only a matter of several months before we have encapsulated graphene transistors with characteristics better than previously demonstrated."

www.manchester.ac.uk

Tunable RF MEMS has MIPI control

Programmable radio frequency (RF) MEMS chip specialist WiSpry has announced the introduction to the market of the WS2018 antenna tuning component. The WS2018 is designed to sit between the antenna and the RF front-end module of a mobile phone to provide impedance optimization over a frequency range from 824-MHz to 2.17-GHz.

The component is based on WiSpry's digitally tunable MEMS capacitor technology, which allows digital control of capacitance values so that the WS2018 can be reprogrammed quickly to compensate for antenna load changes that can be caused by a variety of effects including head, hand and body proximity and which are different at different carrier frequencies, the company said.

The control is applied by either the MIPI Alliance RFFE interface or SPI serial interface.

The WS2018 can be driven by an existing single supply rail such as an LDO regulator output or directly from the battery supply. It includes a charge pump, serial bus and driver circuits integrated on the same CMOS die as the MEMS capacitor elements.

"Our new WS2018 antenna tuner combines the industry's best RF performance with the smallest form factor and the ability to tune any phase, any VSWR for 2G, 3G and LTE frequency bands," said Victor Steel, vice president of products at WiSpry, in a statement.

www.wispry.com

MEMS foundry licenses out TSV technology

MEMS foundry Silex Microsystems AS has said it has licensed its Sil-Via technology for through silicon vias (TSVs) to Nanoshift LLC for use in the early development of complex MEMS products.

"Through this license, MEMS customers can leverage Silex's extensive experience in MEMS, and capitalize on Nanoshift's highly-skilled design and development teams to more rapidly bring their MEMS products to market," said Peter Himes, vice president of marketing and strategic alliances for Silex Microsystems (Jarfalla, Sweden), in a statement.

"The Silex Sil-Via platform has become the go-to TSV technology in the MEMS industry because it has been proven in many high-volume applications," said Salah Uddin, co-founder of Nanoshift (Emeryville, CA).

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UWB to revolutionise car manufacturing with real-time location identification system

By Ubisense, www.ubisense.net

A new agreement has been forged between BMW, IBS and Ubisense, extending the deployment of a real-time Location Identification System (LIS) across the global vehicle manufacturer's production facilities. The LIS system comprises a communication platform from IBS and identification tags and sensors from Ubisense.

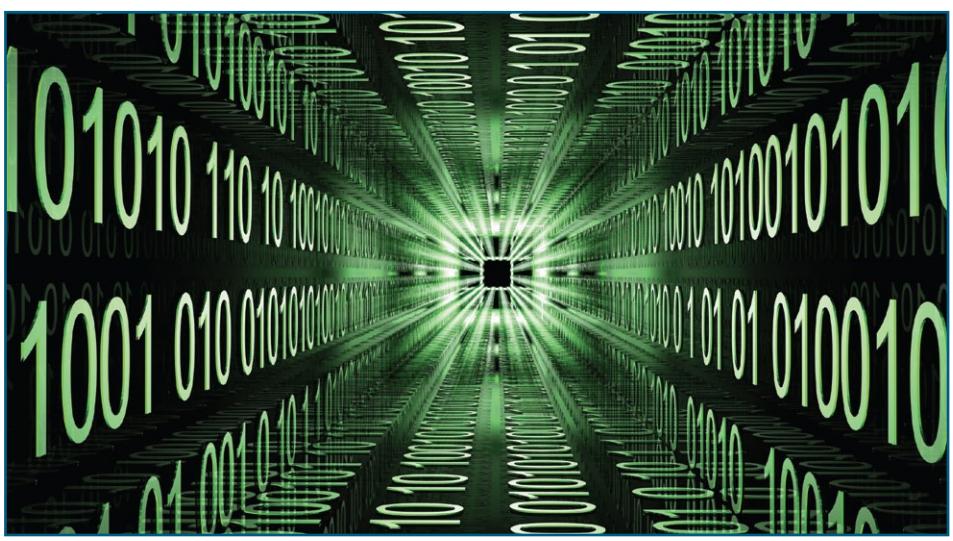
Under the contract, IBS and its software partner Ubisense will expand the roll-out of LIS, which is already delivering significant productivity improvements at two of BMW's eight vehicle assembly plants. The solution will now be implemented at three additional BMW assembly lines in Asia, Europe and the United States.

The LIS integrated real-time location system (RTLS) solution, developed specifically for BMW, combines best-in-class ultra-wideband (UWB) radio tags and sensors with advanced quality management and traceability software, bringing the production process a step closer to Six Sigma and the vision of complete traceability. The technology tracks individual vehicles through on-line and off-line final assembly. It determines the identity and location of each car in the assembly facility and, based on the proximity of the vehicles to both fixed and mobile equipment such as tools and scanners, programs and controls the devices. Delivering unprecedented levels of accuracy and reliability for an RTLS-based solution, the system improves quality and enables line operatives to work more efficiently, achieving time-savings, process safeguarding, zero defects and cost reductions.

In 2008, Ubisense and IBS deployed LIS on a 1.8 km long assembly line at BMW's Regensburg plant in Germany. In 2010, LIS went live on the new X3 assembly line at BMW Spartanburg in South Carolina, USA — home to the company's SUV range. The solution will now be deployed at plants in Shenyang, China; on the X5 and X6 production line in Spartanburg; and at the dedicated Mini plant in Oxford, U.K.

How the technology works

Vehicle assembly is a complex process — particularly at plants where different models



are manufactured on the same line. At BMW Regensburg, Series 1 and Series 3 vehicles are assembled alongside Z4 Roadsters. With each model built to exact customer specifications and travelling along the production line, more or less in the order of purchase, assembly line operatives have to identify the next vehicle at their station quickly and accurately in order to select the right component or tool setting and complete the work necessary in the seconds they have available.

Previously, operatives identified vehicles using hand-held scanners and paper barcode labels, which were attached to the bonnet of each car. They then had to take their Direct Current (DC) tool to the correct location on the vehicle and wait for the correct settings to load before starting work — a time-consuming process in a manufacturing environment where every second counts.

Working with BMW, IBS and Ubisense have automated this process within the BMW IT environment, shaving valuable seconds off assembly line operations. The RTLS tags now replace the barcodes on car bonnets and have been fixed to DC programmable tools. As the cars move through the plant, the tags communicate their location via UWB radio to sensors located along the production line. The sensors instantly relay this data via a local area network (LAN) to LIS, which is integrated with the BMW IT environment. Running under SAP, the BMW IT environment comprises a so-called "communication machine" (KM), the Integrated Production System (IPS) and the Automotive Production System (APS). LIS determines when the tools enter the pre-defined work zones around each moving vehicle, identifying the vehicle and generating a "positive event." This prompts the APS to automatically load the correct vehicle-specific program to the operative's tool so the next job can be performed.

Dr. Klaus-Juergen Schroeder, Chief Executive Officer of IBS AG, said: "The LIS developed and standardised by IBS — along with BMW and Ubisense — is unique worldwide. The tool presents us with a vital unique selling point."

Richard Green, CEO of Ubisense, commented: "Extending our agreement with BMW via IBS is a major endorsement of the Ubisense solution, demonstrating the quality improvements as well as time and cost savings it can deliver. Working with IBS, we have forged a long-term partnership with BMW and look forward to working with the company to drive forward new efficiencies at its global manufacturing sites."

IMEC brings back low power ultrawideband

By Jean-Pierre Joosting

Ultrawideband is back. Imec and Holst Centre are demonstrating a fully chip-integrated ultralow-power IR-UWB (impulse-radio ultra-wideband) solution for use in the 6 to 10 GHz band, available worldwide and which opens the door to relatively small antennas that do not need antenna filters. The radio delivers high-quality communication for battery-operated mobile and sensing applications, and operates fade-resilient and interference-free.

UWB rode up and down the hype curve in the past decade as Intel and others tried to harness it as the transport for wireless USB, outfitted with the WiMedia air interface for 100 Mbit/second data rates. Researchers here are taking a different twist on the technology. Rather than use a continuous modulation wave, the chip set adopts the impulse-response radio techniques tested in military applications. It allows a relatively simple design with chips that can be turned off between data blasts, saving power.

UWB communication is now available for battery-operated applications in the area of personal area networks and positioning sensors worldwide. Examples are short-range video streaming or around-the-body audio streaming (for example between a headset and a smartphone). When using the UWB radio for the wireless streaming of audio between for example a smartphone and an earpiece, the battery lifetime of the smartphone will increase by over 3x compared to a conventional Bluetooth-based solution, and the earpiece will have a battery lifetime increase of over 5x. In contrast to the Bluetooth communication, the UWB radio will not suffer from interference from other wireless technologies that operate in the same location and in the same frequency band.

Impulse ultra-wideband communication is especially suited for short-range (20 m) communication and positioning sensors. The large bandwidth improves the resilience against fades, resulting in a superior communication reliability. This is especially so compared to narrowband solutions, which tend to lose signals in surroundings with reflective surfaces and multi-path propagation. Also, spreading information over a wide bandwidth decreases the power spectral density, thus reducing the interference with other systems and lowering the probability of interception. IR-UWB is also suitable for positioning sensors; the reflection of the wide-band signal allows for centimeter-ranging positioning accuracy.

Imec and Holst Centre's solution consists of a transmitter, receiver front-end, and receiver digital baseband. The transmitter delivers 13 dBm peak power, with an average power consumption of 3.3 mW. The receiver front-end shows -88 dBm sensitivity at 1 Mbps. A digital synchronization algorithm enables real-time duty cycling, resulting in a mean power consumption of 3 mW. A DCO with 100 ppm frequency accuracy and a baseband frequency tracking algorithm ensure the coherent reception. A 75 dB link budget with a data rate of 1 Mbps is achieved.

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Improving the output accuracy over temperature for RMS power detectors

By Andy Mo, RF Applications Engineer, High Frequency Products, Linear Technology Corporation

Introduction

Stable temperature performance is extremely important in basestation designs, as the ambient temperature can vary widely depending on the surroundings and the location. Using high accuracy over temperature, RMS detectors can improve the power efficiency of basestation designs. The LTC5582 and the dual-channel LTC5583 are a family of RMS detectors that offer excellent stable temperature performance (from -40 °C to 85 °C) at any frequency up to 10 GHz for the LTC5582, and 6 GHz for the LTC5583. However, their temperature coefficients vary with frequency, and without temperature compensation, the error over temperature can be greater than 0.5 dB. As a result, it is sometimes necessary to optimize the temperature compensation at different frequencies to improve the accuracy to <0.5 dB of error. In addition, the temperature compensation can be implemented using only two off-chip resistors, with no external circuitry required.

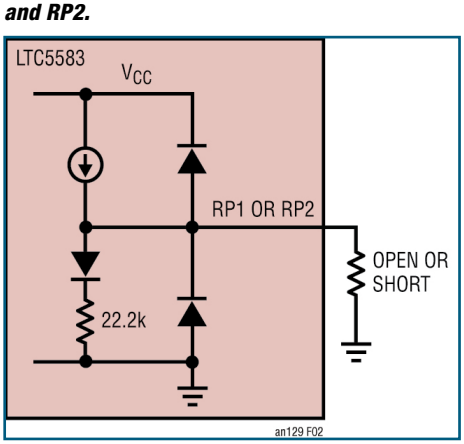
The change in output voltage is governed by the following equation:

$$\Delta Vout = TC1*(T_A - t_{NOM}) + TC2*(T_A - t_{NOM})^2 + detV1 + detV2 \quad ...(equation\ 1)$$

where TC1 and TC2 are the 1st and 2nd order temperature coefficients, respectively. T_A is the actual ambient temperature, and t_{NOM} is the reference room temperature, 25 °C. Further, detV1 and detV2 are output voltage variation when RT1 and RT2 are not set to zero.

The method to calculate the resistor values for temperature compensation is the same for both the LTC5582 and the LTC5583 (see Figures 2 and 3). The two control pins are RT1, which sets TC1 (the 1st order temperature compensation coefficient), and RT2 which sets TC2 (the 2nd order temperature compensation coefficient). Shorting RT1 and RT2 to ground conveniently turns off the temperature compensation feature if not needed.

Figure 2: Simplified schematic of pins RP1 and RP2.



LTC5583 temperature compensation design

LTC5583 includes two additional pins, RP1 that controls the polarity of TC1, and RP2 which controls the polarity of TC2. However, the magnitude of the temperature coefficients is the same with a fixed RT1, or RT2 value, only polarity is flipped. Both channel A and channel B share the compensation circuitry; therefore both channels are controlled together.

Figure 1 illustrates the change in Vout as a function of temperature from the 1st order temperature compensation. Only three resistor values are shown to illustrate that increasing resistor values causes an increase in the magnitude of the slope. The polarity of the slope is controlled by the RP1 pin.

Figure 4 illustrates the effect of 2nd order temperature compensation on Vout. The polarity of the curves is controlled by RP2. The curvature depends on the resistor values. The overall effect is the summation of the 1st order and 2nd order temperature compensation given by equation 1.

Take an LTC5583 as an example at 900 MHz input. The first step is to measure the Vout over temperature without compensation. Figure 5 shows the uncompensated Vout. The linearity error over temperature is referenced to the slope and intercept point at 25 °C. To minimize the output voltage change with temperature, the linearity curve in red (85 °C) needs to be

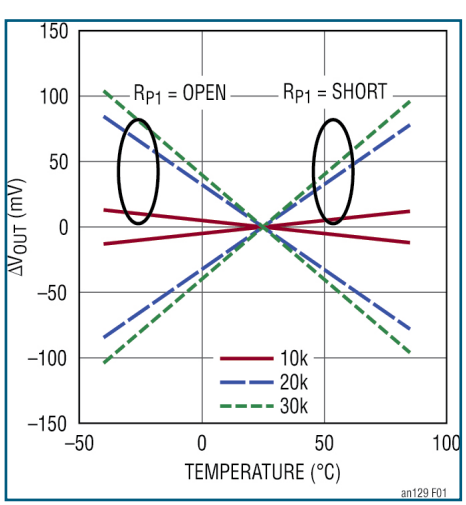


Figure 1: 1st order ΔVout versus temperature.

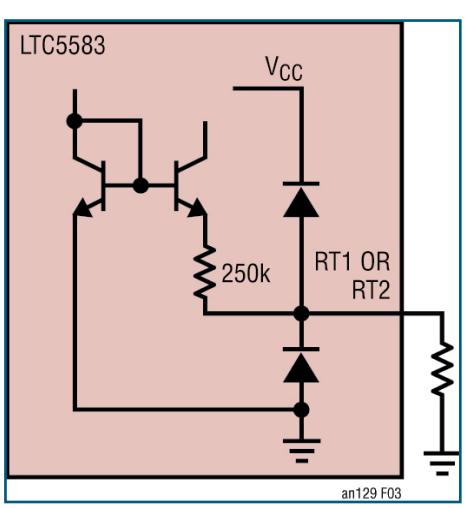


Figure 3: Simplified schematic of pins RT1/RT2.

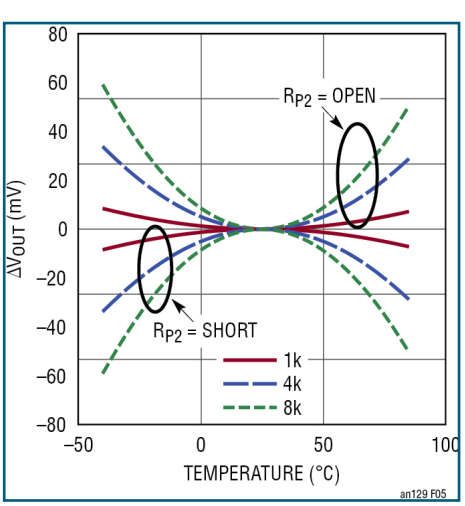


Figure 4: 2nd order Vout versus temperature.

shifted down, and the linearity curve in blue (-40 °C) needs to be shifted up to align with the room temperature in black, and overlap as much as possible. What follows is a step by step design procedure.

Step 1: Estimate the temperature compensation needed in dB, from Figure 5. For example, read the plot at an input power of -25 dBm, which is the middle of the dynamic range. Multiply the linearity error in dB by 30 mV/dB (typical Vout slope) to convert to mV.

Figure 5: Uncompensated LTC5583 at 900 MHz.

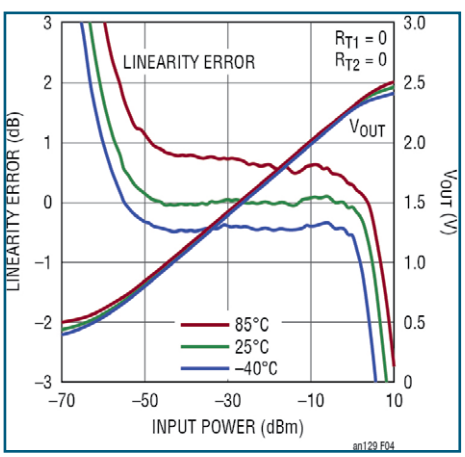
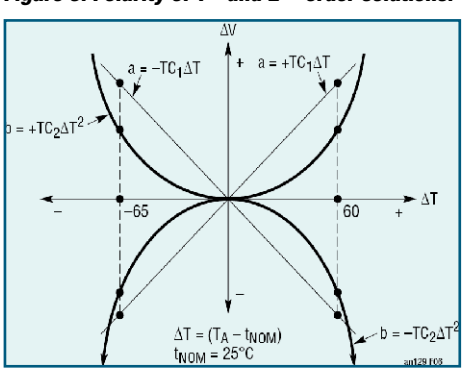


Figure 6: Polarity of 1st and 2nd order solutions.



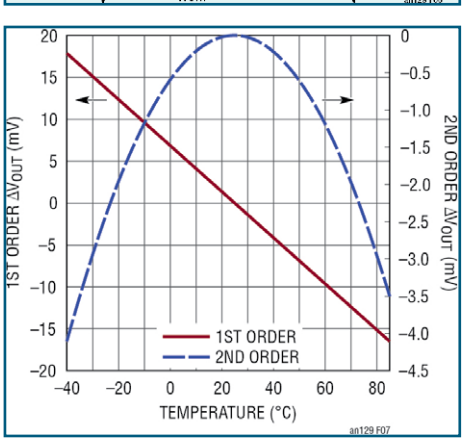


Figure 7: Solutions for the temperature compensation.

Cold (-40 °C) = +13 mV or +0.43 dB
Hot (+85 °C) = -20 mV or -0.6 dB

This is the amount of output voltage adjustment required over temperature.

Step 2: Determine the polarity of RP1 and RP2, and the solutions for 1st and 2nd order compensation. To find the solutions, let a = 1st order term, and b = 2nd order term. Set them up so they satisfy the temperature compensation at -40 °C and 85 °C.

a - b = +13 mV ...(equation 2)
a - b = -20 mV ...(equation 3)
a = 16.5 (1st order solution)
b = 3.5 (2nd order solution)

The polarity of "a" and "b" in equation 2 and equation 3 are determined by the polarity of the 1st order term and the 2nd order term, such that their summation satisfy the +13 mV at cold (-40 °C), and -20 mV at hot (+85 °C) adjustment. Refer to figure 6. The 1st order term and 2nd order term can be either

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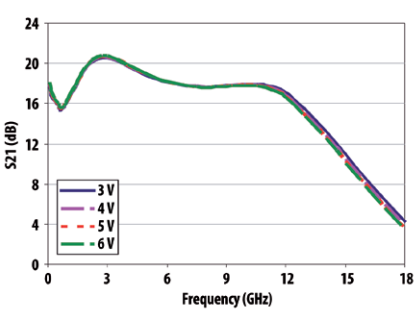
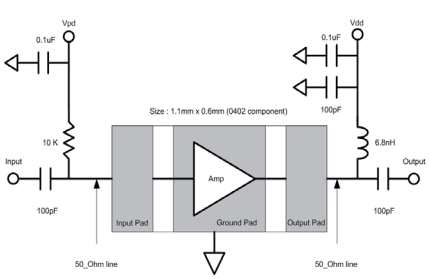
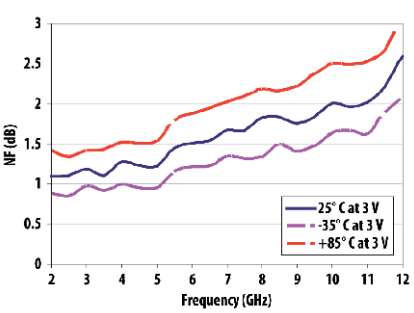


Small Signal Gain



Circuit Diagram



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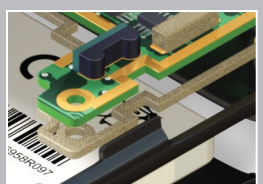


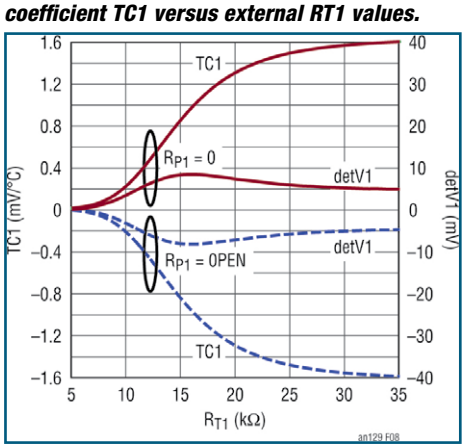
positive or negative. So there are total of 4 combinations possible. In this case, only when both terms are negative will their sum satisfy the required compensation.

Figure 7 shows the 1st and 2nd order compensation required at -40 °C and +85 °C. Notice the polarity of the 1st order and 2nd order compensation are negative such that when both curves are added, their sum produces the required adjustment to Vout. Consequently, TC1 and TC2 are negative, and RP1 and RP2 are determined from Figures 8 and 9. Notice the values of the two solutions add up to approximately +13 mV at -40 °C, and -20 mV at +85 °C.

RP1 = open
RP2 = short

Step 3: Calculate the temperature coefficients at one of the temperature extremes and determine resistor values RT1 and RT2, using Figures 8 and 9.

Figure 8: 1st order temperature compensation coefficient TC1 versus external RT1 values.



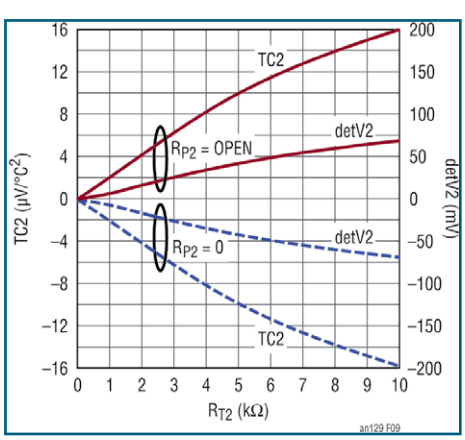


Figure 9: Second order temperature compensation coefficient TC2 versus external RT2 value.

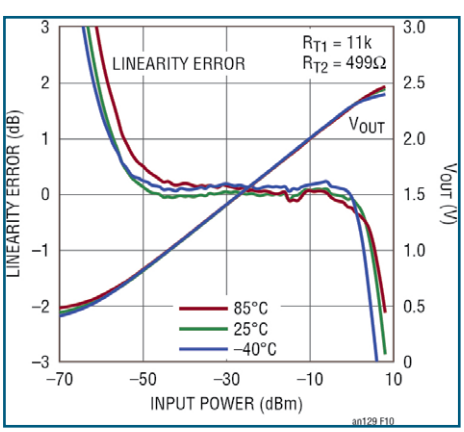
a = 16.5 = TC1*(85 - 25); TC1 = 0.275 mV/°C
RT1 = 11KΩ (from Figure 8)
b = 3.5 = TC2*(85 - 25)^2; TC2 = 0.972 µV/°C^2
RT2 = 499 Ω (from Figure 9)

Figure 10 shows the LTC5583 performance over temperature for one of the two output channels. Notice an improvement to the temperature performance from uncompensated Vout, from Figure 5. This may be satisfactory for most applications. However, for some applications where even better accuracy is needed, a 2nd iteration can be performed to further improve the temperature performance. To simplify the calculation, detV1 and detV2 terms are ignored because they are not dependent on temperature. As a result, the solutions are not precise. However, it is very helpful in improving the accuracy over temperature, as shown here.

2nd iteration calculation

Step 1: Find the compensation needed from Figure 10, the same method in first iteration.

Figure 10: Compensated LTC5583 output after 1st iteration.



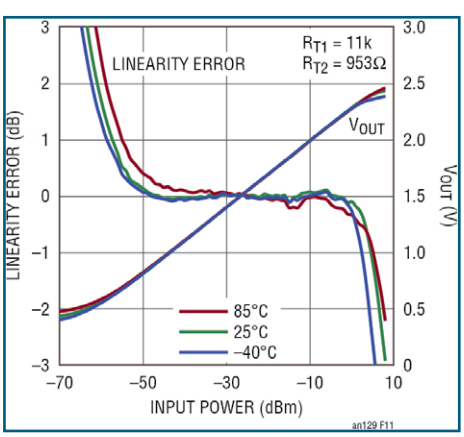


Figure 11: Temperature compensated Vout after 2 iterations.

Frequency (MHz)	RP1 (kΩ)	RP2 (kΩ)	RT1 (kΩ)	RT2 (kΩ)
450	Open	0	115	113
880	Open	0	115	113
900	Open	0	11	953
1800	Open	0	121	15
2140	Open	0	976	11
2300	Open	0	105	143
2500	Open	0	105	143
2700	Open	0	887	121

Table 1: Recommended settings and resistor values for LTC5583 for optimal temperature performance at various frequencies.

Cold (-40 °C) = -3 mV or -0.1 dB
Hot (+85 °C) = -3 mV or -0.1 dB

Add the new values to the 1st iteration

Cold (-40 °C) = -3 mV + 13 mV = 10 mV
Hot (+85 °C) = -3 mV - 20 mV = -23 mV

Repeat steps 2 and 3 to calculate the RT1 and RT2 values.

RT1 = 11 KΩ
RT2 = 953 Ω
RP1=open
RP2=short

The performance results are shown in Figure 11 after two iterations. Over temperature,

Frequency (MHz)	RT1(KΩ)	RT2(KΩ)
450	12	2
800	124	14
880	12	2
2000	0	2
2140	0	2
2600	0	16
2700	0	16
3000	0	16
3600	0	16
5800	0	3
7000	10	143
8000	10	143
10000	10	3

Table 2: Recommended RT1 and RT2 values of LTC5582 for optimal temperature performance at various frequencies.

the dynamic range is 50 dB with 0.2 dB of linearity error, and 56 dB of dynamic range with 1.0 dB of linearity error. Refer to Table 1 for temperature compensation values at other frequencies.

This iteration process can be repeated over and over again to further increase the accuracy. This will allow the designer to dial in the compensation to as accurate as needed for most applications.

LTC5582 single setector

The method to calculate the LTC5582 compensation values for RT1 and RT2 is the same, only easier because the polarity has been predetermined. Both TC1 and TC2 are negative. Refer to Table 2 for RT1 and RT2 values at other frequencies. The compensation coefficients shown in Figures 8 and 9 are different for LTC5582. Refer to the data sheet for additional information.

Conclusion

LTC5582 and LTC5583 offer excellent temperature performance with only two external compensation resistors. The procedure to calculate the compensation resistors is simple, and can be reiterated for even better performance. The example shown here is for LTC5583 at 900 MHz RF input, but the method can be applied to LTC5582 and LTC5583 at any frequency within the limits of the IC. The performance over temperature is fairly consistent. The resulting performance provides accuracy over temperature with less than 1% of output voltage.

Reference

LTC5583 data sheet.

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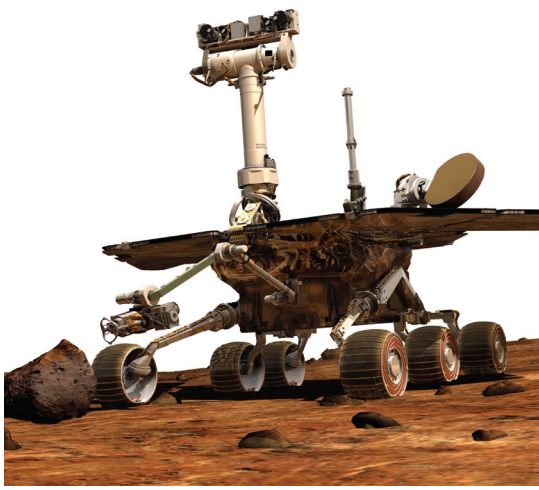

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The insertion loss of the 4436-2 (two-way division) is less than 1.5 dB, less than 3 dB in the 4436-3 three-way version, less than 4.5 dB in the 4436-4 four-way version, and less than 8 dB in the 4436-8 eight-way version. Isolation ranges from 12 to 20 dB depending on the model, and

phase balance of all versions ranges from 6 to 15 degrees.

The power dividers accept a CW RF input power of 500 mW (1.5 kW peak) and operate over a temperature range of 0 to +70 °C with humidity up to 95% (non-condensing). They are housed in rugged aluminum enclosures, weigh between 110 and 650 g, and employ SMA female connectors.

www.nardamicrowave.com/east

18 GHz PLL synthesiser

removes frequency-doubling in broadband applications

Analog Devices has introduced a PLL frequency synthesiser that can be used to implement local oscillators as high as 18 GHz in the up-conversion and down-conversion sections of wireless receivers and transmitters.

The high bandwidth of the ADF41020 allows designers to potentially eliminate a frequency-doubler stage, which simplifies system architecture and reduces cost in applications including microwave point-to-point and multi-point radios, wireless infrastructure equipment, VSAT (very small aperture terminal) radios, semiconductor test equipment, radar applications and private mobile radios.

With an operating bandwidth up to 18 GHz, this is claimed to represent

the highest frequency PLL available on the market today.

The ADF41020 consists of a low-noise, digital phase-frequency detector, a precision charge pump, a programmable reference divider and high-frequency programmable feedback dividers. A complete synthesiser can be implemented if the PLL is used with an external loop filter and VCO (voltage controlled oscillator). The PLL can be used to drive external microwave VCOs via an active loop filter.

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S-band phase shifters

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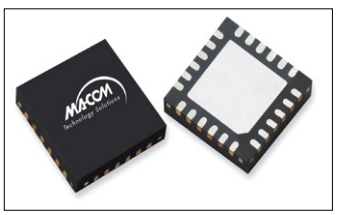
M/A-COM Technology Solutions has introduced a set of S-band digital phase shifters for communications, electronic warfare (EW), and radar applications.

The S-band GaAs pHEMT 4-bit and 6-bit digital phase shifters meet the high performance requirements of communications and radar system manufacturers, optimizing for fast switching speed, low phase error, and serial or parallel control capability.

The 2.3 GHz to 3.8 GHz digital phase shifters maintain low phase error and low attenuation variation over the 360° range, and a built-in CMOS driver allows for serial or parallel control in a small form factor.

The MAPS-010144 is a 4-bit digital phase shifter housed in a 4-mm 24-lead PQFN package. It provides 360° phase shift range with a step size of 22.5°.



It is controlled with a single +5.0 V serial or parallel control line. Its insertion loss is 2.5 dB, with a low ±0.5 dB attenuation variation and ±4.0° phase accuracy over the 2.3 GHz to 3.8 GHz frequency range.

The MAPS-010164 is a 6-bit digital phase shifter housed in a 4 mm 24-Lead PQFN package. It provides 360° phase shift range with a step size of 5.625°. It is controlled with a single +5.0 V serial or parallel control line. Its insertion loss is 3.2 dB, with a low ±0.6 dB attenuation variation and ±5.0° phase accuracy over the 2.3 GHz to 3.8 GHz frequency range.

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Sub-1-GHz ultra-low-power smart radio

ideal for smart meters, medical and home automation

Freescale Semiconductor has introduced an ultra-low-power, sub-1-GHz smart radio for use in smart metering, medical, building and home automation applications. With its MC12311 radio the company is expanding its wireless portfolio beyond its 2.4 GHz devices. The MC12311 platform combines a sub-1 GHz RF transceiver and an 8-bit HCS08 microcontroller in a single land grid array package.

The MC12311 can connect smart meters to remote displays that show consumption data and thermostats that help control energy use. Pike Research predicts 535 million smart meters will be deployed worldwide by 2015, of which approximately 50 percent of them will use wireless mesh technology.

The radio's very low power is suitable for battery operated devices — the M12311 has low-power features such as 100 nA with radio configuration retention, 16 mA Rx current, 20 mA Tx current at 0 dBm and 33 mA Tx current at +10 dBm. The MC12311 platform supports multiple sub-1 GHz standards including Wireless M-Bus, 802.15.4g and other proprietary offerings.

www.freescale.com

Microphone wireless audio reference design kit

Nordic Semiconductor ASA and AKM Semiconductor have announced the nRFready™ Microphone reference design kit that provides a complete two-microphone audio streaming solution based on the recently announced Nordic nRF2460 2.4-GHz mono audio streamer and AKM ADC/DAC audio converters.

The reference design kit delivers crystal clear, wireless 16-bit uncompressed audio with less than 22 ms latency, excellent co-existence performance, over 100-hours of battery lifetime from two AA batteries, and a total BoM (Bill of Material) that supports competitive consumer product pricing.

The nRFready Microphone reference design kit includes two microphone boards, a receiver board with both USB and analog interfaces, plus a complete set of design files, source code, and supporting documentation.

www.akm.com, www.nordicsemi.com

'Zoning-friendly' microcellular device integrates backhaul

Mobile operators are increasingly turning to microcellular underlay networks to augment over-burdened macrocellular networks. Until now, the missing pieces of the puzzle to deploying cost-effective underlay networks has been the backhaul required to deliver capacity to the lamp post or light standard where these microcells are situated, as well as providing the infrastructure (power, environmental, switching, etc.) to support such deployments. DragonWave's Avenue platform provides all this in one 'zoning-friendly' box that mounts on street lamps, traffic-light poles or building walls, enabling mobile operators to now meet the challenge of quickly scaling capacity and optimizing spectrum usage.

DragonWave's Avenue flexibly accommodates a wide range of 3G or 4G microcellular RAN access units and leverages an integrated backhaul antenna array supporting up to three simultaneous backhaul beam paths using frequencies ranging from 2 GHz to 80 GHz to deliver 1.2 Gbps of aggregate, full-duplex capacity. Alternatively, Avenue can be backhauled via fiber or DSL. Its compact design allows it to be easily mounted on street lamps, traffic-light poles or building walls.

RAN base stations integrated into Avenue can be backhauled over distances up to 4 km, 2.5 miles. The platform's ultra-high capacity enables the support of a wide range of network topologies (self-healing rings, constrained meshes, point-to-point/daisy-chaining or multi-point).

www.dragonwaveinc.com

RFID/NFC dual-interface memory IC

relies on RF energy harvesting

STMicroelectronics has extended its family of RFID/NFC wireless memory ICs with a new 16-Kbit device that can also harvest enough energy to enable small electronic items using it to become completely battery-free. The dual-interface memories feature a low power I2C interface, as well as a 13.56-MHz ISO15693 contactless RF interface.

This RF interface can harvest ambient radio waves emitted by RFID reader-writers and convert those waves into a voltage output that may be used to power other electronic components. The energy harvesting capability of the EEPROM will enable new types of miniaturized electronics.

ST has demonstrated the M24LR16E energy-harvesting wireless memory by illuminating indicator LEDs as well as by powering its battery-less STM8L-based Discovery kit. Other potential

applications include e-paper devices such as electronic shelf labels, as well as industrial automation, sensing and monitoring systems, and personal healthcare products.

The M24LR16E features 16 Kbits of non-volatile EEPROM storage, introducing a new lower-density option alongside ST's established 64Kbit dual-interface wireless memory, the M24LR64. The RF interface operates at 13.56 MHz and is compatible with RFID reader-writers. The IC is in volume production and available in SO8, TSSOP8 or MLP8 surface-mount packages.

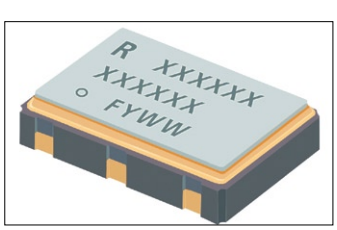
www.st.com

XOs and VCXOs from 2.048 up to 200 MHz

in LVPECL, LVDS and CMOS outputs

Rakon has added ultra low noise 7.0 x 5.0 mm XOs and VCXOs to its expanding portfolio. The RXO7050M (XO) and RVX7050M (VCXO) are available from 2.048 MHz up to 200 MHz in LVPECL, LVDS and CMOS outputs. The use of high frequency fundamental (HFF) inverted mesa crystals eliminates the sub-harmonics associated with other HF technologies.

The RVX7050M is optimized for low close-in phase noise and satisfies the stringent requirements for LTE and QAM (for example less than -147 dBc/Hz at 10 kHz



offset for a 3.3 V PECL output, at 122.88 MHz, or less than -115 dBc/Hz at 100 Hz offset, for a 3.3 V CMOS output at 10 MHz). With RMS phase jitter of 0.1 ps integrated over 12 kHz to 20 MHz, the devices also suit wireline communications requiring high serial data rates.

www.rakon.com

GaN wideband power amplifier

covers 30 MHz to 2500 MHz

The RF3826 wideband power amplifier from RFMD is designed for continuous wave and pulsed applications such as wireless infrastructure, RADAR, two-way radios, and general purpose amplification.

Using an advanced high power density Gallium Nitride (GaN) semiconductor process, this high-performance amplifier achieves high efficiency, flat gain, and large instantaneous bandwidth in a single amplifier design. The RF3826 is an input-matched GaN transistor packaged in an air cavity ceramic package which provides excellent thermal stability through the use of advanced heat sink and power dissipation technologies.

Ease of integration is accomplished through the incorporation of an optimized input matching network within the package that

provides wideband gain and power performance in a single amplifier. An external output match offers the flexibility of further optimizing power and efficiency for any sub-band within the overall bandwidth.

Key features include a 50 Ω internally matched input, output power of 9 W, gain of 12 dB, 30 MHz to 2500 MHz instantaneous bandwidth, power added efficiency of 45 percent over 30 MHz to 2500 MHz) or 50 percent over 200 MHz to 1800 MHz. Large signal models are available.

www.rfmd.com

AWS MIMO support for indoor DAS

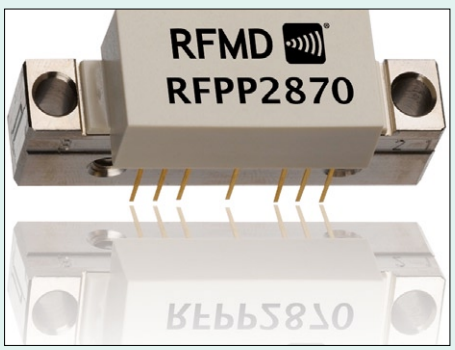
can provide 2x2 transmission on a single cable

TE Connectivity (TE) has announced that its InterReach Spectrum distributed antenna system (DAS) now supports 2x2 multi-input, multi-output (MIMO) mode for Advanced Wireless Service (AWS) frequencies of 1700 and 2100 MHz. This allows the company's DAS products to support multiple frequencies in MIMO mode, including not only AWS but also 700 MHz and 1900 MHz.

MIMO mode works by creating signal diversity between multiple antennas, so it is ideally suited for DAS deployments inside buildings, where the environment is broken up by walls, furniture, and equipment. MIMO mode is being used and planned for use by carriers for LTE and other 4G services in the US and abroad. Support of MIMO in its DAS products puts TE at the forefront of equipment vendors helping mobile operators deliver these services. InterReach Spectrum and InterReach Fusion DAS products are ideal for supporting MIMO because they can support 2x2 MIMO transmission on a single cable versus competing solutions which require duplicate cable infrastructure. This results in quicker and more cost effective installations.

www.te.com

High gain GaN CATV amplifier features low distortion



The RFPP2870 SOT115J push-pull amplifier, from RFMD, features 28 dB minimum gain at 1003 MHz, with excellent distortion characteristics and optimal reliability, all in an industry standard SOT-115J package.

The part employs GaN HEMT, GaAs MESFET, and GaAs pHEMT die and operates from 40 MHz to 1003 MHz. It provides superior return loss performance with low noise and optimal reliability — and the highest level of linearity available.

The RFPP2870 is rated at 46 dBmV output power with typical input and output return loss of 0 better -20 dB. The amplifier is unconditionally stable under all terminations.

www.rfmd.com

Extended temperature VCXO offers wide pull range

Valpey Fisher Corporation has announced its latest product offering: the VFHV570, voltage controlled crystal oscillator, which offers wide pull range with extended temperature range.

The device delivers frequency stability of ±50 ppm and is also available across the industrial temperature range of -40°C to +175°C in a 5.0 x 7.0 mm SMD package.

The VFHV570 offers output frequencies from 1 MHz to 80 MHz in a LVCMOS output with supply voltages of 3.3 V, or 5.0 V. For tracking accuracy of a PLL design, the device's absolute pull range minimum is ±100 ppm. It can withstand harsh temperature conditions without compromising its performance.

www.valpeyfisher.com

Phase lock DRO offers leading phase noise performance

Raditek's latest DRO based, synthesizer product line can be configured as a fixed frequency phase locked DRO, which unlike conventional phase locked DROs does not require a reference frequency that is a sub multiple of the output frequency. The output frequency can be to over 25 GHz. Another option is to have some limited tunability with only a small reduction in phase noise

over a pure fixed DRO type. The reference can be 10 MHz, 100 MHz and so on.

www.raditek.com

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Time-delay phase shifter

delivers 500° adjustable delay over 8 to 23 GHz

Hittite has announced the HMC877LC3 8 to 23 GHz time-delay/phase-shifter, which targets clock chain and skew adjustment in 10G-RZ, 40G/100G RZ-DQPSK fiber optic applications. The device provides up to 1.4 UI (500°) continuously adjustable delay over an 8 to 23 GHz range, while maintaining a constant differential output voltage. It accepts either single-ended or differential input signals, while providing a 500 to 900 mVp-p programmable differential output swing.

The device provides a time-delay/phase-shift which is linearly monotonic with respect to the differential delay control voltage, over a

±0.6 V tuning range. On chip compensation circuitry ensures a stable programmable time delay over both frequency and temperature. A high delay control modulation bandwidth (3 dB rolloff point) of 2.5 GHz combined with single +3.3 V operation also make the device ideal for phase modulation in military and space, test and measurement and broadband.

www.hittite.com

Packet microwave radio platform

provides high power, high capacity backhaul

Redline Communications Group has announced its high end licensed microwave product the RDL-5000, a high capacity, high power, packet microwave radio platform for telecom backhaul and large enterprise connectivity that delivers throughput of up to 800 megabits per second.

With demand for video and other ultra high speed IP-based data services predicted to grow rapidly over the coming years, consuming more and more of the available bandwidth and demanding higher speeds, networks will have to keep pace. This means more base stations in more locations and greater capacity between base stations and to the enterprise.

The RDL-5000 is a key component of the company's wireless Virtual Fiber™ product line, bringing fiber-like network performance to areas where fiber installation is challenging or cost prohibitive. It delivers high speed connectivity wirelessly, replacing the need to dig trenches and lay wires.

The high power, high-sensitivity radio means longer ranges can be achieved at higher data speeds, while using smaller antennas. Its built-in, 2-port, gigabit Ethernet switch provides application versatility and supports redundancy in both traditional point-to-point and ring/mesh topologies.

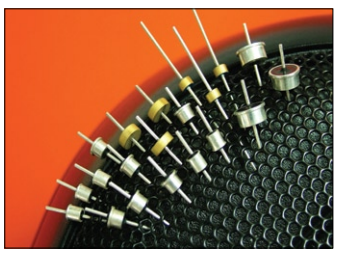
www.rdlcom.com

Low profile, panel mount capacitors

deliver EMI filtering benefits

Syfer has unveiled a number of important extensions to its already wide range of solder-in panel mount EMI filters. Advanced in-house research and development has resulted in the introduction of a series of discoidal capacitor versions, which offer the advantage of high capacitance values, up to several microfarads, in a compact and robust package.

Ideal as low-profile, panel mount filters, the SFSS devices are constructed with a discoidal capacitor soldered to a feedthrough pin. They are offered with a choice of C0G/NP0 or X7R ceramic dielectrics. Available in 5 different diameters (2.3 mm, 2.8 mm, 3 mm, 5 mm and 8.75 mm), capacitance values range from 10 pF to an impressive 2.2 µF.



Working voltages range from 50 V to 3 kV and operating temperature range is -55 to 125 °C. These devices are able to withstand a solder-in temperature of 250 °C.

For designers looking for space saving solutions, the solder-in EMI filter ranges allow the specification of smaller parts when compared to competitive offerings. Custom devices can also be produced on request.

www.syfer.com

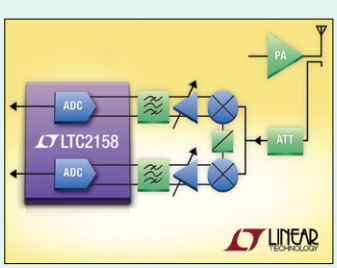
14-bit 310-Msps dual ADC family

can linearize the 60-MHz transmit bandwidth using DPD

Linear Technology has introduced a family of dual (LTC2158-14) and single (LTC2153-14) high IF sampling 14-bit, 310 Msps ADCs designed specifically for wide bandwidth digital predistortion (DPD) linearization.

Due to increasing data demands, next-generation base stations are being architected to achieve much higher transmit bandwidths of up to 60 MHz. To linearize a 60 MHz transmit bandwidth requires an ADC with a minimum resolution of 14-bits and an I/Q sampling architecture with a minimum sample rate of 300 Msps. In addition, the closed loop DPD algorithm requires short latency in the feedback path to achieve better efficiency in the PA.

The LTC2158-14 is the first dual, 310 Msps ADC on the



market to enable linearization of transmission bandwidths up to 60 MHz using I/Q sampling, and offers a short pipeline latency of just 5 clock cycles for fast adaptation.

Operating from a single 1.8 V supply, the dual LTC2158-14 consumes 362 mW/channel at 310 Msps and offers signal to noise ratio (SNR) performance of 68.8 dB and SFDR of 88 dB at baseband with an easy-to-drive 1.32 Vp-p input range.

www.linear.com/hsadc

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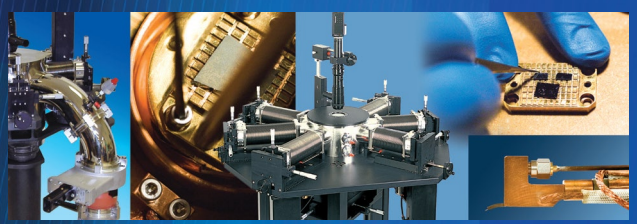

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www.radiowirelessweek.org

Mobile World Congress
27th February - 1st March 2012
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Barcelona, Spain
www.mobileworldcongress.com

EuCAP
26th - 30th March 2012
Prague Congress Centre
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www.eucap2012.org

Microwave & RF
3rd - 5th April 2012
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Porte de Versailles
France
www.microwave-RF.com

CTIA Wireless
8th - 10th May 2012
Ernest N. Morial Convention Center
New Orleans, Louisiana, USA
www.ctiawireless.com

MTT-S International Microwave Symposium
17th - 22nd June 2012
Palais de Congrès de Montréal
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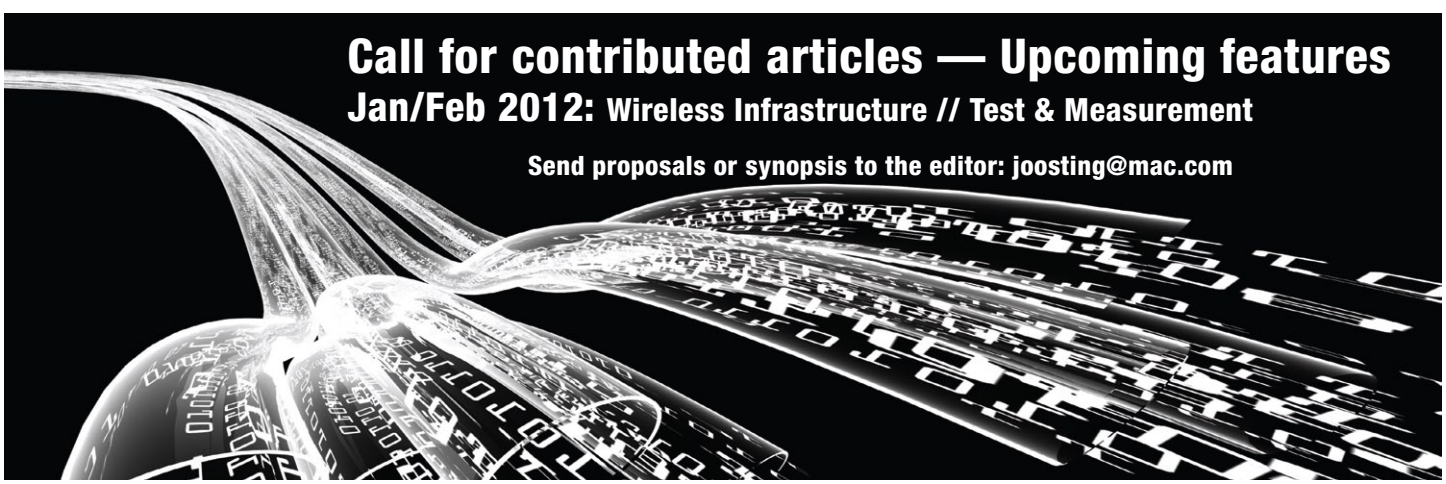
http://ims2012.mtt.org



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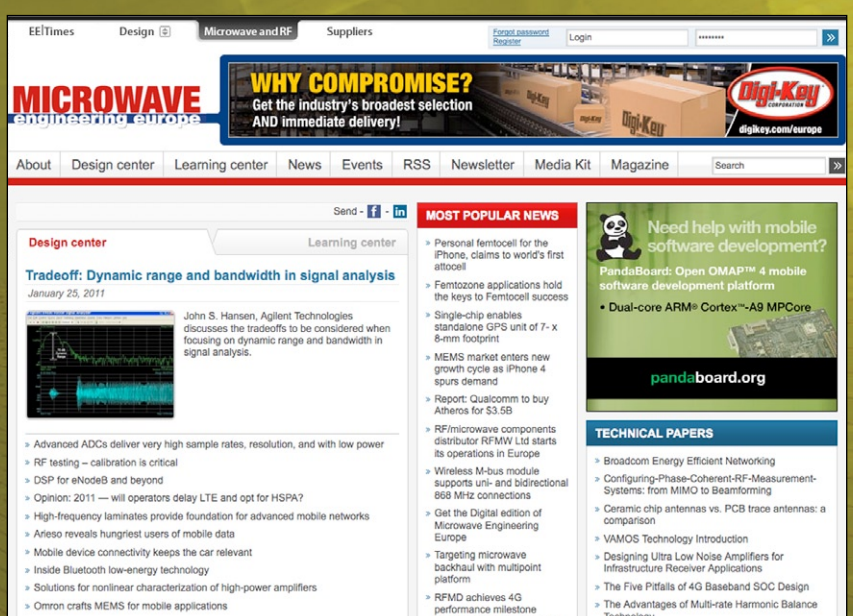

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