July - August 2016

european business press

MICROWAVE engineering europe

www.mwee.com

Design and Test

The European journal for the microwave and wireless design engineer

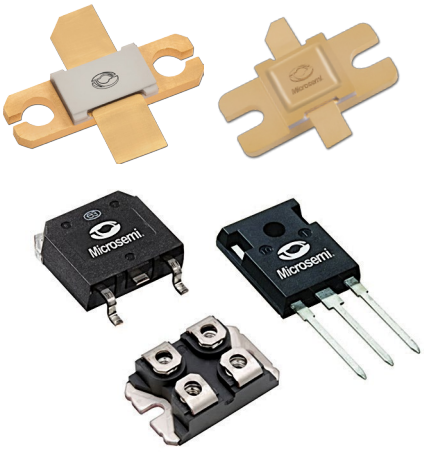
COLLABORATION IS EVERYTHING.

Richardson RFPD and Microsemi proudly support RF Wireless, Energy and Power markets worldwide

For a relay team to win gold in Rio, skill and performance must be flawless.

Richardson RFPD and Microsemi strive to match those levels of dedication and teamwork with our combined support of worldwide A&D, industrial, energy storage, and power conversion applications needs.

When timing is critical, turn to Richardson RFPD and Microsemi for high-performance RF Wireless, Energy and Power solutions.
Learn more at www.richardsonrfpd.com/Microsemi.



Microsemi

RichardsonRFPD
An Arrow Company

Scan me to
LEARN MORE
www.richardsonrfpd.com/Microsemi

Your Global Source for RF, Wireless, Energy & Power Technologies
www.richardsonrfpd.com | 800.737.6937 | 630.262.6800

Contents

MICROWAVE engineering europe

Editor In Chief
Jean-Pierre Joosting
Tel. +44-7800 548-133
email: jean-pierre.joosting@eetimes.be

Advertising Production
Lydia Gijsegom
Tel +32 (0) 2 740 00 50
email: lydia.gijsegom@eetimes.be

Circulation & Finance
Luc Desimpel
Tel +32 (0) 2 740 0055
email: luc.desimpel@eetimes.be

Art Manager
Jean-Paul Speliers
Tel +32 (0)2 740 0052
email: jean-paul.speliers@eetimes.be

Accounting
Ricardo Pinto Ferreira
Tel +32 (0)2 740 0051
email: financial@eetimes.be

Publisher
Andre Rousselot
Tel +32 (0)2 740 0053
email: andre.rousselot@eetimes.be

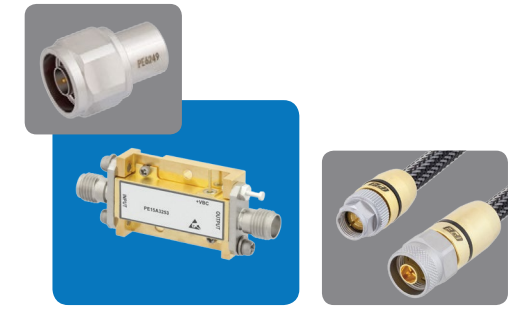
European Business Press SA
533 Chaussée de Louvain
1380 Lasne - Belgium
Tel: +32 (0)2 740 00 50
Fax: +32 (0)2 740 00 59
www.microwave-eetimes.com
VAT Registration: BE 461.357.437
RPM: Nivelles
Company Number: 0461357437

RF Solutions From RF Engineers

Largest Selection ✓

Expert Technical Support ✓

Same Day Shipping From the U.S. ✓



Armed with the world's largest selection of in-stock, ready to ship RF components, and the brains to back them up, Pasternack Applications Engineers stand ready to troubleshoot your technical issues and think creatively to deliver solutions for all your RF project needs. Whether you've hit a design snag, you're looking for a hard to find part or simply need it by tomorrow, our Applications Engineers are at your service.

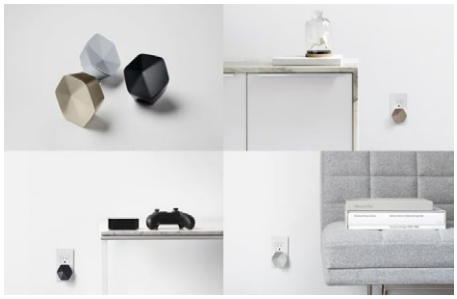
USA (949) 261-1920 • **AUSTRIA** (49) 89 4161 5994 0 • **BELGIUM** (31) 229 50 34 78 • **CZECH REPUBLIC** (420) 235 365 207
DENMARK (46) 8 554 909 50 • **FINLAND** (46) 8 554 909 50 • **FRANCE** (33) 1 47 95 99 60 **GERMANY** (49) 89 4161 5994 0
IRELAND (44) 0 1420 544789 • **ISRAEL** (972) 9 741 7277 • **ITALY** (39) 06 4071603 • **KAZAKHSTAN** (7) 495 961 34 43
LUXEMBOURG (31) 229 50 34 78 • **NETHERLANDS** (31) 229 50 34 78 • **NORWAY** (46) 8 554 909 50
POLAND (48) 22 855 34 32 • **PORTUGAL** (34) 91 636 3939 • **RUSSIA** (7) 495 961 34 43 **SLOVAKIA** (420) 235 365 207
SPAIN (34) 91 636 3939 • **SWEDEN** (46) 8 554 909 50 • **SWITZERLAND** (49) 89 4161 5994 0 • **TURKEY** (90) 216 504 07 87
UKRAINE (7) 495 961 34 43 • **UNITED KINGDOM** (44) 0 1420 544789

www.pasternack.com/Europe

PASTERNACK®
THE ENGINEER'S RF SOURCE

The changing face of Wi-Fi

Today Wi-Fi is practically everywhere, but that is not to say that there not many problems associated with it. Residential Wi-Fi struggles to keep up with the explosion of devices found in many homes and is often poorly distributed and traditional routers are often easily overwhelmed. Public Wi-Fi is better and more robust, but there are still bandwidth issues, and signals are often dropped due to interference.



Rethinking home Wi-Fi from the ground up and ditching the traditional router, Plume offers a completely new system for people wanting fast and consistent connectivity in every corner of their homes.

One company looking ahead is Plume by rethinking home Wi-Fi from the ground up and ditching the traditional router. Plume recently announced pre-sale for its self-optimizing Wi-Fi that will launch this fall and offer a completely new system for people wanting fast and consistent connectivity in every corner of their homes.

Plume works through a set of small Pods designed to plug directly into wall sockets around the home – one Pod per room is recommended. Directed by the Plume Cloud, the Pods offer coverage, speed and reliability far beyond any other solution. Plume is smarter, faster, smaller and simpler to set up.

"A single router can no longer meet the Wi-Fi demands of most homes today," said Fahri Diner, CEO and co-founder of Plume.

"While the latest generation of multi-router systems improve signal strength, they can choke the overall system capacity and speeds. These unnecessarily expensive products are based on decades-old technology that compounds the issue of a central router and cannot handle the complex variables and loads affecting a Wi-Fi network in a modern connected home."

Consequently, the Plume team created Adaptive Wi-Fi™, a deeply distributed, whole-home Wi-Fi system that dynamically responds to varying Wi-Fi conditions.

By actively monitoring the home network, as well as the devices connected to it, Plume detects interference and continuously makes decisions to improve signal, speed and resiliency. For example, the system monitors the UHD TV box in the living room and boosts Wi-Fi capacity there so the 4K stream never loses resolution. Plume also directs mobile devices to seamlessly roam as they move around the home.

The Plume system sets itself up from the cloud in less than two minutes with the Plume mobile app.

WI-FI ON WHEELS

In a separate development Wi-Fi looks to provide dynamic coverage everywhere. Claiming a world first, Ericsson has rolled out a mobile Wi-Fi unit, designated Wi-Fi on Wheels, that will potentially give thousands of people outdoor wireless access while on the go in cities throughout the U.S.

A customised Ford Transit 350 cargo van is outfitted with six Wi-Fi access points – enough to serve an estimated 2,500 people attending an event. Comcast worked with Ericsson to bring the vision to life and plans to use the vans to support community activities, sporting events and emergency response initiatives.

The van specifications also include a number of industry-firsts, including multiple network access connections, non-line-of-sight (NLOS) microwave backhaul, onboard backup power and modular deployment elements that enable Comcast to launch operations in minutes.

Angel Ruiz, Head of Region North America, Ericsson, says: "Driving innovation means not only bringing the best technology, but also enabling it to be used in new ways. This new rapid deployment solution will mean fast dispatch and hassle-free setup for Comcast, so they can bring coverage to new hard to reach locations."

WI-FI GETS LIGHT

Further out, a report highlights the emergence of Wi-Fi based on light. According to Grand View Research's latest report, the global VLC/Li-Fi market could reach $101.30 billion by 2024, boosted by increasing concerns over cyber security. According to the report, the growing need for green technology with low power consumption is encouraging the development of advanced communication systems and visible light communication (VLC) is expected to grab a substantial portion of the Wi-Fi industry in the near future. High illumination, longer life and low power consumption of has led the implementation of LED as a component in Li-Fi (Light Fidelity) systems.

Increasing applications of indoor location-based services embedded with light fixtures in retail shops and hotels is projected to be one of the factors driving revenue growth.

Further, advancements in the automotive industry are projected to enhance the safety of commuters. This is being executed through the vehicle to vehicle (V2V) and vehicle to the roadside (V2R) communication by installing LEDs in headlight and tail light of the vehicle. However, high installation and repair cost are projected to obstruct the large-scale implementation of these systems, especially in the emerging economies.

Jean-Pierre Joosting
Editor

Qualcomm, ST look to minimise smartphone power consumption

Qualcomm Technologies is adding software support for inertial sensors from STMicroelectronic, including its iNEMO inertial module. The companies say that the combination of ST's flexible sensor architecture and Qualcomm All-Ways Aware sensor-processing abilities will add performance and minimize power in mobiles.

The companies say that the support will enable the rapid introduction of Android smartphones based on Qualcomm Snapdragon processors with minimized power consumption and high-performing sensor capabilities through the use of hardware features integrated into the sensor. The reference software is already available to address the specific needs of OEMs creating new devices. While the agreement extends to all of ST's inertial modules and sensors, first efforts will focus on supporting ST's LSM6DS3 inertial module.

www.st.com
www.qualcomm.com

Arrays of tiny lasers could lead to terahertz security scanners

Researchers at MIT and Sandia National Laboratories recently described a new way to build terahertz lasers that could significantly reduce their power consumption and size, while also enabling them to emit tighter beams, a crucial requirement for most practical applications. The work also represents a fundamentally new approach to laser design, which could have ramifications for visible-light lasers as well.

The researchers created an array of 37 microfabricated lasers on a single chip. Its power requirements are so low because the radiation emitted by all of the lasers is phase locked.

In their paper published in Nature Photonics, the researchers identified four previous phase-locking techniques, but all have drawbacks at the microscale. Some require positioning photonic components so closely together that they'd be difficult to manufacture. Others require additional off-chip photonic components that would have to be precisely positioned relative to the lasers. By contrast, this technique uses a monolithic device, meaning all the microlasers are etched entirely from a single block of material.

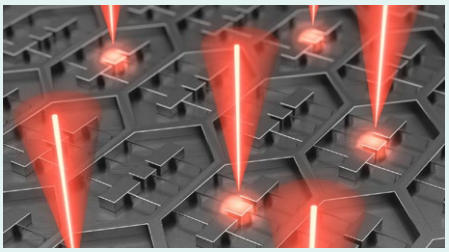


Image courtesy of the researchers at at MIT and Sandia National Laboratories.

"This whole work is inspired by antenna engineering technology," says Qing Hu, a distinguished professor of electrical engineering and computer science at MIT, whose group led the new work. We really were inspired by microwave-engineer technology in a very thoughtful way and achieved something that is totally conceptually new."

http://mit.edu

Keysight and NAR Labs partner on 5G R&D

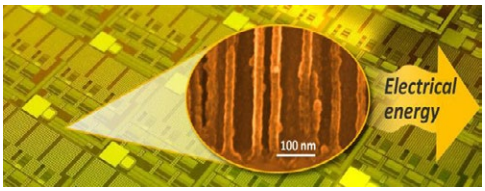
Keysight Technologies, Inc., and National Applied Research Laboratories (NAR Labs) have signed a memorandum of understanding (MOU) to establish a strategic partnership on research and development of 5G communication technologies. Both parties are committed to working together on the 5G enabling technologies as well as prototype verification and evaluations.

The partnership between Keysight and National Chip Implementation Center (CIC) of NAR Labs started with mmWave front-end circuit design technology. The collaboration will lead to the launch of the next generation of high-speed broadband mmWave wireless communications experimental networks. The system will include a Keysight PSG vector signal generator, 12 GSa/s arbitrary waveform generator and an Infiniium oscilloscope. The SystemVue 5G Baseband Verification Library from Keysight will accompany these world-class hardware systems.

www.keysight.com

Supercapacitor integrated inside a chip could power the IoT

A micro-supercapacitor, which can be integrated directly inside a silicon microcircuit chip, has been developed by the VTT Technical Research Centre of Finland as a tiny energy source fthat is ideal for integrated mobile devices and paves the way for zero-power autonomous devices required for the future Internet of Things (IoT).



The high energy and power density of the miniaturized energy storage relies on the new hybrid nanomaterial developed recently at VTT.

The energy and power density of a supercapacitor depends on the surface area and conductivity of the solid electrodes. VTT's research group has developed a hybrid nanomaterial electrode, which consists of porous silicon coated with a few nanometre thick titanium nitride layer by atomic layer deposition (ALD). This approach leads to a record large conductive surface in a small volume. Inclusion of ionic liquid in a micro channel formed in between two hybrid electrodes results in extremely small and efficient energy storage.

For the first time, silicon based micro-supercapacitor competes with the leading carbon and graphene based devices in power, energy and durability.

The demonstrated in-chip supercapacitor technology enables storing energy of as much as 0.2 joule and impressive power generation of 2-W on a one square centimetre silicon chip. At the same time it leaves the surface of the chip available for active integrated microcircuits and sensors.

www.vttresearch.com

LED communications could grab share of Wi-Fi market

According to Grand View Research's latest report, the global VLC/Li-Fi market could reach $101.30 billion by 2024, boosted by increasing concerns over cyber security.

The growing need of green technology systems with low power consumption is encouraging the development of advanced communication systems and visible light communication (VLC) is expected to grab a substantial portion of the Wi-Fi industry in the near future. However, the adoption is at the nascent stage and is currently being used for niche applications, due to which, an extensive R&D investment would help market players to obtain a competitive advantage, says the report.

High illumination, longer life and low power consumption of has led the implementation of LED as a component in Li Fi (Light Fidelity) systems. Government promotions for smart LED bulbs in developed countries such as the U.S., and the UK are expected to provide a massive infrastructure base to the VLC system providers.

Increasing applications of indoor location-based services embedded with light fixtures in retail shops and hotels is projected to be one of the factors driving revenue growth. Several companies are deploying VLC installations in supermarkets which in turn is aiding retailers to tie customers' shopping history by tracking their location details.

Advancements in the automotive industry are projected to enhance the safety of commuters. This is being executed through the vehicle to vehicle (V2V) and vehicle to the roadside (V2R) communication by installing LEDs in headlight and tail light of the vehicle.

www.grandviewresearch.com

Bluetooth 5 coming in 2017 will be much faster

The Bluetooth SIG (Special Interest Group) has announced that its next release, coming late 2016 to early 2017, will be called Bluetooth 5. It will quadruple range, double speed, and increase data broadcasting capacity by 800%.

The SIG says that the forthcoming version of Bluetooth technology will deliver "connectionless" IoT, advancing beacon and location-based capabilities in home, enterprise and industrial situations. Extending range will deliver robust, reliable Internet of Things (IoT) connections that make full-home and building and outdoor use cases a reality. Higher speeds will send data faster and optimise responsiveness. Increasing broadcast capacity will propel the next generation of "connectionless" services such as beacons and location-relevant information and navigation. The way Bluetooth devices transmit information will move away from the app-paired-to-device model to a connectionless IoT where there is less need to download an app or connect the app to a device.

www.bluetooth.org

Contactless and mobile payments to drive cashless society

Research by London & Partners raises the possibility of the UK becoming a cashless society within 20 years. The latest data from MasterCard shows that contactless spending has increased by 326% year-on-year in the UK.

Mobile payments systems such as Apple Pay are also offering customers a contactless payment system that is expected to grow rapidly in the near future.

A survey of more than 2,000 consumers shows that 68 per cent believe that cashless technologies will completely replace physical money by 2036. The figure is higher in London where three quarters of people said they thought cash would disappear within 20 years.

Last week the Bank of England announced that it will be launching a fintech accelerator programme that will work with technology companies to harness fintech innovations. Mark Carney, The Governor of the Bank of England also remarked that "Financial technology companies will change the nature of money, shake the foundations of central banking and deliver nothing less than a democratic revolution for all who use financial services"

Speaking at an event during London Technology Week on the growth of the capital's fintech sector, Gordon Innes CEO of London & Partners said: "London is the global leader for fintech. With the world's leading financial services centre and Europe's fastest growing technology hub, London's fintech companies are disrupting the current financial industry and changing the way we interact with money. As a result, they are attracting record levels of investment and world class talent. From peer-to-peer lending companies, such as Funding Circle and Zopa, to remittance companies, such as WorldRemit and TransferWise, London's fintech companies are pioneering the latest disruptive fintech innovations."

www.londonandpartners.com

FiberTower and PHAZR team up on mmWave 5G

Gigabit Wireless provider PHAZR and FiberTower have announced a partnership focused on 5G millimeter wave systems development. Pursuant to the agreement, FiberTower, the largest investor in PHAZR, will participate in the initial round of funding along with iTimeFund and other investors.

"The FiberTower investment will help PHAZR accelerate the deployment of their 5G technology for a Gigabit per second mobile and fixed access system utilizing mmWave bands between 24 GHz and 39 GHz," said Pulin Patel, PHAZR Board member from iTimeFund.

When available in 2017, PHAZR's 5G millimeter wave system will be the industry's first integrated, high-power, commercial, 5G millimeter wave antennas array. At peak rates the system is expected to deliver 16 Gbps throughput per cell over a 200 MHz channel block, which will be an industry-first.

www.phazr.net
www.fibertower.com

LimeSDR platform gets an app store

Lime Micro and Ubuntu are putting together an App Store for LimeSDR that will ensure the software defined radio (SDR) apps developed with the LimeSDR board are downloadable and those developed by Lime remain completely open-sourced.

Developers are already using the LimeSDR to develop apps with LTE, Bluetooth and LoRa, and future applications including IoT Gateway, 2G to 5G cellular Network in a box, drone command and control, utility meters, home automation and media streaming are anticipated by the team behind the LimeSDR.

The LimeSDR platform is a low cost application-enabled software defined radio (SDR) platform that can be programmed to support virtually any type of wireless standard. From Wi-Fi, ZigBee and Bluetooth through to cellular standards such as UMTS, LTE and GSM and to the emerging IoT communication protocols such as LoRa, the platform offers endless wireless connectivity opportunities.

www.limemicro.com

Report claims IoT to overtake mobile phones by 2018

The latest Ericsson Mobility Report claims that the Internet of Things (IoT) is set to overtake mobile phones as the largest category of connected device by 2018. According ot the report, between 2015 and 2021, the number of IoT connected devices is expected to grow 23 percent annually, of which cellular IoT is forecast to have the highest growth rate. Of the 28 billion total devices that will be connected by 2021, close to 16 billion will be IoT devices.

Western Europe will lead the way in adding IoT connections – the number of IoT devices in this market is projected to grow 400 percent by 2021. This will principally be driven by regulatory requirements, for example for intelligent utility meters, and a growing demand for connected cars including the EU e-call directive to be implemented in 2018.

Rima Qureshi, Senior Vice President & Chief Strategy Officer, Ericsson, says: "IoT is now accelerating as device costs fall and innovative applications emerge. From 2020, commercial deployment of 5G networks will provide additional capabilities that are critical for IoT, such as network slicing and the capacity to connect exponentially more devices than is possible today."

Two other highlights from the report are that smartphone subscriptions will surpass those for basic phones in Q3 this year and teenage use of cellular data for smartphone video grew 127 percent in just 15 months (2014-15).

By 2021, smartphone subscriptions will almost double from 3.4 billion to 6.3 billion. Also revealed in the report, there are now 5 billion mobile subscribers – unique users – in the world today, which is testament to the phenomenal growth of mobile technology in a relatively short period of time.

www.ericsson.com/mobility-report

LTE to drive RF power semiconductor market

In its latest report, market research firm MarketsandMarkets, expects the power semiconductor market to grow from USD 10.57 Billion in 2015 to USD 31.26 Billion by 2022, at a CAGR of 15.4% between 2016 and 2022.

The use of power amplifiers for LTE has increased with the growing demand for LTE. The transition to LTE requires a significant investment in the market as the core networks also need to change to meet the latest wireless standards. This would also drive the demand for RF power devices, which would boost the growth of the RF power semiconductor market. The increased use of smartphones is another major factor driving the growth of the RF power semiconductor market. APAC is expected to hold the largest market share and dominate the RF power semiconductor market between 2016 and 2022 due to the established electronics industry and adoption of innovative technologies.

www.marketsandmarkets.com

Payments through NFC to soar in 2016

According to market research firm Future Market Insights (FMI), mobile payment transaction volume will grow by a massive 42% to reach 26,923.7 million in 2016, up from 18,969.8 million in 2015. In terms of value, this will represent nearly US$ 768.78 billion, up from US$ 549.91 billion in 2015.

Mobile payments will continue to be strong in APEJ and Africa, as unlike US and Europe, a majority of consumers don't own a credit card, and are making a direct shift from cash to mobile payments. Growth will be particularly robust in China, where the entry of Apple and Samsung earlier this year has led to a renewed interest, sprucing up the already fiercely-competitive landscape.

While strong adoption in China will continue to boost the mobile payment market in Asia Pacific, making it the leading market globally in terms of volume, Africa will maintain its top position in terms of value. The tremendous success of M-Pesa in Kenya has influenced consumers and businesses in other African countries to adopt mobile money, leading to a rapid increase in the Africa mobile payment market. Africa currently accounts for nearly 32% revenue share of the global mobile money market, with a subscriber base of over 100 million. Outside of Asia Pacific and Africa, the U.S. and Western Europe remain the other lucrative regions for mobile payment transaction market globally.

By technology, SMS and WAP/WEB will continue to account for most of the transactions conducted worldwide. Mobile payments conducted through SMS will witness a year-on-year growth rate of over 28% and total US$ 385 Bn in revenues. Payments made through NFC, widely touted as the technology of the future, will witness the highest y-o-y growth rate, increasing at over 59% in 2016.

www.futuremarketinsights.com

How to right-size your wireless testing

By JFW Industries, www.jfwindustries.com

Whether mobile devices, Internet of Things, or industrial RF applications, the world runs on wireless.

As a result, wireless testing is more important than ever before. But how do you balance thoroughness, speed, and budgets? Quipping "pick any two of the three" isn't a good answer. Testing must be thorough, fast enough to keep up with getting to market, and yet within tight budgets.

Test engineers should adopt a right-sizing approach to manage trade-offs and find solutions that are the best fit for a particular situation.

SPEC OUT THE TEST REQUIREMENTS

Right-sized wireless testing starts with comparing and contrasting the two general types of wireless test systems: transceiver and handover. Transceiver testing means testing how radios directly communicate with one another. In handover testing, you test how antennas or access points perform with radios, which generally are called handsets.

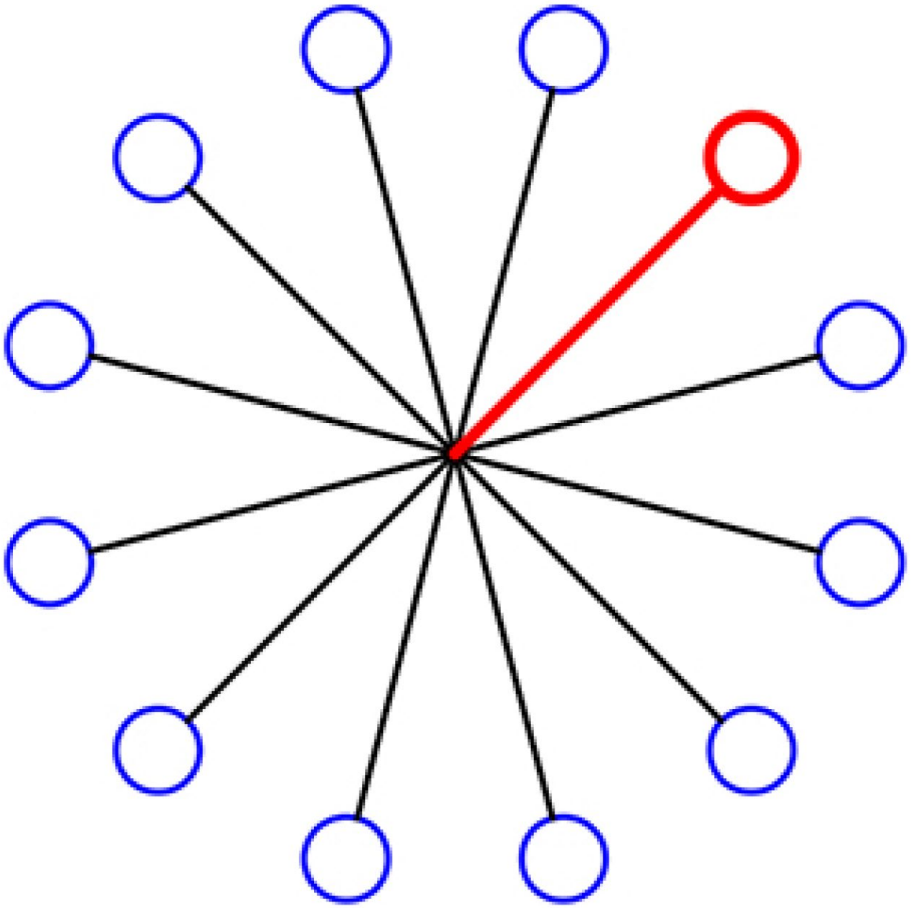
Whether looking at transceiver or handover testing, testing gear has the following considerations:

- Ports connect devices to the test system.
- Internal RF components attenuate, divide, or combine signals.
- Attenuators may be remotely programmable or manual.
- Systems work over specific frequency ranges.
- Configurations establish paths of communications among devices.

The ports, attenuators and divider/combiners, frequency ranges, and internal configurations are where tradeoffs will happen that affect overall testing speed, thoroughness, and cost.

MAKING CHOICES

In a perfect world, you would have the most flexible test system available. It would connect any set of radios or collection of handsets and antennas that you wanted to test. Every path between two devices would have a programmable attenuator to separately adjust the signal strength between the devices and include the ability to adjust signal strength over time to simulate signal fading.



The example diagram shown is a 12 port hub fan-out configuration. All ports are connected via a resistive power divider/combiner with a star configuration. There are a total of 12 programmable attenuators.

However, as the numbers of ports, potential paths, and RF components increase, so does the expense. Additional components expand the amount of rack space necessary for housing. They also put greater demands on power and heat dissipation.

If you reduce the number of components in the test system; size, power, and cooling demands decrease, as does cost. The price you pay is a loss of testing flexibility. Some test configurations may be impossible to model. Other scenarios could take longer as decreased flexibility necessitates more testing iterations to cover individual cases and more time in the schedule to accommodate additional setup and stages of testing.

In handover testing, an additional source that can balance flexibility, time, and savings is the use of manual attenuators. They are less expensive than programmable ones because they lack the circuitry for remote programming. Instead, an engineer sets them through knobs on the front of the attenuators. The manual action increases the time for configuration and cannot accommodate all testing scenarios, like fading the dB setting over time to simulate signal fading.

Even input power specifications can pressure a budget. Test equipment frequently accepts limited antenna or access point power input, like 1 W, versus a typical commercial 40 W device, because of the power dissipation characteristics of the equipment components. Adding a dedicated attenuator instead of running tests at full power is far less costly than upgrading the test system's components.

Although not strictly a trade-off, the use of technically neutral language can broaden your options in searching for appropriate test equipment. The frequencies used by LTE wireless differ by country, for example. Specify actual frequency ranges. Companies vary in how they refer to frequency ranges. Some specify everything in megahertz; others quote gigahertz. Look for the appropriate values under each to be sure you don't shortchange your search.

WHAT ARE YOUR NEEDS TOMORROW?

Trade-offs affect the future as well. Test engineers cannot only consider today's needs, because test devices usually aren't reconfigurable. If you buy a unit that works for a current project, next year may bring another design that has more expansive requirements and will need a separate test system. And yet, that second unit likely could have covered the current test cases, so overly narrow economics can also be self-defeating.

In some cases, the additional expense of greater coverage might be negligible. For example, if you want to test transceivers in the frequency range of 900 MHz to 2 GHz, a customized test system might cost virtually the same as one that would cover 698 MHz to 3 GHz because the latter could use more standard parts, gaining off-the-shelf cost efficiencies.

Consider the amount of attenuation you will need on connections. There are typical ranges, such as from 0 dB to 95 dB in 1 dB steps up to 6,000 MHz, or 0 dB to 127 dB in 1 dB steps up to 3,000 MHz. The more you can contain your testing attenuation needs into typical ranges, the more likely the test system will use less expensive standard components.

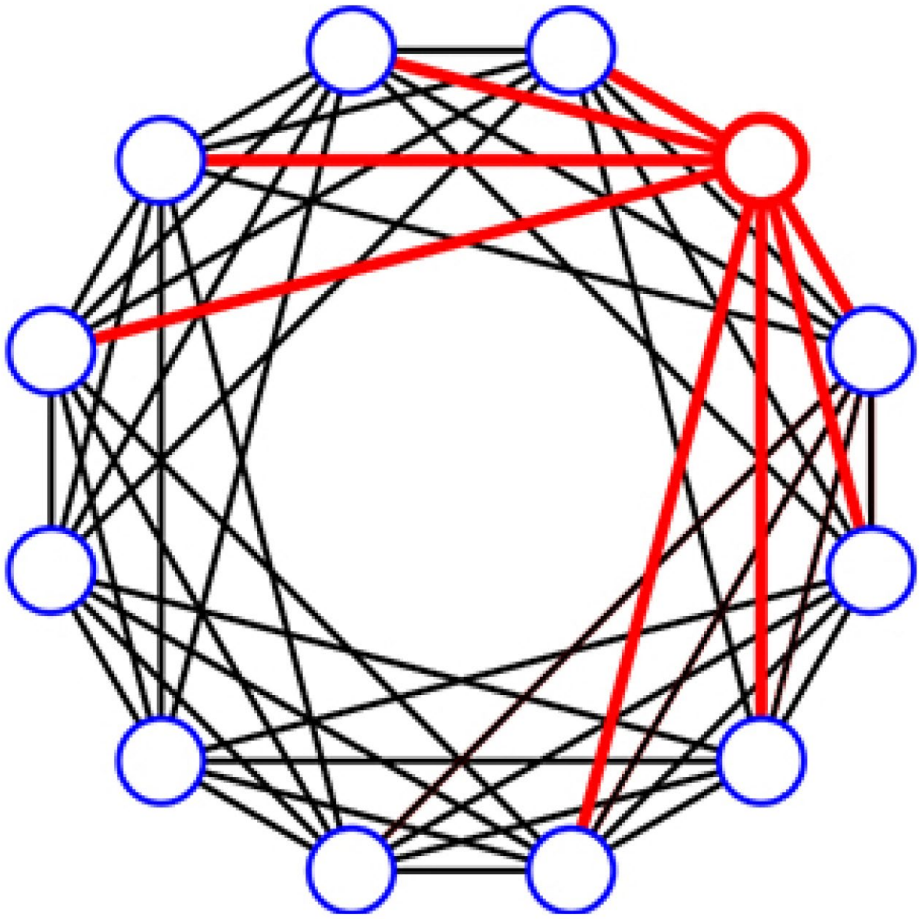
TRANSCEIVER TESTING

Each port in transceiver test equipment will represent one RF signal for one of the radios being tested. Each antenna, with radios often in a shielded enclosure to control the testing environment, is connected to the port through a cable.

There are three types of configurations you may find in transceiver test equipment:

- Full fan-out;
- Limited fan-out;
- Hub fan-out.

Full fan-out is the most flexible because it offers a fully meshed matrix. It is also the most expensive because it requires the most RF components. In a full fan-out configuration, there is an attenuator for each possible path between radio pairs. If you have 12 ports, there are (12 x 11)/2, or 66, possible two-way paths, each requiring a programmable attenuator. With 6 ports, there are (6 x 5)/2, or 15, possible paths, and, so, 15 programmable attenuators.



The example diagram shows a 12 port LC8 design. Each port is connected to only its 8 closest neighboring ports (4 upper neighboring ports & 4 lower neighboring ports). This design requires only 48 programmable attenuators.

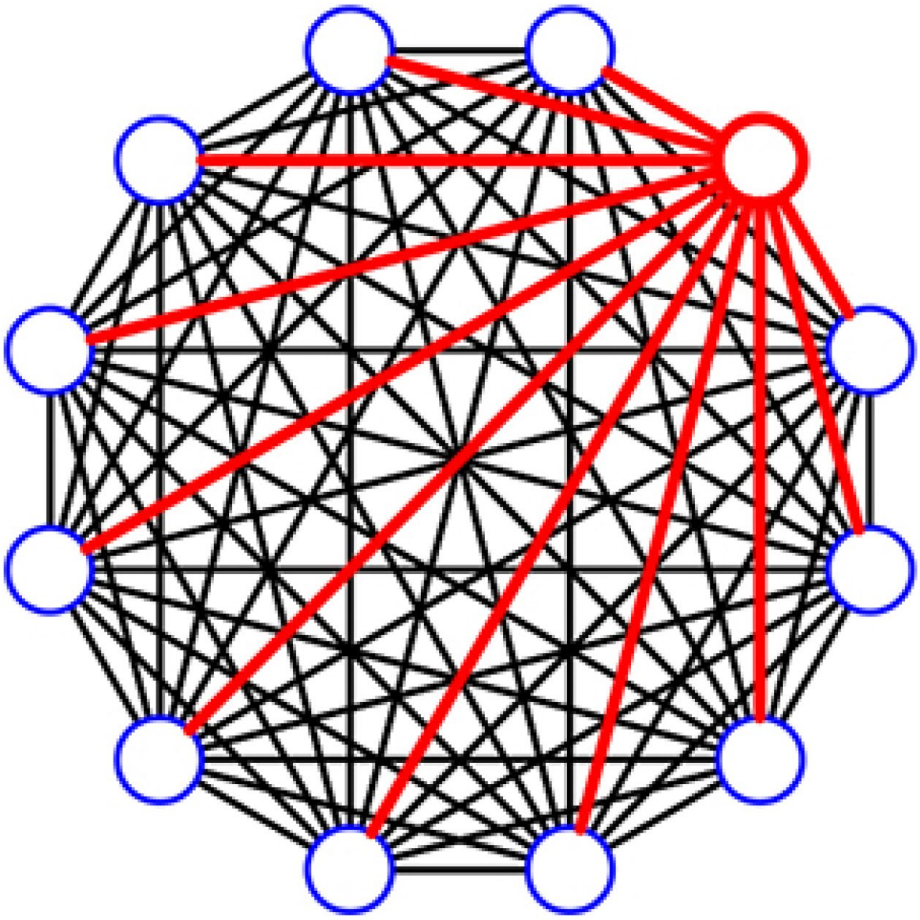
In a limited fan-out, each port connects to a specific subset of other ports to either side. If you take a 12 port box and have an 8 limited fan-out design, each of the 12 ports will connect to the four immediately above it and the four immediately below. That would reduce the number of paths needing attenuators to 48. The more ports, the more economically attractive a limited fan-out design can be. A 36-port full fan-out box would need 630 programmable attenuators. Switch to a 36- port 12 limited fan design and the number of programmable attenuators you need is now only 216, a savings of about two-thirds. A limited fan-out can work, if in real-world use, the radios would be spread out geographically far enough so that not all would directly communicate.

The hub fan-out is the simplest design, using a hub and spoke topology. There is only one programmable attenuator per port. But you sacrifice flexibility. Each radio communicates to every other radio through the test system at the same time.

When you set the attenuator on one port, you've now limited its transmission to every other port, rather than independently setting the attenuation for each possible pair of communicating devices. You can still program a specific amount of attenuation between any one pair of radios, but you lose flexible control over the attenuation on all other possible paths.

HANDOVER TESTING

In handover testing, there are two types of ports: input and output. Input ports represent antennas: base stations, access points, cell towers, or some other type of connection to the communications network. Output ports represent handsets or mobile devices. The terms "input" and "output" in this case are naming conventions, as all paths for a



The example diagram above is a 12 port full fan-out configuration. This 12 port design will have a total of 66 programmable attenuators.

handover test system operate bi-directionally. There are three types of handover configurations:

- Full fan-out;
- Limited fan-out;
- Manual handover.

As with a transceiver test system, a full fan-out handover system means all inputs can talk to all outputs. Each input port is connected to an RF divider/combiner to split the signal into multiple paths corresponding to the number of output ports. Each path has an attenuator. Then each path enters a divider/combiner for the associated output port. To find the number of paths in a full fan-out handover system, multiply the number of input ports by the number of output ports. An 8x4 system would have a 1x4 divider/combiner and 4 attenuators for each input port and a 1x8 divider/combiner for each output. That makes 32 attenuators and 12 total divider/combiners.

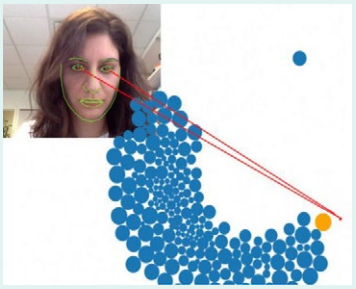
In a limited fan-out, each input has an attenuator, so the same signal strength reaches all the antennas. All the inputs lead into a single divider/combiner, which in turn leads to another divider/combiner connected to the outputs. For the 8x4 configuration, there are only 8 attenuators and 2 divider/combiners. The number of components is far smaller, but you can't independently adjust attenuation for each path from a handset to an antenna.

Manual handover systems also use a limited fan-out configuration. The difference between manual and programmable limited fan-out is that, in a manual system, manual rotary attenuators replace programmable ones. Manual handover systems are the simplest and least expensive type and are usually employed in early R&D.

FIND THE RIGHT SIZE

Options are great to have. They also complicate the process of making decisions. No one can tell you what is best for your specific needs because no one else has to balance your schedule, complexity, and budget. However, chances are you can find the right type of testing equipment to meet your specific needs.

Open source algorithm converts webcams into eye-trackers



Computer scientists at Brown University (Providence, Rhode Island) have developed open-source software that identifies the eyes and tracks the gaze of subjects on webcams.

This is a software-only solution that can determine what parts of web page are catching the user's eye and could therefore provide developers with the ability to optimize applications for users or to create additional features within games for example.

Conventionally eye-tracking devices require specialized hardware and therefore can be expensive as well as requiring the head to be in a relatively fixed position a certain distance from the monitor. A software-only solution therefore eliminates cost and could open up applications especially as video cameras are present in computers and mobile phones.

The software, called WebGazer.js, is written in javascipt and can be included in any web browser with only a few lines of code and can perform eye-tracking immediately with an average error of just a 100 pixels.

The software runs on the user's browser and the user's permission is required to access the webcam but no video is shared. Only the location of the user's gaze is reported back to the website and this can be done in real time.

http://webgazer.cs.brown.edu

Over-the-Air testing is vital if MIMO is to deliver good QoE – The smaller they get, the more gets packed into them…

By David Garrison, Senior Director, Wireless, Spirent

Mobile devices and networks are growing ever more complex, not only in terms of features but also in the underlying technologies needed to support those features – technologies such as MIMO (Multi-Input Multi-Output) that require each tiny handset to contain not one but multiple radio antennas.

The more complex the product and service, the more important it is to test every aspect of network performance and the resultant user experience. In response, operators and manufacturers have collaborated with testers to develop a methodology that fully and consistently evaluates baseband modem performance and antenna design for MIMO operation.

The CTIA - The Wireless Association has recently published a testing standard (Test Plan for 2x2 Downlink MIMO and Transmit Diversity Over-the-Air Performance, Version 1.0) to gauge the Over-the-Air (OTA) performance level of handsets that employ MIMO antennas.

NOT ALL MOBILE DEVICES ARE CREATED EQUAL

How important is this standard and test procedure? Do devices really show much variation in performance?

To explore the scale of MIMO device performance variances, Signals Research Group has published the results of a study evaluating fifteen commercial mobile MIMO devices across two different OTA labs (Chips and Salsa XX: When Iconic Meets Anechoic, Part II published in Signals Ahead, October 2015). It revealed significant performance differences that would have a noticeable effect on user experience. These include: triple-digit differences in data rates, universal under-performance in at least one frequency band, and a minimal relationship between handset price and reception quality.

This study confirmed the importance of OTA testing in evaluating MIMO device performance. Performance issues in the antenna design will translate into reduced Quality of Experience (QoE), including poor reception, slow downloads, and subpar application performance. For operators, poor QoE becomes a major cause of customer churn, and it forces investment in network infrastructure to compensate for the low quality and reduced capacity.

WHY OVER-THE-AIR?

Laboratory simulation of "real world" conditions has become very sophisticated, and it is easy to replicate and control tests over cable connections, bypassing antennas. But with MIMO devices, throughput depends so critically on antenna performance in realistic propagation environments, and these cannot be simulated accurately with such conducted testing.

Single-Input Single-Output (SISO) allows for greater separation of baseband and antenna testing because modem performance is not coupled to antenna performance – other than differences in receiver input levels due to antenna performance. Conversely, in MIMO the two are co-dependent: antenna performance not only affects the signal levels presented to the receivers, but also the correlation between the two (or more) receivers. MIMO performance is a function of Signal-to-Interference-plus-Noise-Ratio (SINR) and antenna correlation. How the device sees the wireless environment through the antennas can greatly affect modem performance – environmental conditions will make it harder or easier to decode the different data streams.

MIMO testing over-the-air creates a unique spatial signature that replicates realistic propagation scenarios but in a controlled, repeatable environment.

MAKING IT REALISTIC

MIMO performance is a function of the wireless channel and the antennas, so testing must combine such characteristics as:

- Antenna gain or efficiency;
- Branch imbalance;
- Dual polarized channel conditions to replicate the handset environment;
- Correlation between antennas.

Thanks to the highly controlled environment specified by the CTIA, MIMO OTA radiated antenna testing is currently the best approximation to real world conditions. It includes the use of an anechoic chamber, enabling spatial channels with the correct field structure so the device under test can observe the realistic expected channel during the test.

The correct field structure is replicated in the anechoic chamber using a special channel emulator and by mapping the signal levels across the probes in the chamber.

INTRODUCING THE CTIA MIMO OTA TEST PLAN VERSION 1.0

An official CTIA MIMO OTA test must be conducted in an anechoic chamber with 8 dual- polarized probes. The lab validation tests must include ripple test, range calibration, and Signal-to-Interference Ratio (SIR) validation, to ensure the quality of the chamber setup and that evaluation is conducted at the correct power levels without extraneous signal interference. Definitions of measurement uncertainty elements are provided, and an overall measurement uncertainty limit is defined.

All the channel model validation procedures are defined for key items such as: Power Delay Profile (PDP), Doppler/temporal correlation, and spatial correlation. Finally, cross polarization is examined to check if the signal arrives at the device in a way which verifies that the amount of signal, in both vertical and horizontal polarization, is in accordance with the expected model. These channel model validation tests are typically performed by the system provider.

Testing can only take place once the setup has been shown to meet CTIA standards. Performance is measured in terms of MIMO Average Radiated SIR Sensitivity (MARSS). Average SIR over a set of orientations within the test environment provides a more representative assessment of user experience. CTIA also provides reporting templates to ensure that test results are presented in a consistent format.

Further detail on the OTA test procedure is available in a Spirent White Paper Ensuring MIMO Device Performance with Over-the-Air Testing.

THE AUTHORISATION PROCESS

So far, CTIA has published the Laboratory Assessment and Validation Requirements Document V1.1, which defines authorisation steps for system vendors and test labs and provides a template for reporting measurement uncertainty results.

The next step is to authorise the test system providers. This requires the on-site participation of a Subject Matter Expert (SME) and documents confirming compliance, including: data for MIMO OTA system validation results, a system configuration description, and example test data. System providers must also show baseline parameter file setups that have been verified for test plan compliance. When these steps are complete, validated configurations for hardware and software can be published as "authorised by the CTIA".

Each test lab must also be authorised. Labs must first be accredited to ISO 17025 and have been previously authorised by the CTIA for SISO OTA testing using the same chamber. Labs must submit work instructions, test setup information for previously authorised equipment (identified above), sample test reports, and a measurement uncertainty test report for SME review. Once approved, the lab becomes a CTIA Authorized Test Lab (CATL) for MIMO OTA.

Once a critical mass of CATLs has been established, V1.0 will become mandatory for CTIA and PTCRB certification.

CONCLUSION

Examining MIMO antenna performance in realistic propagation environments gives an accurate view of the user experience and helps operators ensure good QoE. V1.0 of the CTIA MIMO OTA Test Plan defines standards for MIMO OTA testing, with upcoming releases already in the works.

Spatial channel emulation is an essential part of MIMO OTA testing and, as wireless networks advance toward 5G, the demands of device testing will become increasingly complex, requiring future-proof test solutions capable of scaling to support ever-higher channel density applications.

The good news is that suitable robust channel emulation solutions are already available. These already support the CTIA MIMO OTA Test Plan v1.0 and they are being continually developed to meet the most stringent conditions of future CTIA test plan versions.

ABOUT THE AUTHOR

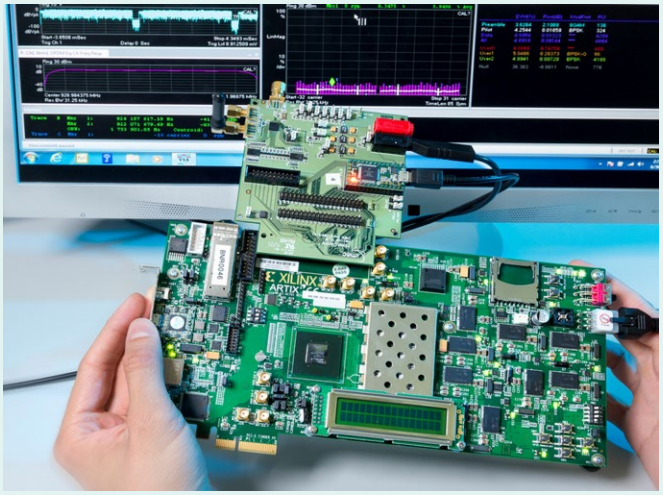
Senior Director of Spirent's Wireless Business unit, David Garrison, leads the RF Channel Emulation Products team. This team has ownership for the product marketing and product development of all RF channel emulation products. In addition, Dave leads developing new business opportunities for RF channel emulation in evolving communications markets including 5G and the Internet of Things (IoT).

Complete low-power Wi-Fi HaLow radio for IoT

Nanoelectronics research center imec, Holst Centre (initiated by imec and TNO), and Wi-Fi IP provider Methods-2Bussiness have presented a complete Wi-Fi HaLow™ radio. The low-power, long-range radio solution uses 10 times less power than state-of-the-art orthogonal frequency division multiplexing (OFDM) radios on the market.

The Wi-Fi HaLow™ radio can be used for a broad range of applications related to the Internet of Things (IoT) and complies with the most recent wireless networking protocol, IEEE 802.11ah.

The radio's compliance with the recently amended wireless networking protocol ensures that it is especially optimized for IoT-related applications. The Wi-Fi Alliance® recently introduced the HaLow™ designation for the new low-power, long-range Wi-Fi protocol IEEE802.11ah. Compared to other IoT standards, its sub-GHz carrier frequency and mandatory modes with 1-MHz/2-MHz channel bandwidths allow devices to operate over a longer range with scalable data rates from 150 kb/s to 7.8 Mb/s. The standard uses OFDM to improve the link robustness against fading, which is important in urban environments, and to achieve a high spectral efficiency (data rate over a given bandwidth).



The radio integrates a sub-1GHz IEEE 802.11ah transceiver from imec and Holst Centre, and a Medium Access Controller (MAC) hardware and software IP and application layer from Methods2Business to enable 802.11ah communication between large numbers of IoT clients and the internet using a central access point. The transceiver comprises a complete low-power physical layer implementation of RF front-end and digital baseband. It features a 1.3nJ/b fully digital polar transmitter optimized for IoT applications as well as for the novel IEEE 802.11ah Wi-Fi protocol. The transmitter surpasses the tight spectral mask and error-vector-magnitude (EVM) requirements of conventional Wi-Fi standards. It does so while demonstrating a power consumption rate as low as 7.1mW in Tx mode for 0 dBm output power.

Methods2Business 802.11ah MAC core implements all the new Wi-Fi HaLow™ functionality to address the drawbacks of traditional Wi-Fi in IoT. Besides mandatory features for connecting up to 8.000 IoT clients (Hierarchical AID), improving collision avoidance in channel access mechanisms (CSMA/CA, DCF, EDCA), and increasing throughput by supporting shorter MAC headers, very advanced power saving modes like Target Wake Time (TWT) and Restricted Access Window (RAW) are also supported. To further trade-off power versus performance, time-critical functions are implemented in hardware while higher level MAC protocols are realized in software.

www.imec.be
www.holstcentre.com

Interference testing on CPRI links at wireless cell sites

By Cyril Noger, Anritsu

INTRODUCTION

A key economic aim for wireless network operators is to reduce the amount of money spent in deploying the network in the field while maximising the cell coverage and ensuring better quality of service despite the impact of interference on the quality of reception.

Today's wireless communication systems are sensitive to interference, especially with LTE when this occurs at the centre of the channel spectrum, and engineers need to locate and isolate any problems and visualise the cause of the interference in order to deal with it. From the operators' point of view, interference can create dropped calls, shrink the cell coverage, decrease the data rate (by increasing the bit error rate) and reduce the quality of service between the mobile phones and the network. These problems cost the operators money as they lose subscribers.

A major change occurred in wireless communication systems with the adoption of centralised radio access networks (C-RAN) by the industry as a contribution to cost reduction. With the use of C-RAN, the new architecture of the mobile front-haul connection is configured with centralised baseband units (BBUs) controlling multiple, distributed remote radio head (RRH) units at antenna sites (Figure1). The RRHs sit on top of the antenna towers, whereas the BBUs are at ground level.

In the past, the BBUs and the RRHs were connected together via coaxial cables that were sensitive to effects such as power losses, aging, corrosion and intermodulation. To prevent most of these effects, a new common standard, CPRI (Common Public Radio Interface), has been adopted by most network infrastructure vendors, using optical fibres rather than coaxial cables. Operators also use optical fibre to reduce the costs of installation and maintenance of each cell site.

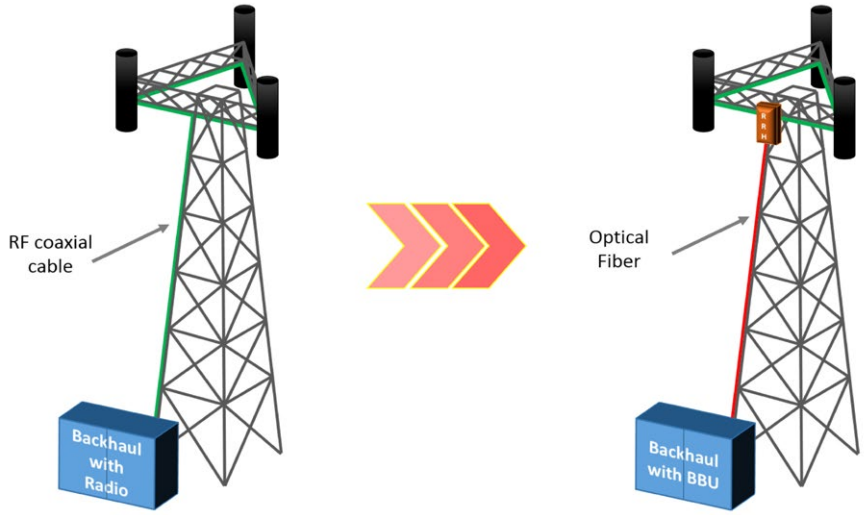


Figure 1: Evolution of cell site architecture from conventional design with coaxial cable to distributed antenna system with optical fibre.

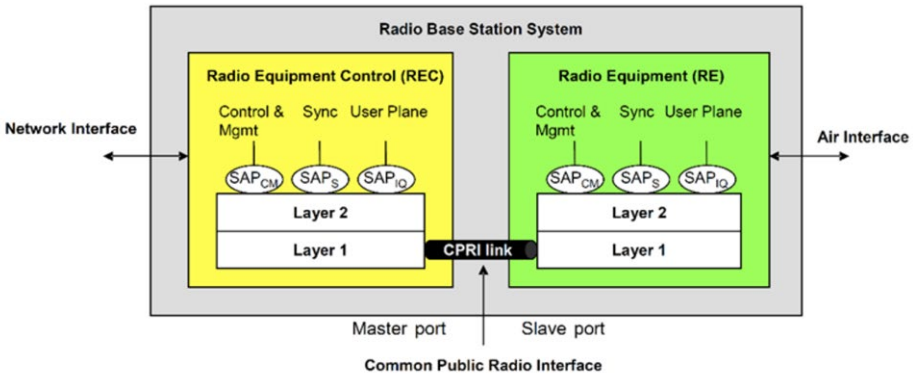


Figure 2: The CPRI standard defines the connection of the BBU and the RRH with protocol layers between them.

This article focuses on the new challenges involved in making CPRI measurements in the field.

MEASUREMENT TOOLS

With CPRI links, it now becomes possible, with appropriate handheld measurement tools, to perform accurate and fast analysis for troubleshooting the radio network by decoding the CPRI link between the RRH and the BBU without the need to climb the tower.

Essentially, CPRI technology converts radio frequency signals from the electrical to the optical domain. This is what the RRH does on top of the tower when it receives the RF signals (for instance W-CDMA for 3G or LTE for 4G technologies) and converts them to optical signals (using CPRI protocol) before they are sent down to the BBU at ground level. The BBU then converts the information from optical to electrical signals to deal with the network at the backhaul stage.

Unfortunately, even though optical fibres are less sensitive to external spurious distortion or interference effects, they do not eliminate the problems that occur if the data coming from the antenna are corrupted by added noise on top of the signal, or if there are any

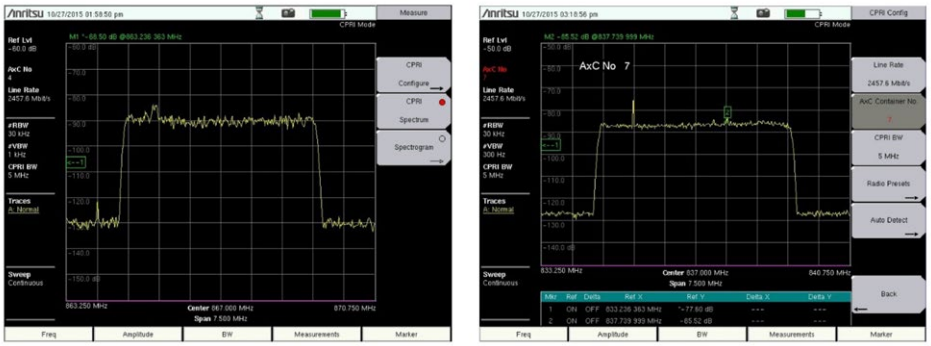


Figure 3: Representation of a LTE 10 MHz bandwidth transmission without and with an interferer in the UL band.

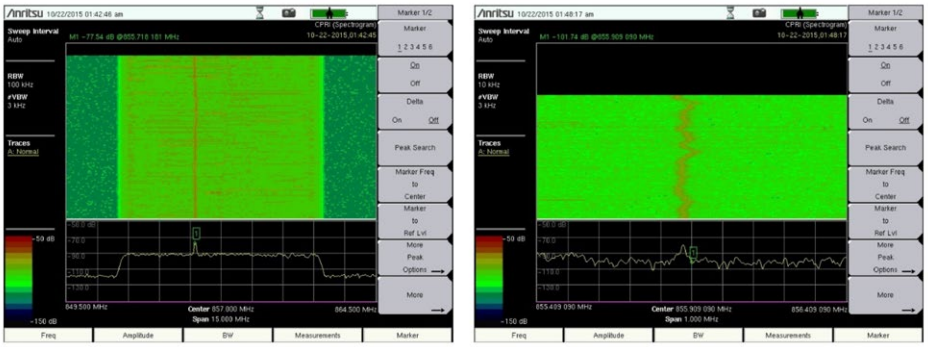


Figure 4: Spectrogram of a LTE 10 MHz channel without and with a zooming capability highlighting an interferer's behaviour.

extra unwanted frequencies inside the signal band itself. External interference still arrives from the antenna to the BBU via the RRH and the optical link.

Analysing the CPRI link in the field with a handheld instrument requires the RF IQ data transmitted from the RRH to the BBU (uplink channel) and from the BBU to the RRH (downlink channel) to be decoded. This then gives access to the representation of the RF channel spectrum being carried in the optical fibre. Looking mainly at the uplink, technicians can more easily understand the kind of disturbance affecting the network that prevents mobile phones from connecting normally to the base stations in the field.

As CPRI is a well-defined standard adopted by almost all the big infrastructure vendors, implementing a CPRI board into a handheld analyser allows users to decode and analyse the two main layers of the standard to troubleshoot alarms and errors in addition to looking at the physical transport of the data.

Figure 2 illustrates the link between the radio equipment and the radio equipment control. The "network interface" is connected to the backhaul and the "air interface" is connected to the antennas, as specified in the CPRI specification v6.0 (2013-08-30).

The radio equipment control (located in a conveniently accessible site) contains the radio functions of the digital baseband domain, whereas the radio equipment itself (close to the antenna) contains the analogue RF functions.

The basic principle of a CPRI handheld analyser is that it captures a small amount of the optical signal power while the RRH is still communicating with the BBU and mobiles are still connected to the live network. To achieve this, it is necessary to use an optical tap (coupler) to insert the CPRI tester between the RRH and the BBU. For example, the Anritsu MT8220T BTS Master™ can embed a CPRI board as an option to allow the field technicians to carry out diagnostics of the kind of spectrum the BBU is getting from the antenna via the RRH and optical fibre.

Most radio technicians worldwide will be familiar with RF spectrum measurements using the widely used MT8220T BTS Master, and because the man-machine interface for CPRI spectrum measurement is very similar to that for standard RF spectrum measurements they can intuitively understand what is happening on the optical link.

The user plan for the CPRI standard defines one other important parameter, which is the antenna carrier (normally designated AxC). This parameter contains the IQ data necessary for either reception or transmission of only one carrier at one independent antenna element, and has to be known by the users in order to select the right antenna to analyse the CPRI signal from the ground level.

SPECTROGRAM DISPLAY

As previously mentioned, looking at the spectrum shape of an RF signal often allows the user to quickly diagnose if everything is correct. This is illustrated in Figure 3, which sows two screen shots showing one "normal" RF CPRI spectrum plot and another one with an interferer located inside the channel itself.

In addition, having the ability to observe the behaviour of the interferer over time using the spectrogram display allows the technician to better emphasise the frequency and amplitude stability of the interfering signal. By colour coding the amplitude level, it becomes easy to see at a glance what occurs in the chosen frequency carrier and channel band (Figure 4).

Once the interferer has been seen from the ground level and the frequency identified by using markers on the plot, the technician can then use a conventional RF spectrum analyser to hunt for the interferer's location on the basis that its amplitude will become higher closer to the source. However, as interferers may occur randomly, it is not always easy or fast to locate them in dense environments. In this case, it may sometimes be useful to drive to a neighbouring site to determine if this new site gets more disturbed by the same interferer or not.

CONCLUSION

Mobile phone subscribers all expect good Quality of Service from their cellular network operator including the ability to connect anytime, anywhere. Having deployed CPRI technology in the field, network operators need to work hard to prevent any network communication drops or failures caused by interference within the system. CPRI testing is therefore becoming more and more important, and the latest handheld instruments offer new ways of investigating interference problems and showing the test results.

Achieving voice service parity for VoLTE subscribers

By Jonathan Bell, VP Marketing, OpenCloud

Mobile operators across the globe are transforming their networks to offer VoLTE services. Delivering VoLTE gives them the opportunity to improve the customer experience by offering superior voice and video quality, faster set-up times and enhanced voice services, as well as delivering network spectrum efficiencies. However, for operators to deliver these benefits requires a smooth transition of the services in the circuit switch network to the IP Multimedia Subsystem (IMS) network. Jonathan Bell, VP Marketing at OpenCloud, discusses how an evolutionary transformation of the service layer is required for operators to transition to VoLTE with no negative effect on the subscriber.

In a traditional circuit switched network used to deliver 2G and 3G services, the switch provides a lot of the basic call handling functionality such as call forwarding and call barring. Over the years, most new services and additional functionality have been added to the circuit switched network. They have been developed on additional Intelligent Network (IN) platforms rather than by making changes to the switch. The IN platform has enabled operators to create value-added services which complement their existing core telephony and communication service offerings. These are services that businesses and consumers worldwide often take for granted as the basic fabric of the network itself, such as voicemail, number translation, least-cost routing and mobile roaming. Most importantly, operators have developed premium revenue generating business services for the enterprise market. There are countless variations of such service implementations and most operators have fifty to a hundred different services being used and valued by enterprises and consumers alike.

In the IMS network, the 'switch' is just a router and does not provide any of the call handling capabilities that are provided by a circuit switched telephony switch. The Multimedia Telephony Telecom Application Server (MMTel TAS) provides the equivalent call handling on the IMS network. The GSMA IR.92 VoLTE standard specifies the set of basic call handling capabilities required of an MMTel TAS. IR.92.However, the standard does not address any of the additional functionality that has been added to all legacy networks on IN platforms and is still being used to deliver services today.

Operators will be running circuit switched and IP networks concurrently for many years as they roll-out network coverage, providing service to users that are happy with their current mobile device and to support roamers. During this period, operators are faced with the challenge of delivering a common and consistent set of value-added services across both networks (commonly referred to as achieving "service parity"). A user's device will latch on to a 2G, 3G or 4G network depending on the prevailing coverage, and they will expect the same customer experience in terms of service availability and operation. Most industry analysts agree users will be using a variety of networks for at least the next three years in the UK despite it being a relatively developed LTE market.

Service parity must be achieved and one way of accomplishing this is to systematically re-implement all of the services on the legacy network again on the IMS network. However, this approach will take a lot of time and is not feasible for those operators under pressure to rapidly bring their VoLTE services to market in a race against their competitors. Whilst operators will want to re-implement most of these services in due course, an urgent and enforced timetable is extremely costly. Re-implementation of their services – either as fully convergent services or for IMS only – all prior to any significant subscriber migration to IMS is a significant impediment to network transformation and the promised re-farming of spectrum.

However, there is another approach that some operators are employing that makes it easier and less expensive to deliver service parity. As a precursor, some operators are choosing to transform their service layer to enable IMS users to use the services in the circuit switch network. Operators can use an IMS service switching function (IM-SSF) between the IMS core and the legacy network. This enables them to re-use the call handling intelligence that already exists in the legacy switch IN infrastructure where needed and deliver a consistent customer user experience. The reverse capability can also be used, so that new IMS services, as they become available, can be made available to legacy network users. The result is that operators can re-use their legacy services and enrich and enhance basic VoLTE at a pace of their choosing without impacting the migration of subscribers to VoLTE and IMS.

The spectrum efficiency benefits together with the superior call quality and set-up times of VoLTE make it an attractive proposition for users and operators alike. Without service parity with their existing service offerings, there is a serious impediment to subscriber migration to the IP network. Operators must look beyond the IR.92 standard for VoLTE and deploy technology that gives them the ability to offer subscribers a smooth, consistent experience. Subsequently any future changes to switching or other service requirements on the IMS network can be easily accommodated, maximising efficiency and value for operators.

ABOUT THE AUTHOR

"Jonathan Bell, VP Marketing at OpenCloud, has worked in VC-funded software product companies in the telecommunications industry for more than 35 years. Jonathan was a founder and member of the executive team at Geneva Technology, a VC-funded telecoms billing start-up company from 1995-2002. He was responsible for the original conception and design of the company's convergent real-time billing system. Bell continued as VP product strategy for Convergys post Geneva's acquisition in 2001."

Design Decision: MCU, MPU, FPGA or System-on-Module?

By Helmut Plötz, Business Development Manager – Central Europe, Arrow Electronics

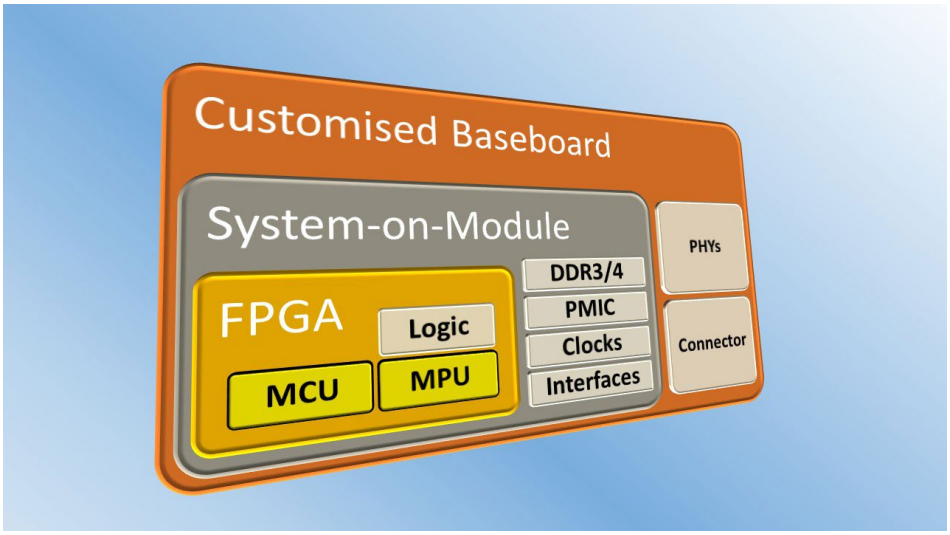
Today's clients are very familiar with the performance categories of MCU/MPUs and their capabilities. However, the requirements for new products are becoming more and more demanding, bringing the question of whether a client should use an FPGA further to the forefront. Helmut Plötz, Business Development Partner at Arrow Electronics, explains the criteria that must be included in the decision-making process.

Important decisions are often already made in the first bidding phase of projects, e.g., the processor platform stage, which can later influence the entire course of development and in the end can also decide success or failure.

That is why it is enormously important to understand project requirements very well from the outset, in order to reach an assessment as to whether all the points can be realised in a standard MCU/MPU or whether a different path must be taken. If the answer with regard to the MCU/MPU is yes, then it is neither commercially nor technically sensible to use an FPGA. However this option becomes interesting as soon as a special requirement is added to the application; this includes high data throughput, PCIe, real time requirements, industrial Ethernet, proprietary or the latest protocols, Gbit transmission, DSP functionalities, functional safety, security or similar that also simultaneously answers the core question in this article: FPGA - yes or no?

Now there are two possibilities, a solution with two or several chips with a standard MCU/MPU plus an FPGA/ASIC for the specific requirement, or single chip use, whereby the entire application is realised in the FPGA.

Version one surely has the advantage that it is often possible to fall back on existing programme code for current projects on the MCU/MPU and one can then concentrate separately on the function that needs to be realised in the FPGAs. However, it can become a challenge to determine the interface used to transfer the data from the FPGA to the processor and whether the processor is even capable of e.g., processing high quantities of data or real time demands. Often it is only through this processor that the processor systems are used to their maximum capacity, or multi-core processors are used, which of course do not make the system more trivial. There are also further challenges from a hardware point of view for the memory connection, the power supply, the circuit board and the general expense of the system.



If we look at the second version we first need to decide whether one MCU (e.g., ARM Cortex-M) is sufficient or if an MPU with an operating system is necessary (e.g., CortexA). It is relatively easy today to implement an MCU in the form of a softcore in an FPGA (NIOS II by Altera being a good example). For the softcore the architecture of a micro-controller is replicated in logic and then embedded in the FPGA. Thus the controller can be programmed as usual using C or other languages. This makes it very easy to realise the standard functionality of an MCU in an FPGA and one also has full flexibility with a softcore for new projects as the periphery of the micro-controller (memory / interfaces / IOs) can be combined individually, e.g., 8x CAN-Bus or 12x SPI are easier to realise and can be adjusted upwards or downwards at any time.

If an MPU is required then the FPGA manufacturers offer combined modules comprising an FPGA and a silicon processor, typically ARM CortexA9, which is termed a system-on-chip (also see Altera Cyclone5 SoC). These are available in different FPGA logic sizes and are currently available as standard as single/dual Core CortexA9, enabling the realisation of a flexible and cost-optimised design. The advantages of this are the single chip design and the internal connection between the FPGA and the CortexA9 that is already hard-wired for fast and simple data transfer. The corresponding evaluation boards are available for these systems with software, for example the Arrow SoCKit or system-on-modules (SOM), suitable for series production, by Exor/Shiratech/Novtech and based on Cyclone5 SoC. This allows the customer fast entry using pre-fabricated projects.

The design is certainly very complex, whether we look at the separate MPU/FPGA or the SoC single chip version. The DDR3 memory connection, with power supply, any required sequencing or the high-speed transceiver alone involve many possible design errors that are difficult to analyse subsequently. The software and the BSP resulting from the hardware also need to be adapted or produced by the clients themselves. And this is exactly the point at which the so-called system-on-modules come in as they resolve the

majority of these risks and also have further benefits.

The system-on-module manufacturer makes a tested and qualified module with the corresponding BSP available to the client. This means that the client only needs to develop the simpler base circuit board with the interfaces, plugs and standard power supplies. This greatly reduces the design risk in the critical blocks and the client can generally bring the final product onto the market substantially more quickly. This also saves costs in the sectors of development and validation. Indirect profit is also made from the purchasing conditions of the SOM manufacturer, who acquires the components for the modules in large quantities.

Theoretically, a point could be reached from which a SOM is worth having compared to an own design. But the final decision to 'make or buy' is left to the client themselves because of the many factors such as time-to-market, development resources, qualification, validation, costs, risk assessment or company philosophy. Arrow Electronics has a worldwide focus on system-on-modules, with all the relevant process manufacturers, different form factors and different operating systems. The latest FPGA module on the Arrow SOM line card is based on the Altera Arria10-SoC and allows clients to realise cost-efficient solutions with high performance FPGAs.

It is essential for the success of a project – and from a commercial standpoint too – to make the right decisions. Working in tandem with Arrow Electronics can be helpful in finding the right solution for a project and to gain specific know-how to solve the FPGA/SOM riddle.

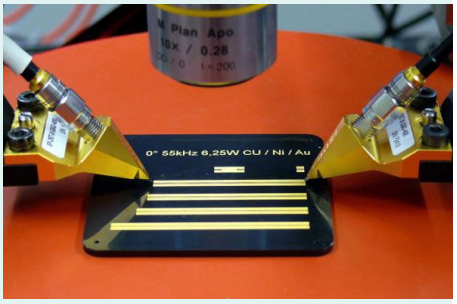
Direct laser structuring for mm-wave antennas

In cooperation with the Institute of High Frequency Technology and Radio Systems (Institut für Hochfrequenztechnik und Funksysteme, HFT) at Leibniz University of Hannover, LPKF is assessing its Laser Direct Structuring (LDS) technique for the design of antennas in the millimeter-wave frequency band.

MID technology (molded interconnect device) represents a solution, allowing electrical structures, such as antennas, to be applied to nearly any surface. HFT uses laser direct structuring in its development work. With LDS, a laser beam structures a three-dimensional part made of an LDS-doped plastic.

The laser beam transfers the desired circuit layout onto the substrate while activating the additive at the same time. In a subsequent electro-less metallization step, copper layers are built up on the structures traversed by the laser beam. These layers can then be given various surface finishes. LDS antennas covering the frequency band up to 6 GHz (Bluetooth, LTE, or Wi-Fi) can be found in many of today's smartphones, tablets, and wearable devices, but understanding the relevant manufacturing criteria for RF applications beyond 6 GHz formed the basis for the cooperation between HFT and LPKF.

The research center has already produced prototypes of an antenna for use in millimeter-wave sensors operating at 24 GHz and is now working on test antennas operating at 77 GHz. So far, the results of the test measurements



are also extremely promising for these applications and demonstrate the potential for LDS-based antennas operating at higher frequencies. LPKF expects research papers to be published in late summer 2016.

www.lpkf.com

Quantum satellite device

Researchers from the National University of Singapore (NUS) and the University of Strathclyde, UK, have become the first to test in orbit technology for satellite-based quantum network nodes by placing a compact device carrying components used in quantum communication and computing into orbit.

The team's device dubbed SPEQS creates and measures pairs of light particles, called photons. Results from space show that SPEQS is making pairs of photons with correlated properties – an indicator of performance.

Team-leader Alexander Ling, an Assistant Professor at the Centre for Quantum Technologies (CQT) at NUS, said "This is the first time anyone has tested this kind of quantum technology in space."

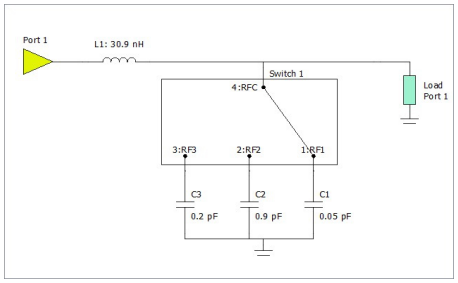
The team had to be inventive to redesign a delicate, table-top quantum setup to be small and robust enough to fly inside a nanosatellite only the size of a shoebox. The whole satellite weighs just 1.65-kg.

Making correlated photons is a precursor to creating entangled photons. Described by Einstein as "spooky action at a distance", entanglement is a connection between quantum particles that lends security to communication and power to computing. Local quantum networks already exist. The problem Ling's team aims to solve is a distance limit. Losses limit quantum signals sent through air at ground level or optical fibre to a few hundred kilometres – but we might ultimately use entangled photons beamed from satellites to connect points on opposite sides of the planet. Although photons from satellites still have to travel through the atmosphere, going top-to-bottom is roughly equivalent to going only 10 kilometres at ground level.

The group's first device is a technology pathfinder. It takes photons from a BluRay laser and splits them into two, then measures the pair's properties, all on board the satellite. To do this it contains a laser diode, crystals, mirrors and photon detectors carefully aligned inside an aluminum block. This sits on top of a 10 centimetres by 10 centimetres printed circuit board packed with control electronics.

www.quantumlah.org

Optenni Lab 3.3 release adds numerous features



The latest release of Optenni Lab, version 3.3 introduces support for optimization of switchable matching circuits, using multiport models of SPNT switches, where all the switch states are obtained from a single MDIF file.

In addition, Optenni 3.3 now allows the the port type to be specified as “External port”, “Component port”, “Open” or “Shorted” in multiport matching. Numerous improvements based on customer feedback have also been added, including: tuning of library component values and tolerances separated into different tuners, user Smith charts, a faster way to add curves to new or existing user plots, and the ability to copy circuit information to the clipboard and stored to a text file.

www.optenni.com

I/Q modulator

simplifies sideband and carrier suppression calibration

A direct conversion, low power I/Q modulator, the LTC5589 from Linear Technology enables battery-powered, high performance broadband transmitters operating in the range from 700 MHz to 6 GHz.

Powered by a single 2.7 V to 3.6 V supply, the modulator draws only 29.5 mA current, 50% lower power consumption than other products. The modulator exhibits best-in-class sideband suppression performance of -50 dBc and carrier leakage of -43 dBm typical without calibration. Sideband and carrier suppression can be further improved by using the on-chip tuning capabilities via the SPI bus, to better than -60 dBc and -60 dBm, respectively. Moreover, the device has a very low output noise floor of -158.8 dBm/Hz, combined with OIP3 of 19 dBm, resulting in superior transmitter performance.

The LTC5589 supports narrowband as well as wideband transmitters. Its baseband bandwidth extends to 92 MHz with ±1 dB gain flatness, providing 184 MHz RF bandwidth at 1.8 GHz. Combined with low power consumption and robust performance, the device is suitable for a wide range of demanding applications for radios and wireless communications. These include broadband modems, femto- and picocell broadband wireless access, wireless microphones and portable audio systems, broadband portable field radios, unlicensed band radios, train communications, software-defined radios, portable RF test equipment, low-power microwave backhaul and repeaters, telemetry radios and satellite modems.

The LTC5589 is available in a 4- x 4-mm plastic QFN package, providing a small solution footprint. Operating temperature range is specified from -40 °C to 105 °C case. The device has an enable pin for TDD or burst mode transmitter operation. When disabled, the LTC5589 conserves power by drawing a typical of 0.6 µA standby current. The modulator can be turned on with full quadrature accuracy in 350 ns

www.linear.com

GaN on SiC RF power transistors

complement LDMOS

A second generation of 50-V 0.5-µm GaN on SiC RF power transistors from Ampleon, dedicated to mobile broadband applications, provides a 5 percent improvement in power efficiency compared to LDMOS-based devices.

The GaN on SiC RF power transistors enabe high-power multiband applications while offering a size reduction in the order of 30 to 50 percent, when compared to similar LDMOS transistors. PA designers can now more easily find the perfect fit for each particular set of requirements, be it efficiency, size, power and cost.

The latest portfolio will include transistors with 15 to 600-W of peak power for all major cellular bands between 1.8 and 3.8 GHz.

The CLF2H27LS-140 is a single-ended transistor providing 140-W of peak power in band 41. Other devices currently sampling include the CLF2H1822LS-160 and CLF2H1822LS-220 suitable for 1.8 to 2.2 GHz multiband applications, and the CLF2H38LS-140 and CLF2H38LS-40 (driver) for 3.4 to 3.8 GHz applications with 140- and 40-W outputs at P3dB.

The family is ideal for RF PA designers developing high efficiency or multiband Doherty power amplifiers for use in wireless infrastructure networks.

Comprehensive application support, including ready-to-go Doherty reference designs optimized for mass-production, is available.

www.ampleon.com

RadioVerse™ SoCs

integrate transceiver technologies to simplify design

The RadioVerse™ technology and design ecosystem, from Analog Devices, Inc., (ADI), provides customers with integrated transceiver technologies, a robust design environment, and market-specific technical expertise to move their radio designs from concept to creation quickly.

RadioVerse transceiver technologies reduce radio size, weight and power (SWaP), while the design environment offers board support packages, software and tools to help customers simplify and accelerate radio development across a range of applications including wireless infrastructure, aerospace and defense electronics, and electronic test and measurement. The technology and design ecosystem aims to redefine radio design at the circuit, architecture, system and software levels to simplify integration and speed customers’ time-to-market.

As part of the RadioVerse technology and design ecosystem release, ADI introduced the AD9371, the latest addition to the integrated wideband RF transceiver product series. It is a highly versatile, car-

rier-grade, system-on-chip radio system that achieves a wide RF tuning range of 300 MHz to 6 GHz, 100-MHz signal bandwidth, and power consumption of less than 5 W under standard operating conditions. It replaces or eliminates as many as 20 discrete radio components and can be used as a common design platform across multiple applications and standards, increasing R&D efficiency and reducing time-to-market of the end product. Other products in the wideband RF transceiver series include the AD9361 and AD9364.

The RadioVerse technology and design ecosystem accelerates customer time-to-market by providing integrated RF transceivers, software API, design support packages, robust documentation, access to ADI's EngineerZone® online technical support community, and more. RadioVerse provides integrated wideband RF transceiver evaluation boards that directly connect to an FPGA development platform, allowing customers to perform chip-level performance evaluation and rapid prototyping of complete wireless scenarios using a single hardware platform. The boards are supported by a toolkit that includes HDL, Linux drivers, software API, a GUI, and design files necessary for customers to kick-start their own designs. An exact, verified model of the AD9371 transceiver, enabling advanced simulation and analysis of the transceiver, can be developed by using MATLAB and Simulink.

www.analog.com

Low PIM switches

cover DC to 65 GHz

Switches are available in any frequency range from DC up to 65 GHz, and the low PIM designs offer the customer the ability to reduce intermodulation in active devices in order to reduce system interference. Typical performance ranges from -160 dBc to -175 dBc, and the high isolation minimizes cross-talk between channels to ensure signal integrity.

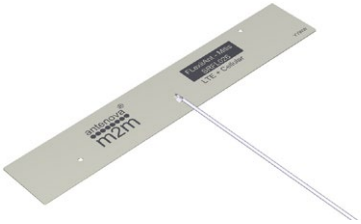
Customer applications include DAS, surveillance and communication systems. Low passive intermodulation (PIM) is crucial for applications where two or more transmitted signals share a common antenna or whenever the transmitter signal is too high or the receiver is sensitive to high intermodulation.

www.rlcelectronics.com

FPC antennas

target small devices in the 3G, 4G and LTE bands

Antenova Ltd has announced three flexible printed circuit antennas to cover the 3G, 4G and LTE bands, representing the company's first flexible antennas for 4G and LTE. Together, this set of three antennas offers options for all of the world's 4G and LTE bands, as well as a choice of antenna shape and size.



The antennas designated as: Mitis, part number SRFL026, and Moseni, part number SRFL029, have been developed for 4G and LTE applications, including MIMO. Zhengi, part no SRFC015, covers all of the 3G and 4G LTE bands B7 (2500 to 2690 MHz) and B30, B40 (2300 to 2400 GHz), including LTE Bands B7, B30, B38, B40 and B41.

Antenova has designed these FPC antennas so that they can be folded and inserted inside a small electronic device, where they will operate flat, folded or curved. They can be placed vertically, horizontally or co-planar to the PCB, and are ideal for use in applications where there may not be room for an SMD antenna.

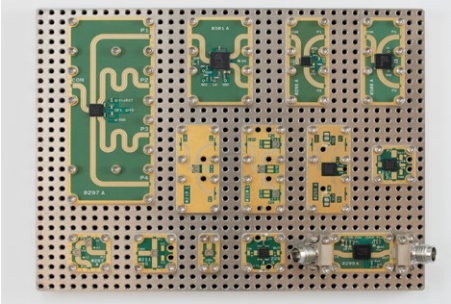
The antennas come with an IPEX MHF (UFL) cable, in a choice of three lengths for easy connection to a wireless module – making them effectively plug and play antennas, particularly as they can be integrated without matching.

Each antenna has a peel-back self-adhesive backing to fix it in place – which means they can easily be placed in a design, in the desired position, and they can be retro-fitted to earlier designs.

These three new antennas belong to Antenova's flexiiANT range of antennas, which was introduced last year. The Mitis, Moseni and Zhengi antennas are designed for applications such as smart meters, network devices, Femto and Pico base stations, telematics, remote monitoring, M2M, IoT and Point of Sale devices.

www.antenova-m2m.com

X-Microwave and Peregrine offer modular design and prototyping



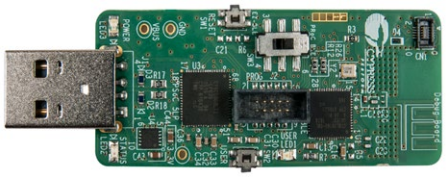
X-Microwave, LLC, and Peregrine Semiconductor Corp., have announced their collaboration and the addition of Peregrine's RF products to X-Microwave's online simulation tool and hardware prototyping system. X-Microwave's building-block system simplifies the modular design process and enables RF engineers to easily simulate and prototype RF and microwave circuits. To kick off this relationship, 16 Peregrine products are being added to the X-Microwave system as drop-in X-MWblock™ components.

At the heart of X-Microwave's system is an X-MWblock portfolio of hundreds of physically compatible, drop-in or drop-on components. These components are highly characterized and modeled with X-Parameters and S-Parameters at the system block level. To create a modular design, X-Microwave provides a free, non-linear online simulation tool that leverages Keysight's Genesys Spectrasys engine. After simulation, X-MWblock drop-in components are used to prototype systems through X-Microwave's innovative prototype station for testing, aligning and configuring integrated microwave assemblies up to 50 GHz. Finally, the same X-MWblock components can be moved from the prototype station directly to machined housings for production hardware, eliminating the need for custom layouts.

www.xmicrowave.com
www.psemi.com

IoT sensor beacon design kit

uses solar power



The CYALKIT-E02 solar-powered BLE sensor beacon reference design kit from Cypress Semiconducto provides an easy-to-use platform for the development of a solar-powered wireless sensor node (WSN) that can sense the temperature and humidity around its location and transmit the data using Bluetooth Low Energy connectivity.

The reference sensor beacon, which is 25 mm in diameter, can be placed and left to operate without maintenance for battery changes, making it suitable to monitor environmental conditions in smart home, commercial building, factory, and agriculture settings.

The tiny new reference design integrates Cypress's energy harvesting power management integrated circuits, EZ-BLE PRoC Bluetooth Low Energy module and a 15 x 15-mm solar cell that enable operation using as little as 100 lux of ambient light - less light than a typical warehouse aisle receives.

The kit contains the solar-powered BLE sensor beacon, a BLE-USB Bridge and Debug Board that can be connected to a host PC via a USB interface to receive sensor data and for on-chip debugging of the sensor beacon.

www.cypress.com

Thin, light directional antennas

for 60, 70 and 80 GHz applications

HUBER+SUHNER has added to its SENCITY® range of antennas with the launch of the SENCITY Matrix small form factor antennas designed by the company specifically to minimise the visual impact of mm-wave radio networks while delivering excellent electrical performance.

The small size of SENCITY Matrix antennas allows operators to access rooftop, wall and street-level sites that are not suitable for traditional parabolic antenna systems because of technical, environmental or planning restrictions. According to the company, the antenna's "community-friendly" design helps to address aesthetic concerns for urban deployments.

Matrix antennas are available in standalone, dedicated and integrated formats with models designed to cover both E-Band (70/80 GHz) and V-Band (60 GHz) applications. These are highly directional antennas making them suitable for small cell, fronthaul and traditional backhaul systems.

All SENCITY Matrix antennas enable installers to reduce installation times particularly since the bore sight gain of the antenna inherently coincides with the normal axis of the radiator allowing installers to use optical alignment techniques to easily and quickly align the radio.

The standalone and dedicated antennas comply with ETSI Class 2 sidelobe suppression requirements and are ideally suited for macrocell backhauling. A typical standalone antenna measures just 280- x 280- x 34-mm and is IPx8 rated.

Those antennas designed to be integrated into the radio are perfect for smallcell backhauling and feature the lowest weight and smallest sizes. As an example, a 38 dBi E-band antenna measures just 102- x 106- x 8-mm and weighs a mere 80 g.

www.hubersuhner.co.uk

Body worn antennas

RFMW, Ltd., has announced design and sales support for two body worn antennas from Southwest Antennas.

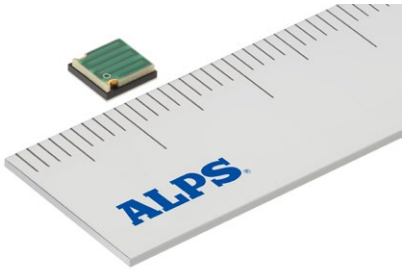
Model 1065-028 is a right-hand, circularly polarized (RHCP) antenna while model 1065-029 offers left-hand polarization (LHCP). Developed to offer a high performance, rugged antenna option, the antenna radome housing is resistant to damage from drops, being stepped or jumped on, and other potential abuse. Both 1065-028 and 1065-029 antennas are designed for use with handheld or body worn MIMO / MANET or SISO radio systems operating from 2100 to 2500 MHz.

Circular polarization offers performance enhancements in multi-antenna radio configurations, crowded RF and/or non line-of-sight scenarios, and improved performance in adverse weather conditions providing greater radio range for law enforcement, military or civilian applications. Free-space gain is specified at 4.5 dBic. Measuring only 5,6- x 5.6- x 1.3-cm (2.2- x 2.2- x 0.51-inches) and weighing 36.9 g (1.3 ounces), the 1065-028 and 1065-029 are lighter, smaller and more rugged than similar antennas currently on the market and are easily secured into pouches, vests and MOLLE gear.

www.rfmw.com

Bluetooth module

comes with built-in antenna



Ideal for applications such as IoT devices, wearable computers, pen type devices, healthcare, and energy management, ALPS is starting mass-production of its low-power UGMZ2AA Bluetooth® SMART communication module with built-in antenna.

Devices powered by batteries or button cells, in particular, increasingly employ communication modules conforming to low-power communication standard Bluetooth® SMART. Parts inside devices must also be compact and power-efficient as products become ever smaller and more sophisticated.

Addressing these issues, the UGMZ2AA with built-in antenna is among the smallest and has one of the lowest power consumption levels in the industry.

The series has compact dimensions of 4.7- × 4.7- × 2.0-mm, achieved using RF circuit design and precision processing technologies accumulated by ALPS over many years. The module also has an originally designed antenna circuit pattern on the top of the unit in a single package. This omits the need for end product

manufacturers to separately prepare an antenna, thereby helping to reduce the workload during equipment development and design.

Power consumption is low at 5.1 mA (0.6 µA in sleep mode), making the module ideal for devices running off a button cell or other battery.

www.alps.com

Low VSWR conformable cable assemblies

offer phase matching to 1 degree

P1dB has released its improved YouForm™ conformable cable assemblies that can be built to an ultra low VSWR, such as 1.08:1, at a comparable price to standard conformable cables. These cables can also be phase matched to 1 degree, depending on the frequency and configuration.

YouForm™ cable assemblies are available in 0.034 inch (0.86 mm), 0.047 inch (1.19 mm), 0.086 inch (2.18 mm), 0.141 inch (3.58 mm) and 0.250 inch (6.35 mm) coax diameters. They are also available in jacketed or non-jacketed configurations. YouForm™ coax is compatible with semi-rigid connectors, which means that P1dB can build a wide variety of cable assembly configurations.

www.p1db.com

Tiny circularly polarized cloverleaf omni antennas

Southwest Antennas has introduced small form factor "Turbo Cloverleaf" family of circularly polarized (CP) Omni antennas in 1.98 to 2.2 GHz and 2.3 to 2.5 GHz frequencies.

These innovative antenna products deliver substantial increases in high data rate throughput and signal-to-noise ratio (SNR) in a very compact, rugged radome that measures two inches or less on each side. Each antenna in the new family of products also features an integrated three inch RF coaxial gooseneck assembly with

ruggedized non-rotating RF connector options that allows for flexible antenna mounting and positioning with other closely located equipment or co-located antennas.

The Turbo Cloverleaf antennas were designed with radio users in mind who are in need of the performance that only a Cloverleaf style CP Omni antenna can offer, but in a new compact form factor. The resulting design delivers the world's smallest cloverleaf style antenna offering robust performance with modern radio systems that are increasingly seeing operation in the wireless broadcast TV, wireless video and live sports markets, UAV and drone video systems, vehicle-mounted radios, and tactical law enforcement and military radios that are utilizing MIMO/MANET system architectures for improved video, voice, and data transmission.

The proprietary Southwest Antennas Turbo Cloverleaf antenna designs offer over 40 dB of isolation between two co-located antennas with opposite CP polarizations which is a significant improvement over two co-located vertical or opposite slant polarized antennas. This latest design has shown over 50% improvement in data rate throughputs and over 30% improvements in SNR.

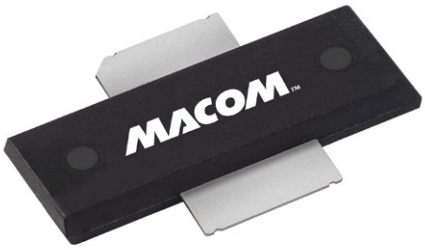
www.southwestantennas.com

Plastic-packaged GaN power transistors

hit 79% efficiency

MACOM Technology Solutions (MACOM) has announced the latest entries in its MAGb series of GaN on Silicon power transistors for use in macro wireless basestations. Based on the company's Gen4 GaN technology, the MAGb-101822-240B0P and MAGb-101822-120B0P power transistors harness the clear performance benefits of GaN in rugged, low-cost plastic packaging, enabling improved cost efficiencies that further distinguish these GaN power transistors as the natural successors to legacy LDMOS offerings for basestation applications.

The plastic TO-272-packaged MAGb-101822-240B0P and MAGb-101822-120B0P power transistors provide 320 W and 160 W output peak power, respectively, in the load-pull system with fundamental tuning only, and cover all cellular bands and power levels within the 1.8 to 2.2 GHz frequency range. These transistors' ability to operate over 400 MHz of bandwidth precludes the need to use multiple LDMOS-based products, further optimizing cost and design efficiencies.



Plastic-packaged MAGb power transistors deliver power efficiency up to 79% – an improvement of up to 10% compared to LDMOS offerings – with only fundamental tuning across the 400 MHz RF bandwidth, and with linear gain of up to 20 dB. These transistors provide a compelling alternative to ceramic-packaged devices without compromising RF performance or reliability – thermal behavior is improved by 10% compared to ceramic-packaged MAGb offerings.

These power transistors enable the implementation of a simple symmetric Doherty amplifier design while maintaining excellent RF performance compared to lesser performing and complex asymmetric Doherty topologies imposed by LDMOS-based transistors.

www.macom.com/wirelessinfra

Microwave mixers

suit applications up to 50 GHz

Link Microtek is offering one of the most extensive mixer product lines on the market, manufactured by L-3 Narda-MITEQ, which comprises more than 400 standard models that deliver a wide variety of configurations for operating frequencies from 1 GHz all the way up to 50 GHz.

Primarily aimed at up- and down-converter applications in communication, radar and electronic-warfare systems, the range includes numerous Schottky-diode mixers in single-, double- and triple-balanced designs, as well as several MESFET-based mixers, which are ideal for use wherever high dynamic range is the paramount consideration.

The majority of the mixers are double-balanced Schottky types, with different series covering requirements for ultra-broadband operation, high isolation and wide IF bandwidth. There are also several double-balanced integrated modules, which feature a built-in low-noise IF amplifier to save space and reduce component count.

Coaxial connectorised, surface-mount and microstrip package styles are available, and many of the devices feature a high-reliability hermetically sealed construction utilising a Kovar chassis.

In addition to the range of standard products, L-3 Narda-MITEQ can also design and manufacture customised microwave mixers to meet the requirements of specific applications, including space-qualified systems.

www.linkmicrotek.com

Bluetooth LE chip

targets in-car applications

A great number of present and future connected applications in vehicles ranging from smartphones to wireless sensors, intelligent seats and steering wheels to accident reporting systems will utilize the Bluetooth technology to communicate. For these applications, Nordic Semiconductor is introducing an automotive-version of its popular nRF51822 Bluetooth chip.

A great number of present and future connected applications in vehicles ranging from smartphones to wireless sensors, intelligent seats and steering wheels to accident reporting systems will utilize the Bluetooth technology to communicate. For these applications, Nordic Semiconductor is introducing an automotive-version of its popular nRF51822 Bluetooth chip.

The new nRF51824 is qualified to the automotive AEC-Q100 stress test qualification for integrated circuits, and delivers the same feature range and performance as Nordic's field-proven nRF51822 Bluetooth low energy SoC (256kB Flash and 16kB RAM variant) upon which the nRF51824 is based.

The nRF51824 is sampling now and is supplied in a 6x6 48-pin QFN package.

www.nordicsemi.com

Signal generator covers 2-8 GHz

with harmonic performance of -40 dBc

Vaunix Technology Corporation has recently added the the LMS-802DX signal generator to their family of LMS PC-driven signal generators.

The LMS-802DX has a power control range of 80 dB, +10 dBm to -70 dBm, exceeding the range of its predecessors by 25 dBm. The signal generator operates in the 2 to 8 GHz frequency range with a resolution of 100 Hz and a fast 100 microsecond switching time. When set to +10 dBm this compact, one-pound signal generator exhibits typical harmonic performance of -40 dBc.

The latest signal generator still offers the advanced features in the LMS family of Vaunix signal generators including phase-continuous linear-frequency sweeping, internal/external 10 MHz reference, and optional pulse modulation. The Lab Brick signal generators are operated and powered through USB and controlled with the included graphical user interface (GUI) or through one of the company's many API's.

www.vaunix.com

10 GS/s, DC coupled, 10-bit PCIe digitizer

Keysight Technologies has launched the U5310A 10-bit PCIe® high-speed digitizer running at 10 GS/s. With its very-high dynamic range and 10-bit resolution across a wide 2.5 GHz bandwidth, the high-speed digitizer allows the capture of fast transients with high fidelity.

This unique ADC card is designed for embedded OEM applications, such as medical research, analytical time-of-flight (MS-TOF), environmental monitoring (LiDAR), ultrasonic non-destructive testing (NDT), semiconductor testing and distributed strain temperature sensor (DSTS). Furthermore, the U5310A is ideal for advanced physics experiments using single-shot or event-based application.

The high-speed digitizer features two channels with 10-bit resolution, simultaneous sampling at up to 5 GS/s, and an unrivaled 10 GS/s in interleaved mode. With a DC up to 2.5 GHz bandwidth, this digitizer provides on-board real-time averaging at full sampling rate and large 4 GB memory.

Keysight developed new proprietary ICs for the U5310A. In particular, the low distortion and low noise LDNA front-end amplifier IC to drive the ADC. This key component provides single ended to dif-

ferential outputs with a distortion from 10 to 15 dB lower than the distortion of the ADC — therefore overall performance is not impacted. Keysight also designed a low noise dedicated QMCK clock IC with very low 25 fs jitter. This specific IC drives the two ADCs, minimizing jitter. Moreover, the TRAC trigger IC provides time precision of 15 ps RMS.

www.keysight.com

LNA families

industry-leading noise figure

Guerrilla RF Inc., has introduced the GRF207X and GRF208X families of ultra-low noise amplifiers, adding to the company's growing portfolio of infrastructure amplifiers.

The devices are offered in an industry standard 2x2 mm DFN-8 package. The RF performance of the devices in the two families is essentially the same. GRF208X offers a shutdown capability on pin 6 making the devices optimal for TDD applications, while GRF207X allows the user to set Iddq independently from Vdd via the enable input to pin1 – thus enabling optimal power consumption for a particular application.

"With their industry leading low NF and high gain, these devices enable the low cascaded receiver noise figures that cellular infrastructure applications require," said Alan Ake, vice president of applications and technical marketing at Guerrilla RF. "The internal architecture of these devices results in simple external matching which yields excellent fractional bandwidths exceeding 40 percent with a single set of matching component values. These devices deliver incredibly low NF levels. As an example, GRF2071/GRF2081 evaluation board NF at 1.9 GHz is typically 0.35 dB."

http://guerrilla-rf.com

Radio modem

simplifies long range telemetry in Europe

The latest Radiometrix FPL3 radio modem simplifies the design of long range wireless appliances that can be marketed in any European country.

This highly integrated multi-channel radio with 400 mW RF output power operates in the 869.4 to 869.65 MHz frequency band, which is the only band

permitted for license-free operation at up to 500 mW in all EU countries.

The FPL3 features a built-in modem that minimises demand for external components. In addition, the modem has inverted-RS232 serial interfaces at 5-V CMOS voltage level, which enables direct connection to a UART or host microcontroller without a driver or level shifter. The FPL3 also integrates firmware for managing data timing and formatting at the radio interface, which saves the user keying the transmitter on or off and ensures dependable link latency.

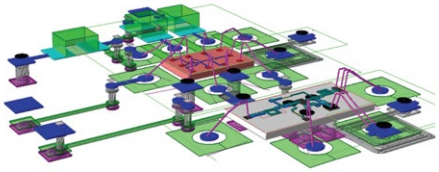
With maximum serial data rate of 9600 baud and radio range of more than 3km, depending on operating conditions, the FPL3 is a strong choice for new designs such as security systems, fire-warning systems, industrial controls or telemetry, asset tracking, and control of remotely operated vehicles (ROVs).

The eight-channel radio is programmed for 869.475 MHz and 869.565 MHz in the EU, with channels 4-7 set to 869.50 MHz for backward compatibility. The 67- x 30- x 12-mm module operates from a single 5-V supply, and draws 50 mA in receive mode and 500 mA when transmitting at 400 mW (+26 dBm) RF output power.

www.radiometrix.com

AWR Connected™

enhances EM interoperability



The improved EM Socket II architecture within NI AWR Design Environment™ has been developed in order to enhance the AWR Connected™ for EM interoperability between third-party electromagnetic (EM) simulation tools and the company's flagship high-frequency circuit design software, Microwave Office.

The latest architecture, which is also utilized by NI AWR Design Environment's AXIEM 3D planar and Analyst 3D FEM EM solvers, leverages the automation and design management developed for circuit, system and EM co-simulation. With the opening of the EM Socket II architecture to third-party tools, companies can take advantage of the Microwave Office design environment with their existing investments in other vendor EM products, benefitting from a use model that is seamless and robust.

The latest release of AWR Connected is for the High Frequency Electromagnetic Field Simulation (HFSS) software from ANSYS. This flow utilizes EM Socket II to enable bi-directional interoperability between Microwave Office and HFSS and expands upon the prior offering by allowing designers to define an HFSS 3D layered structure, seamlessly launch an HFSS simulation and embed S-parameter results directly back into Microwave Office without leaving the software environment.

Additionally, Sonnet Software and Computer Simulation Technology (CST) have upgraded from prior EM Socket implementations to this new format.

www.ni.com/awr

High frequency RF SOI mixer

covers 10 to 19 GHz

Peregrine Semiconductor has added the UltraCMOS® PE41901 high frequency image reject mixer into its growing portfolio of high frequency RF SOI products.

This complete MMIC is based on the company's UltraCMOS technology and provides reliable, repeatable and consistent frequency-mixing. It is ideal for test and measurement systems and Ku band earth terminals such as very small aperture terminal (VSAT) and point-to-point communication systems.

Image reject mixers provide an integrated phase-canceling capability by removing the unwanted image signal from the output. This type of mixer reduces the number and complexity of the filters required in a system, resulting in minimized board space and design effort. The PE41901 is the company's first image reject mixer and its first mixer at high frequencies.

The UltraCMOS PE41901 is a passive double-balanced, Ku band mixer with image rejection. It integrates two mixers, a local oscillator (LO) path 90-degree coupler and RF port baluns on a single die. Integrating these functions provides good image rejection, reduces LO leakage and improves LO to RF isolation. This mixer operates with single-ended signals on the RF and LO ports, and it can be used as an upconversion or downconversion mixer. It supports a broad RF frequency range of 10 to 19 GHz. The intermediate frequency (IF) port accepts broadband quadrature signals from DC to 4 GHz, while the LO port covers a frequency range of 12 to 19 GHz.

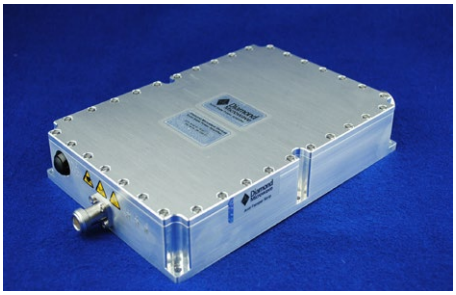
The PE41901 delivers high LO to RF isolation of 38 dB and LO to IF isolation of 23 dB. It has high linearity of 21 dBm IIP3. The mixer has low conversion loss of 10 dB and achieves image rejection of 25 dB. No external blocking capacitors are required if 0 VDC is present on the LO or RF pins.

www.psemi.com

GaN X-band SSPAs

integrate monitoring and protection

A range of X-band GaN-based pulsed solid-state power amplifiers from Diamond Microwave have been launched that offer integrated monitoring and protection, with output power levels up to 300 W, and an ultra-compact footprint of only 220- x 150- x 41-mm excluding heatsink.



Despite their small size, the amplifiers include key parameter monitoring with self-protect functions which are activated if the SSPA detects that the VSWR threshold, duty cycle or current limits have been exceeded. The SSPA will also alert the host system when a low output power condition is detected, or when temperature limits have been exceeded. An interface to the host system is provided by Ethernet connectivity.

With variants covering the 8.4 to 9.6 GHz band, these amplifiers are ideally suited for use as a solid-state alternative to a travelling wave tube amplifiers (TWTA) or magnetron technology in many radar applications.

www.diamondmw.com

Exhibition Space is Filling Up Fast. Book Your Booth Today!

EDI CON 2016
Electronic Design Innovation Conference
Workshops & Exhibition

September 20-22
Hynes Convention Center
Boston, MA

Join the Growing List of Exhibitors:

Keysight Technologies
Rohde & Schwarz
National Instruments/AWR
CST - Computer Simulation Technology AG
Mini-Circuits
Analog Devices
ANSYS
Copper Mountain Technologies
Electro Rent Corporation
Freescale/ NXP Semiconductors
Rogers Corp.
A.J. Tuck Company
Accurate Circuit Engineering
AEM
Agile Microwave Technology Inc.
Altair Engineering
Amplical Corp.
Anokiwave
Applied Thin-Film Products
AR RF/Microwave Instrumentation
ARC Technologies
ATE Systems
Barry Industries
Berkeley Nucleonics
Boonton
Colby Instruments
Noisecom
Microlab
Wireless Telecom Group
COMSOL, Inc.
Dynawave Incorporated
EMSCAN
EZ Form Cable Corp.
GigaTest Labs
Gowanda Electronics
High Frequency Electronics
Holzworth Instrumentation
Instec
Integrated Device Technology (IDT)
International Manufacturing Services
Ion Beam Milling
IW Microwave Products Division
JFW Industries, Inc.
Lake Shore Crytronics
LPKF Laser and Electronics
MACOM
Marki Microwave
Massachusetts Bay Technologies
Maury Microwave
Mentor Graphics Corp.
Microwave Product Digest
Millitech
Mitsubishi Electric US
Modular Components National
Noisewave
Nuhertz Technologies, LLC
Ophir RF
Orban Microwave
Piconics
Planar Monolithics
PPG Aerospace-Cuming Microwave
Queen Screw & MFG. Inc.
Reactel, Inc.
Response Microwave, Inc.
Semiconductor Enclosures
SemiGen, Inc.
Southwest Microwave
SV Microwave
Synergy Microwave Corporation
Taconic
TechPlus Microwave, Inc.
Tech-X Corporation
Times Microwave Systems
TowerJazz
Transline Technology Inc.
T-Tech, Inc.
TTE Filters, LLC
Weinschel Associates
Werlatone, Inc.
X-Microwave
Zentech Manufacturing

Contact your MWJ Sales Representative or See us at IMS Booth #1410

EDICONUSA.com

Premium Sponsors

KEYSIGHT TECHNOLOGIES
ROHDE&SCHWARZ
NATIONAL INSTRUMENTS
Raytheon

Organized By

horizon house
Microwave Journal

FIVE DAYS ■ THREE CONFERENCES ■ ONE EXHIBITION

EUROPEAN MICROWAVE WEEK 2016
EXCEL LONDON, UK
3 - 7 OCTOBER 2016

EuMW 2016
Microwaves Everywhere

EUROPEAN MICROWAVE WEEK
LONDON, UK
3-7 OCTOBER 2016
www.eumweek.com

EUROPE'S PREMIER MICROWAVE, RF, WIRELESS AND RADAR EVENT

The Exhibition (4th - 6th October 2016)

- 8,000 sqm of gross exhibition space
- 4,000 key visitors from around the globe
- 1,700 - 2,000 conference delegates
- In excess of 300 international exhibitors (including Asia and US as well as Europe)

The Conferences:

- European Microwave Integrated Circuits Conference (EuMIC)
- European Microwave Conference (EuMC)
- European Radar Conference (EuRAD)
- Plus Workshops and Short Courses
- In addition EuMW 2016 will include the 'Defence, Security and Space Forum'

EuMA European Microwave Association

Official Publication: Microwave Journal

Organised by: horizon house

Supported by: IET The Institution of Engineering and Technology

Co-sponsored by: MTT-S

Co-sponsored by: IEEE

EuMIC 2016
The 11th European Microwave Integrated Circuits Conference
Co-sponsored by: GAAS, Electron Devices Society

46TH EUROPEAN MICROWAVE CONFERENCE 2016
The 46th European Microwave Conference
Co-sponsored by: APS

EuRAD 2016
The 13th European Radar Conference
Co-sponsored by: APS, AESS

INTERESTED IN EXHIBITING?

For International Sales:
Richard Vaughan
International Sales Manager
E: rvaughan@horizonhouse.co.uk
Tel: +44 20 7596 8742

For US Sales:
Alyssa Connell
Event Coordinator
E: aconnell@mwjournal.com
Tel: +1 781 619 1930

For more information visit:
www.eumweek.com