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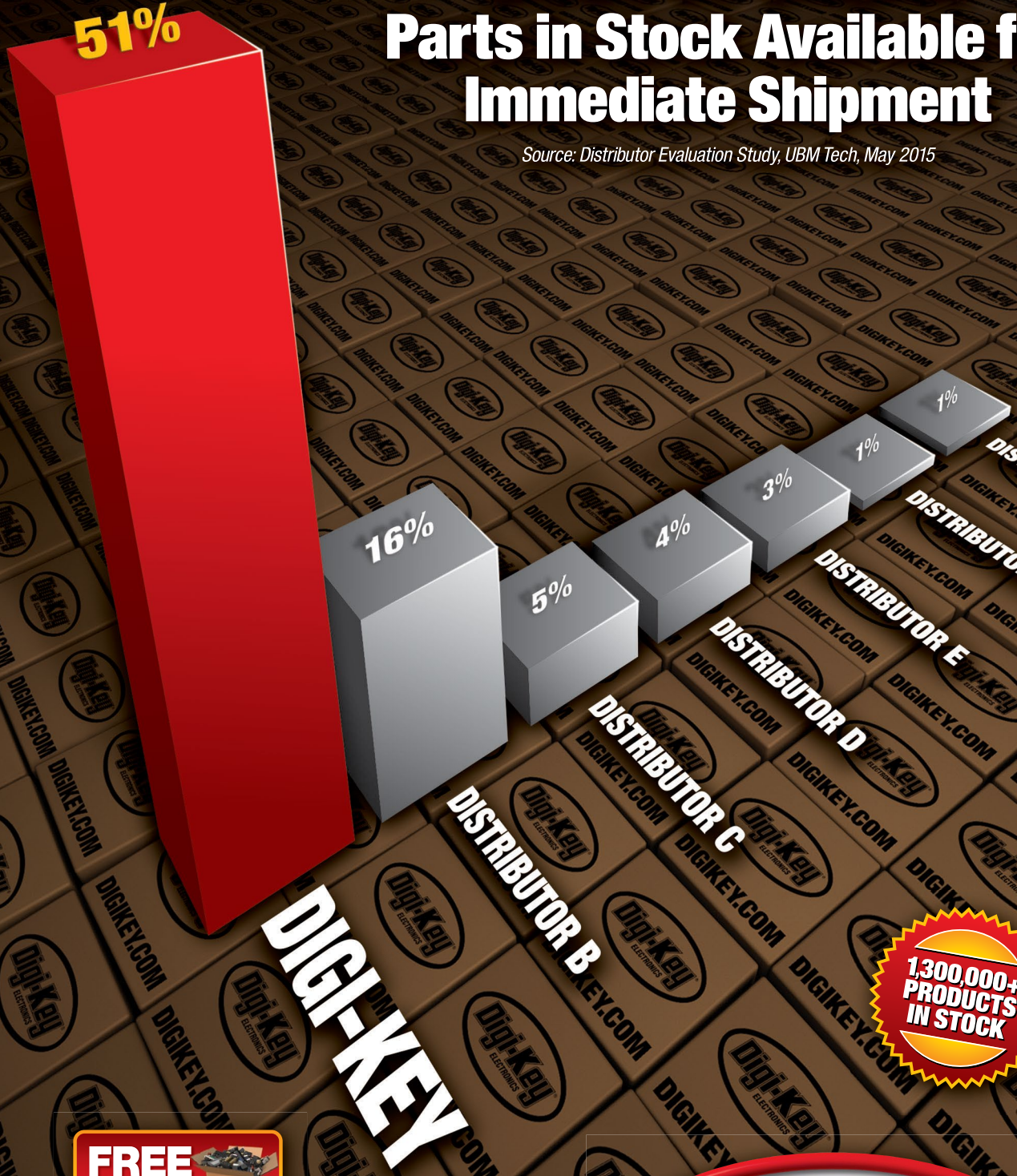

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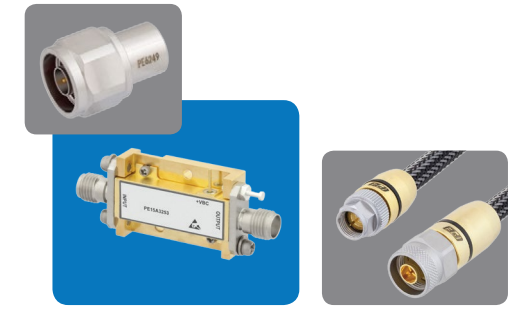

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The death of the smartphone is vastly exaggerated

With all the buzz surrounding the IoT and smartwatches some have dared to suggest that we will soon be seeing the decline of the smartphone. The argument follows the analogy of the desktop computer that morphed into laptops and eventually into tablet computers. However, even after all this the desktop computer lives on.

Smartwatches have a place and might be the next big thing. However for the next decade or two, the smartphone will reign. Innovation in the smartphone has become evolutionary rather than revolutionary. But, I would argue that we are not even half way through the smartphone revolution. Improving services as 4G advances will push new use cases, mobile payments being one such example. Even NFC is beginning to take off. A recent Strategy Analytics report claims that mobile payments made via NFC-enabled handsets will approach $240 billion in total value by 2021, with handset NFC payments users to pass 100 million in 2016.

Nitesh Patel, Director, Mobile Payments, at Strategy Analytics noted, "Transport for London has highlighted the importance of wide reaching contactless payment acceptance in driving adoption and use. With three percent of all journeys paid for using contactless driven by mobile phones in December 2015, just six months after the launch of Apple Pay, it is clear that NFC-based payments have strong potential for future growth."

The smartphone will live on through added use cases. Potentially these are many. We will see evolutionary changes to the smartphone, such as longer lasting batteries, wireless charging, depth sensing and 3D cameras, more sensors for smarter phones, augmented reality, multi-screen capabilities, gesture control,

and possibly flexible screens. It still remains the case that all this is nice but the use case will drive market.

Mobile payments are one use case, but many more exist. Using the smartphone as a home controller is another, and the market here is emerging with heating and lighting systems that are controlled via an app on the phone. Similarly, the security and surveillance camera market would also benefit. Another area that has barely being touched is the medical monitoring market. As 5G begins to emerge there will be a huge boost in coverage and reliability to move medical monitoring from a personal level to a professional level. That being said, legal issues will need to be resolved.

Smartphones could also eventually replace the entertainment hub in cars, as well as provide connectivity. Apple CarPlay is an example of what might be in store for the automotive industry. Just as many industries leveraged the common PC platform, so will many leverage the smartphone app model. Not only can this get products to market quickly, but is ideal for companies with little or no wireless expertise to compete with larger companies that have the financial muscle to develop their own systems.

As the IoT takes hold and wearable technology advances, the smartphone will still be there to provide the raw computing power and connectivity to co-ordinate and communicate with all these new devices. The idea of adding sensors to a phone, either integrated or tethered via Bluetooth is a powerful concept. In some parts of the world, an air quality sensor would be popular, as is the idea of a carbon monoxide sensor for home safety.

We can see this already taking place in many areas of research. For example, last year researchers at the University of California, Los Angeles (UCLA) developed a device that can turn any smartphone into a DNA-scanning fluorescent microscope. The implications for medical diagnostics are profound and show once again how the smartphone can be leveraged to bring down the costs of healthcare as well as bring cutting edge diagnostics to the developing world.

To conclude, the smartphone revolution is just warming up. The market will continue to be driven through use cases and the development of innovative sensors rather than through radical changes to the smartphone itself.

Flexible skin cloaks objects by trapping radar waves

A flexible, stretchable and tunable "meta-skin" that uses rows of small, liquid-metal devices to cloak an object from the sharp eyes of radar has been developed by Iowa State University engineers. The metamaterial can be tuned to reduce the reflection of a wide range of radar frequencies by controlling the stretching and flexing of the polymer meta-skin.

"It is believed that the present meta-skin technology will find many applications in electromagnetic frequency tuning, shielding and scattering suppression," the engineers wrote in their paper, published in the journal Scientific Reports.

To prove the idea that electromagnetic waves — and perhaps even the shorter wavelengths of visible light — can be suppressed with flexible, tunable liquid-metal technologies, the researchers implemented rows of split ring resonators embedded inside layers of silicone sheets. The electric resonators are filled with galinstan, a metal alloy that's liquid at room temperature and less toxic than other liquid metals such as mercury.

Those resonators are small rings with an outer radius of 2.5 millimeters and a thickness of half a millimeter. They have a 1 millimeter gap, essentially creating a small, curved segment of liquid wire.

The rings create electric inductors and the gaps create electric capacitors. Together they create a resonator that can trap and suppress radar waves at a certain frequency. Stretching the meta-skin changes the size of the liquid metal rings inside and changes the frequency the devices suppress. Tests showed radar suppression was about 75 percent in the frequency range of 8 to 10 gigahertz, according to the paper. When objects are wrapped in the meta-skin, the radar waves are suppressed in all incident directions and observation angles.

www.iastate.edu

Compact Thz source operates at room temp

Northwestern University's Manijeh Razeghi has developed a compact room temperature continuous wave, highly tunable, high-power terahertz source. As a security detection device it has the ability to detect explosives, chemical agents, and dangerous biological substances from safe distances – making public spaces more secure.

This is in contrast to current terahertz sources, which are large, multi-component systems that sometimes require complex vacuum systems, external pump lasers, and even cryogenic cooling. The unwieldy devices are heavy, expensive, and hard to transport, operate, and maintain.

"A single-component solution capable of room temperature continuous wave and widely frequency tunable operation is highly desirable to enable next generation terahertz systems," said Razeghi, Walter P. Murphy Professor of Electrical Engineering and Computer Science in Northwestern's McCormick School of Engineering.

www.northwestern.edu

Domestic microwave oven first to use solid-state RF power

Ampleon – the Dutch RF power device spin-out from NXP - and Midea, a global consumer appliance manufacturer, have announced the results of a collaboration into the use of solid state technology for compact oven design, resulting in Midea's launch of a product believed to be the first commercially available solid state RF energy oven.

Ampleon has explored and demonstarted the possibilities of using RF power transistors rather than a magnetron to generate the energy for microwave cooking for some time now. By addressing the technical challenges associated with designing a small-cavity appliance with a single antenna, Midea has created a 200-W table top oven that achieves homogenous cooking. The oven can be powered either from a mains power source or, for portable use, from a 24 VDC battery. Midea and Ampleon jointly developed the electronics and power amplifier stages while Midea focused on the overall product design.

Designed for space constrained kitchens or for portable food-on-the-go applications, the oven is the first result of the on-going collaboration between the two companies.

Mr Pinglu Chen, Head of Sales Asia and Country Manager Greater China, Ampleon, comments, "The major benefit to adopting a solid state approach to cooking is that it yields a more uniform cooking experience by allowing total control over output power, frequency and phase, something that is impossible with a magnetron."

www.ampleon.com

DARPA funds novel ADC architecture

Analog IP specialist IQ-Analog Corp., (San Diego, California) has been awarded a $4.5 million contract by the Defense Advanced Research Projects Agency (DARPA) to develop and validate a novel analog-to-digital converter (ADC) architecture.

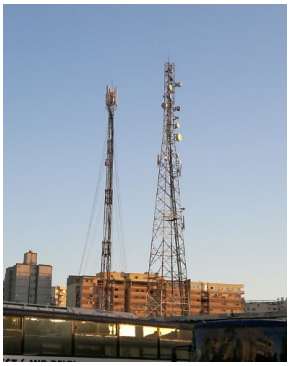
The architecture uses a patented innovation known as traveling pulse wave quantization (TPWQ) to increase the effective data rate of the conversion rate but at half the power consumption of established ADC approaches, IQ-Analog claims.

IQ-Analog is planning to design a prototype ADC IC that will operate at sample rates of over 60 Hz and provide full spectrum conversion up to 30 GHz. This is of interest to DARPA because of its ability to enhance radar and other electronic warfare systems, IQ-Analog said. The prototype IC is set to be manufacture in Globalfoundries' 14nm FinFET process.

www.iqanalog.com

First live traffic application of Super Dual Band backhaul

The first live traffic application of the innovative microwave "Super Dual Band" with throughput more than 6 Gbps in mobile backhaul in the Alex region, Egypt has been completed according to Etisalat Misr and Huawei.



Etisalat Misr, one of the leading mobile operators in Egypt and a subsidiary of Etisalat Group, achieves technology leadership through various MBB services. In the recent few years, the mobile broadband applications have grown dramatically and increased the demands on mobile backhaul bandwidth exponentially.

Microwave backhaul struggles to meet the need for multi-Giga bandwidth at long distances. Etisalat Misr with Huawei Super Dual Band microwave system have achieved 6.19 Gbps over a relatively long distance (3.37 km) link in Alex region, applying state-of-the-art features (EPLA, AM and QoS) that stretch the benefits from the E-band equipment.

Huawei "Super Dual Band" bonds the traditional frequency (6-42 GHz) together with E-band (71-86 GHz) in a unique manner, offering increased protection via special link aggregation techniques and advanced Quality of Service mechanisms. "Super Dual Band" combines long distance benefit of traditional frequencies together with the large capacity advantage of the E-Band, ensuring efficient multi-Giga transmission.

www.huawei.com

Enabling smartwatches to track a finger in mid-air using sonar

The small screen interface of mobile and wearable devices such as smartwatches raise a host of problems for people to interact with. To alleviate this issue, computer scientists and electrical engineers at the University of Washington have developed a new sonar technology that enables one to interact with mobile devices by writing or gesturing on any nearby surface such as a tabletop, a sheet of paper or even in mid-air.

The reseachers created FingerIO, which tracks fine-grained finger movements by turning a smartphone or smartwatch into an active sonar system using the device's own microphones and speakers. Because sound waves travel through fabric and do not require a line of sight, users can even interact with a phone inside a front pocket or a smartwatch hidden under a sweater sleeve.

In a paper to be presented in May at the Association for Computing Machinery's CHI 2016 conference in San Jose, California, the UW team demonstrates that FingerIO can accurately track two-dimensional finger movements to within 8 mm, which is sufficiently accurate to interact with today's mobile devices, even though sonar echoes are weak and typically not accurate enough to track finger motion at a high resolution.

The UW researchers employed an Orthogonal Frequency Division Multiplexing (OFDM) signal — and demonstrated that it can be used to achieve high-resolution finger tracking using sound. Their algorithms leverage the properties of OFDM signals to track phase changes in the echoes and correct for any errors in the finger location to achieve sub-centimeter finger tracking.

www.washington.edu

Handset NFC payments users to pass 100 million in 2016

According to market research firm Strategy Analytics, mobile payments made via NFC-enabled handsets will approach $240 billion in total value by 2021.

Increasing competition between mobile wallets from device vendors Apple and Samsung, payment card issuers, and mobile operators, combined with a maturing contactless payment infrastructure across most regions, will finally catalyze in-store handset-based NFC purchases. Furthermore, the firm expects consumer readiness to adopt mobile payments to improve as providers of mobile wallets increasingly support coupons and loyalty cards.

Strategy Analytics is encouraged by rising use of contactless payments over the past twelve months, particularly in cities like London where the acceptance of contactless payments has become nearly ubiquitous.

www.StrategyAnalytics.com

World record in 5G wireless spectrum efficiency set

Research by engineers from the Universities of Bristol and Lund, working alongside National Instruments (NI), have demonstrated how a massive antenna system can offer a 12-fold increase in spectrum efficiency compared with current 4G technology. Using a flexible prototyping platform from NI based on LabVIEW design software and PXI hardware, the Bristol configuration implements Massive MIMO, where 128 antennas are deployed at the base station – in contrast to the standard MIMO today based on up to four antennas.

The hardware behind this demonstration was provided to Bristol University as part of the Bristol Is Open programmable city infrastructure. Lund University has a similar setup, the LuMaMi testbed, enabling researchers at both sites to work in parallel with their development.

Bristol's Massive MIMO system used for the demo operates at a carrier frequency of 3.5 GHz and supports simultaneous wireless connectivity to up to 12 single antenna clients. Each client shares a common 20 MHz radio channel. Complex digital signal processing algorithms unravel the individual data streams in the space domain seen by the antenna array.

The Massive MIMO demonstration was conducted in the atrium of Bristol's Merchant Venturers Building and achieved an unprecedented bandwidth efficiency of 79.4 bit/s/Hz. This equates to a sum rate throughput of 1.59 Gbit/s in a 20 MHz channel.

Ove Edfors, Professor of Radio Systems at Lund University says: "We see massive MIMO as the most promising 5G technology and we have pushed it forward together with partners in Bristol and in our EU project MAMMOET."

www.bristol.ac.uk

ISL to revolutionise satellite antennas

Aiming to develop antennas that address the most common operational challenges in satellites — efficiency, cost, form factor and durability — Isotropic Systems Limited (ISL) has secured an additional $1M in funding.

ISL antennas aim be the first truly 'broadband' low-profile antenna with fully electronic beam steering, easily scalable to effective apertures and can be designed to match almost any desired form factor. Designed for satellite broadcast, VSAT, microwave, multipoint wireless and 5G broadband, the antennas will be low cost and have no moving parts.

"As advances in high throughput satellites and constellations continue to drive demand for high capacity data on the move, a new range of low profile antennas, with no moving parts, exceptional spectral efficiency, at low price prices is required," said Dan DiFonzo, Chief Technology Officer, ISL

www.isotropicsystems.com

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Managing power dissipation in 5G antenna design

By Rik Jos, Fellow RF Technology, Ampleon

The emerging 5G wireless standard holds the promise of delivering more data to more customers at higher data rates than is currently possible – up to 1000 times more bandwidth by 2025, according to some forecasts. One way this will be achieved is by massive MIMO, using antennas made up of arrays of elements, driven by individual signals. Such antenna arrays can create multiple signal beams. Massive MIMO can be applied in a scattering rich environment, i.e., in conditions where signals are scattered of buildings and other objects such that each user can be reached via multiple paths. At the location of the intended user signals from all these paths add constructively, enabling a high data rate. Away from the intended user the signals are not correlated and merely add to the background noise.

For operators to continue improving their services in this way, as we have come to expect, there will be a cost, particularly in the increased complexity and related power consumption of basestations and terminal equipment.

What's the issue? Multichannel phase shifting can be done in the analog domain, by taking the transmit data stream, dividing it as many ways as there are elements in the antenna array, and then applying phase shifting to each of them (see Figure 1). This works, but is inflexible – it can only handle one data stream and therefore it can only generate one signal beam. If the system needs to handle multiple data streams and generate multiple beams from one array, we need to move to digital beam forming, as shown in Figure 2, in which each element of the antenna array has its own transceiver and set of data converters.

Greater complexity leads to greater power consumption, which needs to be controlled to reduce the environmental impact and operating-cost implications – and the cooling challenge.

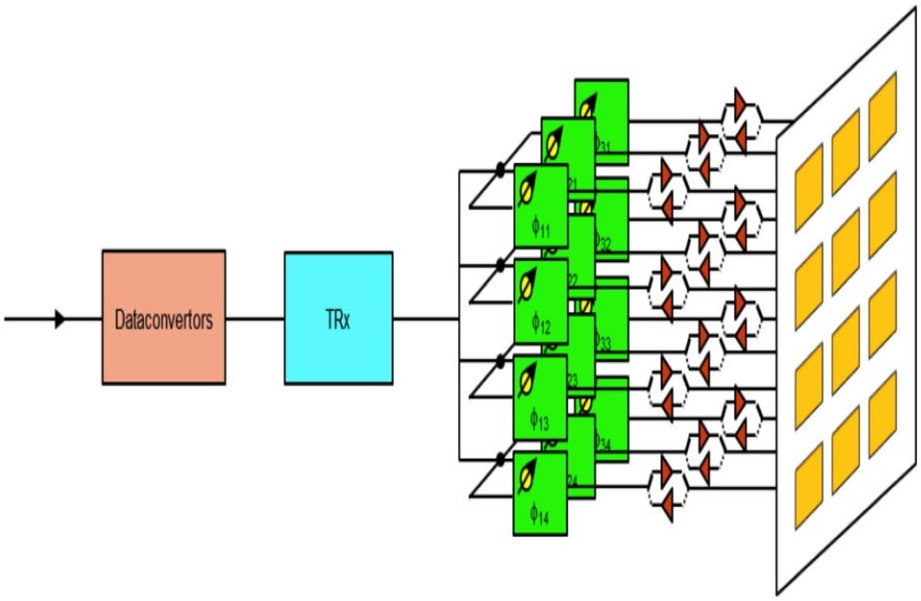


Figure 1: Phase shifting in the analog domain for a 5G antenna array (Source: AMPLEON).

ESTIMATING THE COOLING NEEDS OF AN ANTENNA ARRAY

Take a 4x4 antenna array panel operating at 30 GHz, in which the antenna elements are placed half a wavelength apart – that is, 5mm. To use digital beam forming means each element needs 2 DACs (for I and Q), 2 ADCs, 1 PLL, 1 LNA, 1 PA, 1 transmit/receive switch and some amplifiers and other electronics, including filters. The circuits for each element should ideally be on one chip, for cost and size reasons. The antenna is then assembled by laying out 16 chips evenly across a panel, so that they have short connections to the

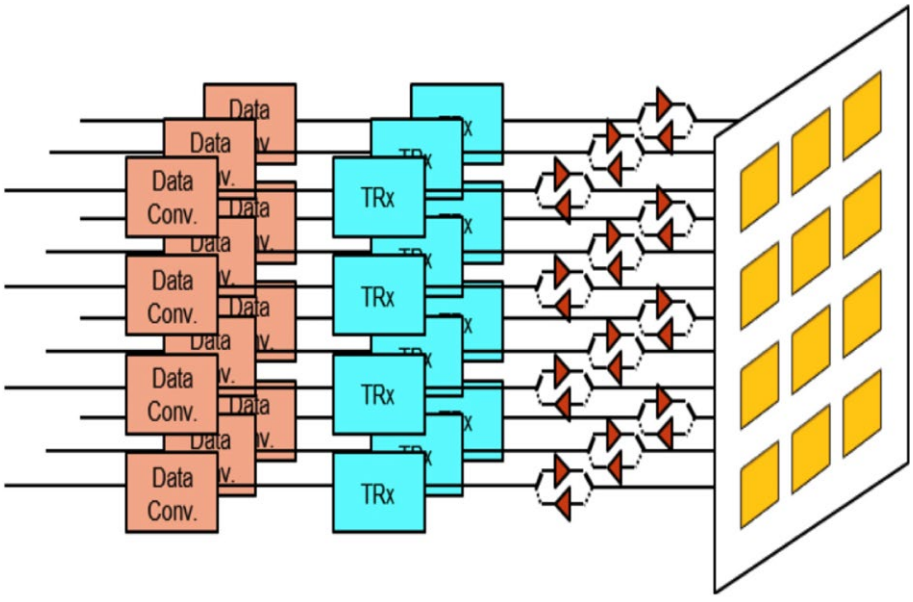


Figure 2: Basic architecture of a digital beam forming array (Source: AMPLEON).

antenna elements they are driving and the heat they produce can be evenly distributed, as in Figure 3.

If the power amplifiers have a peak output power of about 20 dBm each, and are built using the most advanced techniques available today, the total power dissipation in such a panel will be 3- to 4-W. This already assumes the use of data converters with limited bit depths, since research shows that we may need less resolution to deliver the same signal integrity to the receiver when using multiple antenna elements than when using a single antenna. However, the data converters still need to run at high speed to handle large signal bandwidths. The power amplifies account for about 75% of total dissipation when transmitting, since the efficiency at mm-wave frequencies is very low.

There are techniques, such as Doherty circuit architectures and envelope-tracking schemes, to improve PA efficiency, but they need elaborate digital pre-distortion, which itself consumes power, to achieve acceptable spurious signal levels. At some point, the benefits of these techniques are outweighed by the energy cost of implementing them, and there is no net gain. This 4x4 array example is very close to that cross-over point, so there is little point in applying such energy-saving PA architectures. Even in case of a simple, pretty linear class AB amplifier some kind of energy-efficient linearization will be required anyhow. Fortunately massive MIMO systems will probably use TDD and the power amplifiers are only on part of the time.

In our example design, then, between 3- and 4-W of heat is being generated on a panel of 400mm^2. We want to cool it passively, for cost, energy consumption (in the fan), and reliability reasons. We can do this with an aluminum plate with cooling ribs, which has a cooling capacity of about 60 W/m^{2}K. Assuming an ambient temperature of 60°C (think of a basestation on a Middle Eastern rooftop in summer) and a temperature of 100°C at the connection between the antenna panel and the transceiver chips, a quick calculation shows that we can cool 0.25 W/cm^2 – or about a quarter of what the array needs. To dissipate the full 3.5 W will take a cooling panel of about 1400mm^2.

One way to fix this issue is to build a panel of the right size to cool the electronics, and then have it drive a separate, smaller antenna array panel. This may work for a 4x4 element array,

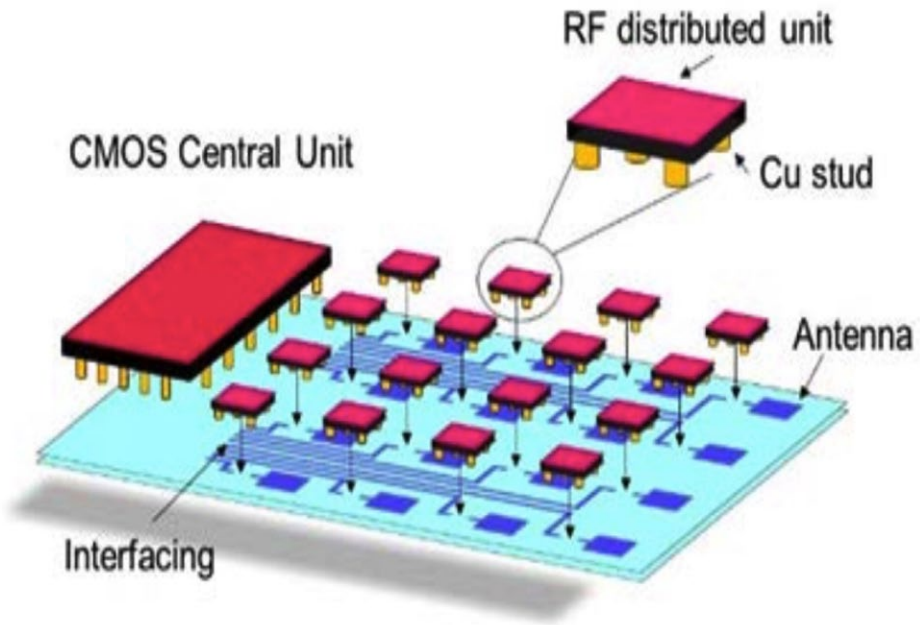


Figure 3: A 4x4 antenna array panel, with distributed elements per element and a central processing unit (Source: AMPLEON).

but is impractical for arrays with tens or hundreds of antennas.

BUILDING A SPARSE ANTENNA ARRAY

One solution may be to use sparse array architectures, in which the distances between the antenna elements are much larger than the transmitted wavelength, but the array still should not generate unwanted side lobes or grating lobes next to the transmitted beam to avoid interference.

Antenna arrays with inter-element spacing equal to or larger than the transmitted wavelength λ give rise to unwanted grating lobes - if the elements are placed uniformly in a grid. If the elements are not spaced uniformly, as in the 150 element 'sunflower array' shown in Figure 4, the average inter-element spacing can be larger, in this case 5λ, without suffering from grating lobes [1].

To design a sunflower array, the elements are placed along a Fermat spiral (see Figure 5) so that with each turn, an equal amount of area is enclosed. The individual elements are positions on the spiral at multiples of the angle Χ, which is 4π/(3+√5), the so-called Golden Angle.

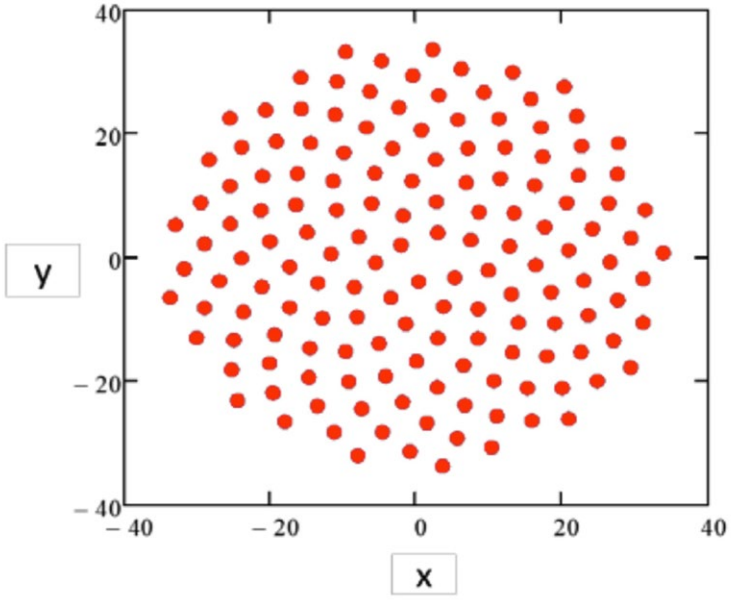


Figure 4: A non-uniform antenna array, modeled after a sunflower (Source: AMPLEON).

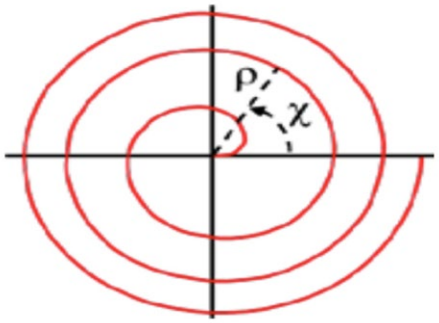


Figure 5: A Fermat spiral (Source:AMPLEON).

The sunflower array has an almost uniform power density, which simplifies cooling and makes effective use of the total aperture if all elements are excited to the same level. This arrangement does not generate unwanted grating lobes, and its beam angle can be steered as well as that of a dense array. This makes the sunflower array a good candidate for the kind of sparse arrays that will be needed in passively cooled 5G mm-wave antenna panels.

The 3 dB beam width of a sparse array is inversely proportional to the aperture size A, which means that using them to make cooling easier will mean accepting the design tradeoff of a narrower beam. Using reasonable assumptions for an access point with a range of 150m, simple calculations show that the maximum achievable beam width is probably 5 to 8 degrees – effectively a pencil beam.

CONCLUSIONS

Many research challenges remain before 5G systems will be deployed in the field. The most important ones for the physical hardware are reduction of power consumption and development of low-cost assembly techniques for the array panels.

REFERENCE

[1 Maria Carolina Vigano, Sunflower array antenna for multi-beam satellite applications, PhD Thesis TU Delft, 2011, ISBN 987-94-6113-030-3

Rik Jos holds a PhD in Physics from the University of Utrecht, The Netherlands. In 1986 he joined Philips Semiconductors in the development of RF technologies for power amplifier applications, where he was appointed a Philips Semiconductor Technology Fellow in 2002. Since 2004 he is also an adjunct professor at Chalmers University in Sweden. He has held leading positions in RF innovation in Philips and NXP Semiconductors. Since 2015 he is part of Ampleon in The Netherlands where he works on innovation of RF power technologies, especially wide bandgap semiconductors, and amplifier architectures, like switch mode power amplifiers. His current research activities focus on 5G mm-wave technologies and architectures.

Wi-Fi transmission achieved at 10,000 times lower power

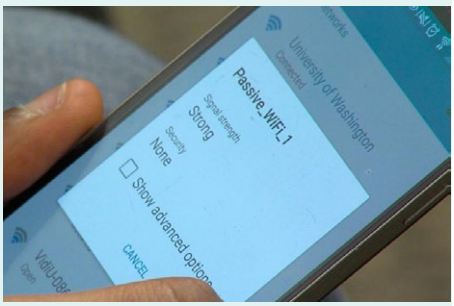
While Wi-Fi is everywhere, the downside is that using Wi-Fi consumes a significant amount of energy, draining the batteries of connected devices. To address this issue, a team of University of Washington computer scientists and electrical engineers has demonstrated that it's possible to generate Wi-Fi transmissions using 10,000 times less power than conventional methods.

The new Passive Wi-Fi system also consumes 1,000 times less power than existing energy-efficient wireless communication platforms, such as Bluetooth Low Energy and Zigbee. The technology has also been named one of the 10 breakthrough technologies of 2016 by MIT Technology Review.

Passive Wi-Fi can for the first time transmit Wi-Fi signals at bit rates of up to 11 Mbps that can be decoded on any of the billions of devices with Wi-Fi connectivity. These speeds are lower than the maximum Wi-Fi speeds but 11 times higher than Bluetooth. Aside from saving battery life on today's devices, wireless communication that uses almost no power will help enable an "Internet of Things" reality where household devices and wearable sensors can communicate using Wi-Fi without worrying about power.

To achieve such low-power Wi-Fi transmissions, the team essentially decoupled the digital and analog operations involved in radio transmissions. In the last 20 years, the digital side of that equation has become extremely energy efficient, but the analog components still consume a lot of power.

The Passive Wi-Fi architecture assigns the analog, power-intensive functions — like producing a signal at a specific frequency — to a single device in the network that is plugged into the wall. An array of sensors produces Wi-Fi packets of information using very little power by simply reflecting and absorbing that signal using a digital switch. In real-world conditions on the UW campus, the team found the passive Wi-Fi sensors and a smartphone can communicate even at distances of 100 feet between them. Because the sensors are creating actual Wi-Fi packets, they can communicate with any Wi-Fi enabled device right out of the box.



"Passive" Wi-Fi transmissions use 10,000 times less power than current methods. Image courtesy of University of Washington.

The technology could enable entirely new types of communication that haven't been possible because energy demands have outstripped available power supplies. It could also simplify our data-intensive worlds.

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NATIONAL INSTRUMENTS

Optimising DAS installations

By John Spindler, VP of marketing and product management at Zinwave

Given that installation costs can amount to 50 or 60 percent of the total cost of a distributed antenna system (DAS) deployment, it's important to select systems and cabling that minimise total cost of ownership (TCO). This article will take a look at three key factors in DAS installations that can impact TCO, which includes cable selection, future proofing, and facilities use.

CABLE SELECTION

The first factor impacting TCO is the cable infrastructure the system uses. The most common choices are coaxial cable, Cat 5/6, or fibre. The medium you choose has a lot of impact not only on TCO, but also on the system's performance.

Coaxial cabling was the first transport medium used for DAS installations. The older systems, as well as some of the newer ones, use a mixed infrastructure of fibre optic cable (generally used from the head end of the system to a closet-mounted remote unit) and a half inch diameter coax (the "last mile" from the remote unit to the passive antenna). When looking at material cost, a half inch coax is the most expensive of the various cable media typically used in a DAS solution. From an installation standpoint, a half inch coax is problematic because it is heavy, has an extremely limited bend radius – which if exceeded will stop the "flow" of RF similar to a kink in a garden hose – and often requires special cable trays to support its weight. In addition, connectorising a half inch coax can be both time-consuming and costly.

When considering all of these factors, the use of a half inch coax can add around 25 percent to 35 percent to the cost of installation, and it doesn't necessarily deliver the broadband capacity one would expect from such large cabling. In fact, RF signal attenuates as it travels over coax cabling, so there will be different output performance at different antennas, depending on the length of the cable run in each case. This makes system design and planning the antenna placement difficult and time-consuming. Note that a few DAS systems use thinner CATV (RG-6/U) cabling now, so the cable itself is easier to pull, but many of the same performance limitations still exist.

Another point to be considered regarding coax cabling is that if the DAS deployment demands use of multiple input/multiple output (MIMO) technology. This will require two antennas at each remote location and, therefore, two separate coax cable runs. MIMO is increasingly popular in DAS deployments because it delivers greater capacity than single input/single output (SISO) implementations (which have been the norm until recently), particularly for those applications where there is either a high user density, such as a stadium or airport, or a significant amount of wireless data use. But using MIMO means that installers must pull twice as much coax to support such an architecture, thereby doubling the material cost and greatly increasing the installation cost.

Cat 5/6 Ethernet cabling has been used by a number of DAS solutions, but many of these systems were introduced a number of years ago, prior to the proliferation of available mobile frequencies. This cable type is inherently a narrowband medium, so it's constrained in the amount of frequency it can practically support. In one system, for example, the vendor was only able to support a maximum of 37 MHz of bandwidth on a single Cat 5/6 cable. This is problematic in today's mobile-centric world, as some spectrum bands come in much broader swaths than that. So supporting a relatively meager 37 MHz of bandwidth only allows you to support a single mobile band or frequency (and in some instances only a portion of that band). Meeting today's frequency support requirements (which can require support of as many as 6-8 bands) would require independent layers of equipment and cabling for each band supported. Clearly, this kind of solution would radically impact the total cost.

The other limitation with Cat 5/6 which must be considered is run length. The distance is limited to only about 100 metres, so some installations, particularly those in larger venues, won't be possible with Cat 5/6 cable.

In contrast, fibre is a broadband transport medium that is thin, light, flexible, and can support many frequencies. While a few solutions can use either multi-mode or single mode fibre, single mode fibre is most commonly used in DAS systems. Given the broadband nature of fibre transport, some DAS systems which use fibre transport end-to-end – effectively from the headend to the antenna – can support mobile, public safety, and Gigabit Ethernet services on the same cable.

Fibre is also commonplace in any Class A building. Contractors put in bundles (generally speaking, using a minimum 12-strand fibre in a single bundle) in order to accommodate current and future services, so there may be existing fibre that can be leveraged for a

Figure 1: A DAS head-end.

DAS deployment in a building, thereby reducing the turnkey cost of the solution.

When using existing cabling, however, there are some issues to consider. While some DAS installations use existing fibre cabling to save the cost of pulling new cabling, installers need to be careful about what kinds of fibre and connectors have been installed, because some systems don't support multi-mode fibre. In addition, reflections in the fibre can cause issues; this is particularly true for multi-mode fibre. Typically, if multi-mode fibre is being used it will require the use of angle polished connectors (APC), not only at the start and end point of the cable run, but also at any intermediate point where a patch panel is in use. If APC connectors weren't used, it may require changing out not only all the fibre connectors but also the patch panels as well. And if the system does not support multi-mode fibre, and single mode fibre is not already available in the venue, then additional fibre will have to pulled to support the system. Another issue with fibre use is making sure that the fibre is not dirty – you will find that even with fibre pulled new, if it sits before you plug it in and commission the system, it can get dusty and you'll end up with system performance issues.

FUTURE PROOFING

DAS systems typically consist of a main hub or head-end – fed by an RF source such as a repeater or base station – connected via fibre, usually single mode, to either one or more secondary/intermediate hubs. This, in turn, distributes the signal via fibre to one or more remote units. Alternatively, the head end may be directly connected to the remote via fibre without an intermediate stage. The remote unit is the last point of amplification in the system; this gear is usually a rack-mounted chassis with card slots accommodating various radio frequency cards, each supporting one frequency.

The difference between hybrid fibre/coax DAS systems and all-fibre DAS systems is that with hybrid fibre/coax solutions, the remote is placed in a wiring closet or IDF, and the "last mile" of cabling is a half inch coaxial cabling used to feed passive antennas. With an all-fibre DAS, the remote and antenna are collocated (usually in the ceiling) and there is no use of a half inch coax cabling infrastructure.

Regardless of the system architecture, the challenge with most DAS systems is that they frequently must be upgraded with new equipment every time a new frequency is added. Operators add new frequencies every couple of years – and even public safety systems will soon be moving to 700 MHz frequencies – and this means adding new hardware and amplifiers to a conventional DAS. This is because, as mentioned previously, conventional DAS solutions use a separate amplifier to support each frequency, so they have to "stack" amplifiers in order to support more than one frequency. Today's demands typically require support of as many as eight frequencies. When it becomes necessary to add a frequency to the system, yet another amplifier must be added to the stack.

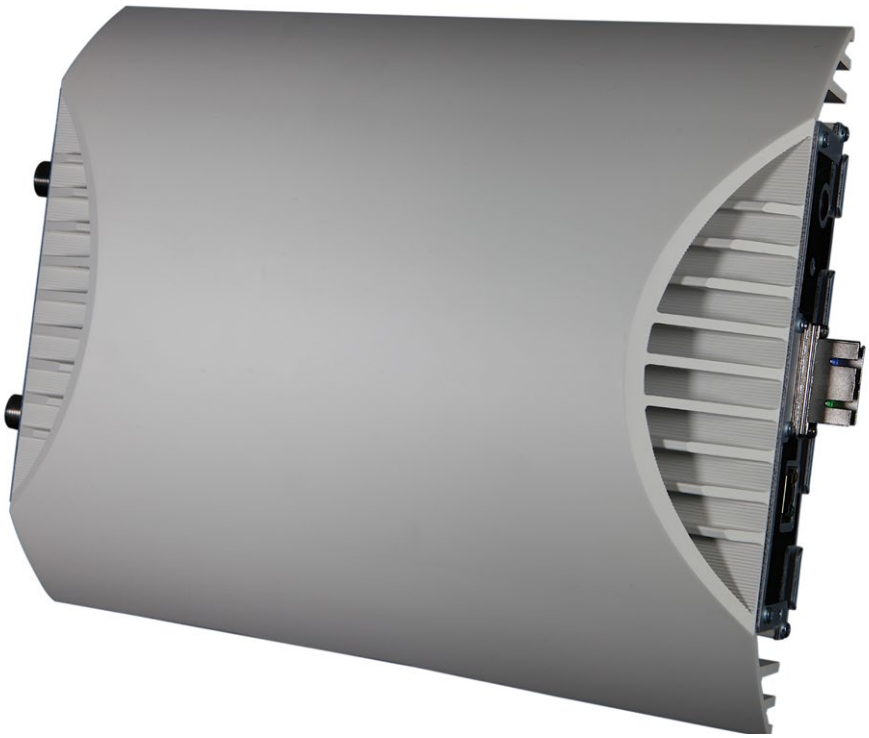


Figure 2: A ceiling-mounted RAU.

To add that additional amplifier to a conventional DAS you may need to add another card or blade into the head end, the intermediate hub (if one is being used), and in the remote unit, assuming the remote is a chassis which is closet-mounted and can accept cards or blades. With a self-contained ceiling-mounted remote – which is typically found in an all-fibre DAS – you would have to insert an add-on module, or you would add a second remote. That second remote would have to be daisy-chained off the primary remote, and if that's not possible, then you would end up deploying a whole new second layer of equipment simply to support one additional frequency. And this may be the case in any event if there is no additional space (card slots) in the head-end, intermediate hub, or remote chassis.

A truly wideband DAS is different; it uses a single amplifier that covers every frequency. Because of the high-power nature of this amplifier, it allows you to spread the amp's power across multiple frequencies – as well as operators using those frequencies – while being able to balance the power output at the end of the remote so that coverage is consistent for each and every frequency.

FACILITIES USE

When deploying a DAS, space for the needed equipment is always an issue. Equipment uses space, power, and cooling resources, so the size of the overall system impacts TCO.

There's a difference in size between types of DAS systems. Hybrid fibre coax systems, in particular, can be fairly large. Most hybrid fibre coax systems have a head-end hub which is rack mounted and can easily be accommodated in a standard telecom or IT room, but the remotes, which are typically 4-6U high rack- or wall-mounted units, go in the tight confines of a wiring closet. Finding the necessary space and power for these units can often be a challenge. You should also consider the amount of space the cabling takes – it spreads from the remote unit to 4-8 antenna points, and that's a pretty heavy foot-

print caused by the cable infrastructure when you are using heavy coax.

The head-end is also a space consideration. Space is precious in equipment rooms and data centres, and, while the head-end hub of a DAS solution may not be a space issue, most DAS systems require attenuation panels between the carrier base station and the DAS head-end to condition the carrier base station's signal. This is necessary to ensure that the signal is of an appropriate strength so it can be fed to the DAS head-end without damaging the equipment. Most DAS manufacturers now use active integration panels to reduce the amount of such "plumbing" required, and some even use direct digital interfaces so the base station can talk directly to the head-end without a lot of intermediate "plumbing." But even with these improvements, the space requirements – as well as power and HVAC – can be significant, particularly for larger buildings supporting multiple wireless operators.

RECOMMENDATIONS

While Cat 5/6 Ethernet may be a tempting DAS system cabling option because of its ubiquity, its distance and capacity constraints make it suitable only for smaller buildings and applications requiring support of only one or two wireless frequencies. As we've seen, while the use of coax cabling provides more available bandwidth, even hybrid fibre coax systems have their drawbacks in terms of cost, reach and performance. A pure fibre cabling infrastructure offers the most advantages, particularly in terms of key attributes such as cost, performance, and flexibility.

Ultimately, given the relative characteristics of cable types and DAS architectures, it seems clear that a DAS which uses end-to-end fibre connectivity and a truly wideband amplification architecture will deliver the lowest TCO. This type of system will deliver a genuinely future proof solution, which is critical in today's rapidly changing wireless landscape.

John Spindler joined Zinwave as VP marketing and product management in November 2015 and has over 30 years' of product management and marketing experience in the wireless and telecommunications industries. His most recent role as director of product management was with TE/CommScope, and prior to this as VP marketing at ADC Telecommunications. John holds a BA degree in Psychology from UCLA and has an MBA from the Marshall School of Business at USC.

Qualcomm and Ericsson collaborate on 5G for commercial roll out

Qualcomm Incorporated, through its subsidiary, Qualcomm Technologies, Inc., and Ericsson have announced their collaboration on 5G technology development, early interoperability testing and coordination on select initiatives with leading mobile operators.

The companies will engage in early trials and verification of key 5G technology components to support the technical work required for 3GPP standardization in Release 15, which is expected to be completed in 2018. In order to enable standards-compliant 5G infrastructure and devices to be available shortly after the completion of Release 15, the companies are also driving interoperability in alignment with 3GPP to enable rapid adoption of new 5G standards.

With decades of experience shaping the evolution of mobile technologies including 3G and 4G LTE, Qualcomm Technologies and Ericsson are working on 5G research and development, standardization, interoperability testing and trials in cooperation with leading operators around the world.

This collaboration will further the goal of completing the first release of 3GPP 5G standards on time by supporting 3GPP with data from joint trials and will enable the two companies to perform early interoperability testing based on the evolving draft standard. Operators will be able to better understand the capabilities of 5G by trialing interoperable prototypes provided by the two companies with the intent of hastening the rollout of standards-compliant, commercial 5G infrastructure and devices.

In parallel with 5G development, Qualcomm Technologies and Ericsson will continue leading advancements in 4G with 3GPP LTE Advanced Pro, pioneering new technologies such as LTE in unlicensed spectrum (including LTE-U, Licensed-Assisted Access and MulteFire™), LTE IoT (including eMTC and NB-IOT) and advanced antenna techniques that bring many of the capabilities and use cases envisioned for 5G into today's LTE networks. The recent successful testing of Gigabit-class LTE with a major operator is an example of how collaboration in 3GPP LTE Advanced Pro will pave the path to envisioning 5G use cases and user experiences.

Matt Grob, executive vice president and chief technology officer, Qualcomm Technologies, Inc., commented, "Now that the vision and interest for 5G are well established, it is time to focus on the technical and engineering work required to support operator trials and commercial network launches."

"With many operators accelerating the 5G timelines, it is important for leading members in the ecosystem to work together to advance standards-based solutions that benefit consumers and society. Ericsson has a longstanding history of technical collaboration with Qualcomm Technologies and we look forward to continuing this as the companies lead the way towards 5G," said Ulf Ewaldsson, chief technical officer at Ericsson.

www.qualcomm.com

Nokia report shows smartphones account for 60% of infections

Nokia Security Center Berlin has released research findings showing that in the mobile networks, smartphones pulled ahead of Windows™-based computers and laptops, now accounting for 60% of the malware activity observed in the mobile space.

The Nokia Threat Intelligence Report also reveals an increase in iOS-based malware, growing sophistication of Android malware and the rising threat of mobile ransomware. The report examines general trends and statistics for malware infections in devices connected through mobile and fixed networks. Data is aggregated where Nokia malware detection technology is deployed, with more than 100 million devices covered.

Due to a decrease in adware activity the overall infection rate in mobile networks declined from 0.75% to 0.49% on Windows-based PCs connected to the Internet via the mobile network in the second half of 2015. In the same time period, smartphone infection rates increased and now account for 60% of infections detected in the mobile network.

For first time since the report began iOS-based malware – including XcodeGhost and FlexiSpy – is on the top 20 list. In October 2015 alone, iPhone malware represented 6% of total infections. The XcodeGhost malware was injected into apps through a compromised software development kit that was used by Chinese developers to create legitimate apps distributed via the Apple App Store. Apple has removed these apps from the Apple Store, but some malware remains active.

Ransomware — malware that effectively holds a device hostage by encrypting data and then locking it — like CryptoLocker has been around for a while on Windows PCs, but 2015 saw several varieties attacking Android, as well. Recovery can only be achieved by paying the attacker a ransom fee via a prepaid cash voucher or with bitcoins.

Mobile malware is becoming more sophisticated in the techniques it uses to persist on the device. It is becoming very difficult to uninstall and can even survive a factory reset.

http://nokia.com

Test tool sniffs mobile payments transactions at the POS

Regardless of already existing contactless communication standards such as NFC and EMVCo, the payment service providers and terminal vendors are still coping with teething problems resulting from the large number of smartphones, point-of-sale (POS) terminals, and technologies used.

Test manufacturer Comprion and test service provider P3 have teamed up to develop the nano tracer, a portable tool dedicated to monitor NFC based payment transactions at the point-of-sale (POS).

The nano tracer is a testing tool embedded in a smartphone case which is able to trace payment transactions under real-life conditions. While carrying out a common mobile purchase at the point-of-sale, nano tracer captures the contactless transaction data between the smartphone and the POS terminal. The whole tracing process happens in a very inconspicuous way without affecting the daily business and without influencing the payment transaction itself.

Once collected, Comprion's monitoring software processes, displays and analyzes the communication data. The analyzing software visualizes if communication failures were caused either by the mobile phone or the POS terminal.

The smartphone case will be available as a standard for Samsung Galaxy S6 or iPhone 6S but can also be customized for other smartphones.

www.comprion.com

Smartphone technology adapted into super-sensitive gravity detector

Scientists have found a way to adapt a system often found in smartphones – to create a super-sensitive detector capable of measuring minute changes in gravity.

In a paper published in Nature, researchers from the University of Glasgow describe how they have adapted cheap, widely-available technology to make a small but powerful gravimeter for the first time. Affordable, portable gravimeters could have a wide range of applications, including volcano monitoring, environmental surveying, and oil exploration.

The detector, built at the University's James Watt Nanofabrication Centre, is a collaboration between the School of Physics and Astronomy (Institute for Gravitational Research) and the School of Engineering (Electrical & Nanoscale). The work is one of the first research outcomes from QuantIC, the UK's centre of excellence for research, development and innovation in quantum enhanced imaging, which was established in 2015.

Gravimeters measure the gravitational field of the Earth. Although these devices have been available commercially for decades, and are often used in the oil and gas industry to discover fossil fuel deposits, widespread uptake has been limited due to their expense and large physical size.

The team's new device, which they have named 'Wee-g', uses the same cheap, mass-producible micro-electro-mechanical systems (MEMS) which are used in smartphones' internal accelerometers. While the MEMS technology in phones uses relatively stiff and insensitive springs to maintain the orientation of the screen relative to the Earth, Wee-g employs a silicon spring ten times thinner than a human hair. This allows Wee-g's 12mm-square sensor to detect very small changes in gravity.

The team used their device to measure the Earth tides from the basement of the University's Kelvin building. Many people are familiar with the idea that the gravitational pull of the moon affects the tides of the planet's seas and oceans, but the moon and the sun also exert a subtle effect on the Earth's crust, an effect known as the 'Earth tides'. The pull of the sun and the moon displace the crust, creating a very slight expansion and contraction of the planet of around 40 cm.

Dr Giles Hammond of the University's School of Physics and Astronomy, one of the co-authors of the paper, said: "The Earth tides are a well-established phenomenon, which we're able to accurately predict using mathematical models.

"One of the factors which separates gravimeters from simple accelerometers is stability, allowing users to monitor variations in gravity over the course of several days-weeks. We used our Wee-g system to monitor the Earth tides under Glasgow over the course of several days, and our results aligned perfectly with the variations in gravity the model had predicted.

"The significance of this is two-fold: firstly, we've shown that a MEMS device can maintain its stability over a long period of time, and secondly, that a device which could easily be built using existing mass-production technology can act as a very accurate gravimeter."

Co-author Richard Middlemiss said: "There are a lot of potential industrial applications for gravimeters, but their cost and bulkiness have made them impractical in many situations. Wee-g opens up the possibility of making gravity measurement a much more realistic proposition for all kinds of industries: gravity surveys for geophysical exploration could be carried out with drones instead of planes; and networks of MEMS gravimeters could be places around volcanoes to monitor the intrusion of magma that occurs before an eruption – acting as an early warning system.

www.glasgow.ac.uk

Virtual networks, real challenges: maintaining a consistent subscriber experience

By Said Saadeh, Senior Director, Products and Portfolio Management, NETSCOUT's Service Provider Business Unit

Operators are no strangers to change. From 2G to 3G and on to LTE, each significant milestone in the mobile lifecycle has increased the complexity of managing the network. The shift to LTE has had the biggest impact to date, putting additional pressure on operators to deliver a consistent quality of experience to a user base now heavily reliant on data services. At a time when OTT applications are capturing subscriber attention and having a direct impact on traditional operator revenue streams, this has become a highly complicated issue, even if it's not a new one.

Operators have long faced the challenge of reducing operating costs while increasing the speed of service delivery, especially in the modern IP-based mobile environment. They are currently experiencing the two-pronged attack of price pressures along with managing demand for network capacity to support next-generation services amid the rigidity of the telecoms landscape. Progress is slow. This had led operators to take an alternative approach – revolutionising the mobile network through Network Functions Virtualisation (NFV).

FORM AND FUNCTION

The biggest benefit of NFV is also its Achilles' heel in terms of maintaining a consistent Quality of Service. Through NFV, mobile operators are finding themselves in an environment that's increasingly software-defined. Just as enterprise IT has gone through a process of virtualisation, where functions such as storage are controlled via software rather than hardware, mobile operators are now looking to virtualise network node functions such as session border control, firewalls, and encryption.

The increased agility of a virtualised environment means mobile operators can adapt their networks quickly, and new operator-branded services can be added in minutes rather than days. There still exists the complexity of running and troubleshooting a network. But this new agility adds another set of variables to the equation. The criticality of having best-in-class service assurance is paramount. Furthermore, there is an increased potential for service disruption to occur, which has made the shift to NFV a double-edge sword. Although operators can improve user experience by being able to deploy new applications and functionality closer to the network edge, subscriber churn or reputation damage is bound to happen if said operator delivers anything less than stellar and consistent performance.

This challenge is partly driven by today's industry landscape. The increasingly competitive mobile environment demands total service uptime, meaning that every NFV mobile experience must be of the highest quality – rapid, responsive, and without disruption. With this in mind, there's no avoiding the fact an operator's ability to maintain a consistent subscriber experience during the shift from a physical to virtualised network design will make or break the success of NFV initiatives. Real-time tracking and monitoring of network resources, therefore, is even more important in a virtualised environment, helping to flag network issues and allow operators to resolve problems as they emerge, long before the end user even becomes aware of them.

SERVICE ASSURANCE: IN PLAIN VIEW

For operators, this may feel like a temporary step backwards. In the physical network environment they have streamlined hardware performance over the past decade with great success. Through 'on-the-fly' analysis of network data, operators can identify root causes of issues immediately and rapidly restore service levels. Such analytical approaches are fundamentally important to understanding network and application performance, and are vital to assuring the quality and continuity of services delivered over virtualised networks.

Operators are already accustomed to having full visibility of activity across

their legacy and all-IP networks, yet the same cannot be said for new virtualised assets. There's also a greater degree of complexity that must be managed in the case of NFV-enabled networks. This is because many of the virtualised functions that make up a virtualised network are absolutely critical to service quality, including authentication services, routing and switching functionality, and domain name services. If operators cannot view the performance of these elements in real-time, it is highly likely that the end user experience will suffer.

Working with the right service assurance provider will become a necessity as a result. Not only to retain the end-to-end visibility operators have come to expect, but to help them unlock the valuable commercial driver that NFV represents without damaging their bottom line in the process. By doing so, operators will also be able to pre-empt service issues or network degradation by constantly monitoring and adapting network performance in real-time, thereby extending the role of service assurance beyond troubleshooting and issue prevention into an end-to-end resource management capability.

To make this a reality, big data will have a key role to play. In addition to working with an advanced service assurance provider, operators will need

a handle on the wealth of data residing on their networks for the purpose of predictive analytics. This will help identify trends, patterns and subscriber behaviour, which will be infinitely useful when it comes to maximising network performance and improving the subscriber experience. This approach will also give operators the insights needed to dynamically scale resources up and down to cope with drastic changes in network traffic. Combined with network automation, through a system fed by big data from the network in real time, operators can truly make their networks work for them.

Ultimately, migration to network virtualisation will be a gradual process. Although some implementations are already in place and interest in NFV has ramped up significantly, both physical and virtual network assets will continue to exist side by side for some time in a heterogeneous network. Yet this only goes to show how important service assurance and real-time monitoring software, capable of supporting a hybrid network design, will be for operators in 2016 and beyond. With virtualised networks representing a patchwork of different and ever-changing network functions, it's imperative that operators consider how best to maintain the quality of subscriber experience at all times to ensure the risks associated with NFV do not outweigh the reward.

Said Saadeh is senior director of products and portfolio management for NETSCOUT's Service Provider Business Unit. NETSCOUT is a market leader in real-time service assurance for today's most demanding service provider networks.

Tools cut DAS testing times by up to 90%

The SkyBridge Tools™ cloud-based test management system from Anritsu has added enhanced features that reduce the time associated with testing and verifying distributed antenna systems (DAS) by as much as 90%. SkyBridge Tools can serve as a DAS test management tool that automatically creates detailed test plans based upon easily imported test criteria to greatly simplify installation and commissioning of in-building wireless systems for more timely reimbursement of completed work.

Built on a Microsoft architecture, the latest version of SkyBridge Tools brings a more simplified test process to the DAS installation workflow. It accepts information from iBwave designer, Excel, and customer-supplied test criteria. It quickly and automatically processes this data to create comprehensive test plans that enable test sequencing, job progress tracking, trace judgement, and report generation. Also included in the new SkyBridge Tools is a unique easyTest feature that allows a set of one-button instrument control scripts to be created from a test plan. Necessary tests as well as accurate instrument setups, limit lines, and required file names for the resulting traces are included in the script, dramatically reducing test time, miscommunications, and errors.

Because it is an automated process, SkyBridge Tools is a significant advancement in improving the workflow of installing and commissioning DAS, which may require 1,000 to 15,000 traces, photos, and other deliverables to verify that the installation of a single system meets performance standards.

SkyBridge Tools can be used with a number of different Anritsu field instruments to create a complete DAS test solution. It can be integrated with the industry leading Site Master™ "L" and "E" series handheld cable and antenna analyzers, PIM Master™ MW82119B portable PIM analyzer, Cell Master™ "E" series base station analyzers, and BTS Master™ MT8220T. It can also be used with Anritsu fiber field systems including Network Master™ MT9090A, ACCESS Master™ series, and CMA multi-layer network test and measurement platform.

www.anritsu.com

Grenoble, Shanghai sign research deal for SOI, IoT

The Shanghai Industrial Microtechnology Research Institute (SITRI) has made an agreement with France's state-funded CEA-Leti research institute (Grenoble, France) and the Minatec innovation campus to collaborate on developing technology for the Internet of Things.

SITRI, which was founded in 2013, is a research center, engineering resource and incubator for startups with a focus on the Internet of Things. SITRI is building a 200mm pilot line wafer fab for MEMS and other processes to help with that function.

The framework collaboration agreement includes microelectromechanical systems (MEMS) and sensors, 5G RF front ends, ultra-low power computing and communication, radio-frequency silicon-on-insulator (RFSOI) and fully depleted silicon-on-insulator (FDSOI) technologies. CEA-Leti has pioneered silicon-on-insulator, MEMS and NEMS systems and the use of through silicon vias for 3D monolithic integration.

"Through this agreement and SITRI's established platform for More-than-Moore commercialization, we can accelerate the adoption of these latest technologies and create a global innovation ecosystem for emerging IoT applications," said Charles Yang, president of SITRI in a statement.

www.sitrigroup.com
www.leti.fr
www.minatec.org

R&S FSWP: measuring phase noise from high-end signal sources for radar applications

By Rohde & Schwarz

INTRODUCTION

Signal source quality is a primary driver of performance in advanced radar applications. Lower phase noise means better spatial resolution and more accurate velocity readings on moving objects. To measure the phase noise of these signal sources in pulsed mode and to improve performance, developers require highly complex systems consisting of numerous components such as phase detectors, FFT analyzers and very good reference sources. These sources must deliver significantly better quality than DUTs in order to ensure accurate measurements. If this is not possible, developers can also use the cross correlation technology i.e., two parallel receive paths, two difference reference sources and two phase detectors. Engineers can suppress the inherent noise of the sources and test setup components by averaging the noise that results from the two measurement paths. The test setup thus becomes extremely complex but delivers significant gains in terms of sensitivity.

The equation below describes the improvement that can be expected:

$\Delta L = 5 \cdot \log(n)$ [Also referred to as additive phase noise], where ΔL is the improvement in phase noise sensitivity through cross-correlation (in dB) and n is the number of correlations/averages

Increasing the number of correlations by a factor of 10, for example, lowers the phase noise of the test setup by 5 dB.

Phase noise, however, is a key parameter for more than just radar applications, and developers have to use these complex systems to carry out sensitive measuring tasks. The technology is also needed for measuring highly sensitive oscillators such as OCXOs, DROs and synthesizers used for scientific and communications applications.

The R&S FSWP phase noise analyzer and VCO tester (Figure 1) now offers all these necessary measurements at the push of a button on a single device without any complex setups. It enables developers to concentrate on improving their system instead of dealing with T&M equipment. Extremely good

Figure 1: R&S FSWP phase noise analyzer and VCO tester. The screen shows a trace of a high end OCXO with –190 dBc/Hz at a frequency offset of 1 MHz.

internal reference sources and cross-correlation technologies combined with additional measurement options such as phase noise measurement of pulsed sources and residual phase noise characterization (also pulsed) of components at the push of a button make the test instrument unique for radar applications.

The R&S FSWP can also operate as a signal and spectrum analyzer to verify, for example, if a signal to be measured has the expected level and frequency. The R&S®FSWP is an all-in-one solution, so technicians can easily switch between various measurement channels. A quick glance at the spectrum and then on with phase noise measurements – no problem.

MEASURING PHASE AND AMPLITUDE NOISE WITH HIGH SENSITIVITY

The R&S®FSWP requires no external reference sources or other complex setups to measure the phase noise of stable radar system oscillators. Its in-

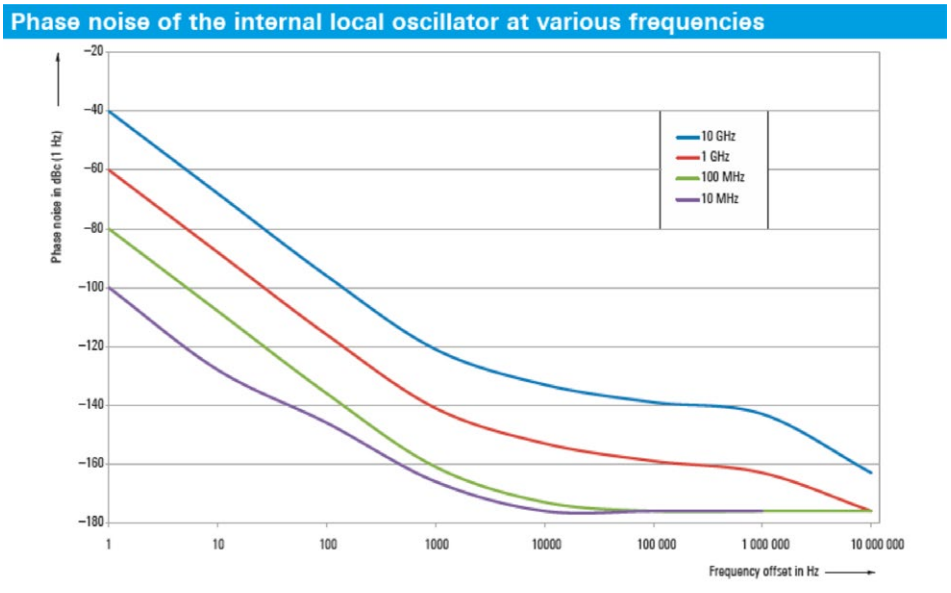


Figure 2: Phase noise of the R&S FSWP local oscillator at various frequencies.

ternal local oscillator surpasses almost any generator or source available on the market when it comes to phase noise performance. Figure 2 shows a typical phase noise value for an internal oscillator. If even better sensitivity is required, cross correlation uses a second internal local oscillator to improve sensitivity to 25 dB (R&S®FSWP-B60 option). A gray area below the trace shows the achievable level of sensitivity for a particular measurement for the selected number of correlations (see Figure 3). The correlation process can be aborted automatically if adding more correlations fails to improve the sensitivity. Thanks to the analyzer's very low noise internal sources, often only a few correlations are in fact needed to measure a high-quality oscillator. Users receive reliable results for extremely sensitive measurements up to 100 times faster than with comparable systems – an advantage that reduces development and manufacturing times.

The R&S®FSWP mixes the signal into the baseband and then digitizes and demodulates it. In addition to phase noise, it can measure amplitude noise – a parameter of increasing importance especially for digital modulation methods. Users can take advantage of cross correlation in this case as well to measure with over 20 dB more sensitivity than with diode detectors (currently most common method). Phase and amplitude noise can also be displayed simultaneously in a diagram or in two windows (see Figure 3).

PHASE NOISE MEASUREMENTS ON PULSED SOURCES AT THE PUSH OF A BUTTON

Signals from radar systems in the A&D sector are almost always pulsed. In the past, the test setup for phase noise measurements of these signal sources required extremely costly, complex systems, as the necessary pulsed sources had to be synchronized with the DUT. The engineers also needed accurate pulse parameter information and a great deal of patience to achieve stable measurements. That is now history. When equipped with the R&S®FSWP-K4 option, the R&S®FSWP now carries out these measurements at the push of a button. It records the signal, automatically calculates all parameters such as pulse repetition rate and pulse width (see Figure 3), demodulates the signal and displays the phase and amplitude noise. Maximum offset range and measurement calibration take place

Figure 3: Measuring a pulsed signal with the spectrum analyzer in the time and frequency domain (below) and with the phase noise analyzer (above). The upper left window shows the phase noise of the pulsed source; the upper right window displays the amplitude noise. The results can be displayed in separate windows or together in one window. The gray area represents the sensitivity gained through cross correlation.

automatically. Users do not have to worry about correctly setting these parameters. In any case, they can also define a gate, for example, to suppress transients or increase sensitivity (Figure 4). Cross correlation can also be used to measure very good sources, to compensate for desensitization, which reduces the dynamic range, as longer pulse off times produce significantly lower average signal strength with pulsed signals.

As a signal analyzer, the R&S FSWP does more than measure the phase noise of pulsed signals. Equipped with the R&S FSWP-K6 option, it also automatically identifies all of the additional parameters required for characterization of pulsed sources e.g., pulse rise and fall times, phase and frequency response and parameter trends.

INTERNAL SOURCE FOR MEASURING RESIDUAL PHASE NOISE, ALSO ON PULSED SIGNALS

When characterizing and optimizing radar systems, it is also important to know the residual phase noise of components such as amplifiers. The R&S®FSWP offers an internal signal source (R&S®FSWP-B64) for this purpose. Two port components can have a negative impact on the phase noise of a signal and add noise (residual phase noise), even though they do not generate a signal. When developing high end

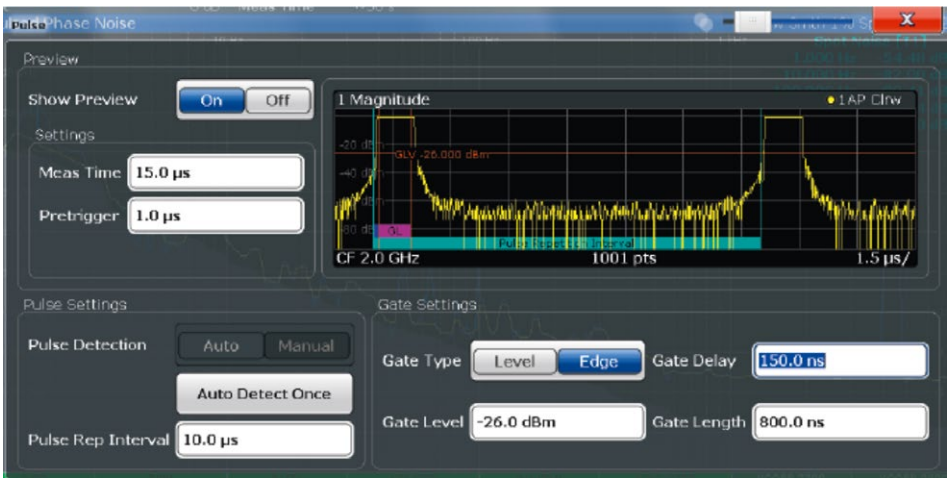


Figure 4: The instrument measures pulse parameters automatically, yet users still have the freedom to define the gates.

radar applications, for instance, it is vital to know how much phase noise these individual components such as amplifiers are adding to the local oscillator in the signal path. Only then is it possible to develop extremely low noise transmitters. The R&S FSWP carries out this previously complex measurement requiring extremely good sources and phase shifters at the push of a button. Users simply connect the internal signal source to the input of the DUT and the DUT output back to the R&S®FSWP. The residual phase noise of the DUT is then available. The R&S®FSWP uses cross correlation for this operating mode as well to suppress the residual phase noise of the internal frequency converter.

Equipped with the R&S®FSWP-K4 option, the R&S®FSWP can measure residual phase noise on pulsed signals. When characterizing and optimizing the components of radar transmitters, measurement must take place under real-world conditions i.e., with pulsed signals. This is due to the fact that pulsed and continuous signals have different effects on component behavior.

SUMMARY
The new R&S FSWP phase noise analyzer and VCO tester offers more than one of a kind sensitivity for phase noise measurements. This instrument is unparalleled in terms of user friendliness and range of measurement options. It measures the phase and amplitude noise of continuous and pulsed signals. The R&S FSWP also measures residual phase noise and can be used as a signal and spectrum analyzer.

Car to cloud gateway reference design for Big Data analytics

Movimento and Aricent have unveiled a reference design for an intelligent automotive gateway, that will have a closed-loop OTA analytics system to continuously update and improve vehicle performance and services.

The sensors on today's automobiles generate enormous amounts of data but until today, virtually all of it has gone uncollected and unanalyzed. That has now changed with the introduction of what is claimed to be the industry's first reference design for an on-board gateway and cloud-based service that will intelligently bring data to the cloud and turn that data into easy to understand, insightful business intelligence.

The raw data that is being generated by on-board sensors, cameras, Lidar, amongst others, will only accelerate as ADAS and self-driving cars become a reality — a rate that is expected to reach 1 gigabits per second by 2020, according to an Intel report.

"This data could amount to 5.4 terabytes daily," explained Mahbubul Alam, CTO of Movimento Group.

"Imagine if this data was analyzed and used to create vehicle improvements and cost savings. We're currently gathering less than 1% of the data generated," he added. "Car manufacturers and Tier One vendors have known they need to start making use of all this data but they don't have the resources to properly collect and analyze it. Now for the first time, they have a way to develop an intelligent car-to-cloud data analytics solution."

The in-vehicle communications gateway relies upon Movimento's smart data agent to selectively gather, aggregate and filter data and then send to the cloud for detailed analysis and action. The gateway links to a car's internal communications bus and includes all the connectivity, storage and compute power. A cloud-based analytics platform and rules engine developed by Aricent allows the OEM to run both statistical and probabilistic models on the data to determine whether a software or firmware update should be scheduled at an appropriate time, for example at the next schedule maintenance event.

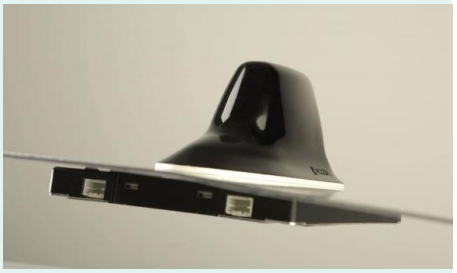
www.movimentogroup.com
www.aricent.com

Ficosa and Panasonic to collaborate on IoT for vehicles

A top-tier global technology provider for the automotive and mobility sectors, Ficosa has partnered with Panasonic to developed a Smart Connectivity Module (SCM) that enables all passengers to be simultaneously but independently connected through the vehicle's own connection.

The system offers a secure connection for communications inside and outside the car, and for communication between vehicles (V2V) and with infrastructure (V2X). The SCM provides important features to improve safety, such as how long the vehicle has been running without a stop, traffic density, weather conditions, dangerous areas and those with limited visibility in order to avoid accidents. It also allows users to surf the Internet, watch movies, listen to music, play online games and access the GNSS navigator, among other functions.

The unit is based on a connectivity platform that can be easily integrated into the car, which incorporates in one single device different sorts of telecommunications technologies, such as LTE, WiFi, Bluetooth, AM and FM, DAB and GNSS positioning for each specific

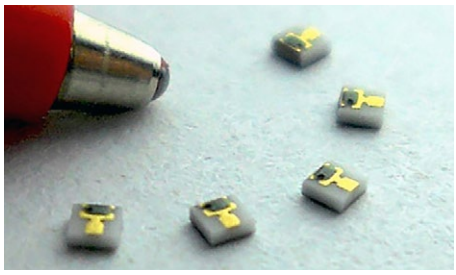


market and the mandatory emergency call in Europe (eCall) and Russia (ERA-GLONASS).

www.ficosa.com

DC to 60 GHz chip termination resistor

targets wireless backhauls



Barry Industries has introduced an ultra-broadband, DC to 60 GHz chip termination for microwave applications. The uniquely designed TV0404FA-50R0JN-91 has been third-party tested to show a typical return loss of 18.5 dB or better over a DC to 60 GHz bandwidth.

The TV0404FA-50R0JN-91 is a compact, 0404 (1.016- x 1.016-mm) size chip constructed of robust thick film on alumina with a wire-bondable input pad and epoxy or solderable ground. This 50 ohm impedance device is RoHS/REACH compliant and is rated at 250 mW on a 100°C mounting surface temperature. The TV0404FA-50R0JN-91 is available in bulk or tape and reel packaging for high-speed pick and place assembly.

www.barryind.com

Low-power IC delivers 100 Gbps

over SMF optical links

Socionext Inc., has launched the MB8AJ2060, its 100G per wavelength, fully- integrated transceiver based on Discrete-Multitone (DMT) modulation. With a power dissipation of less than 5 W, this system-on-chip sets a record for transmission of 100 Gbps using a single wavelength.

The MB8AJ2060 100G DMT PHY targets low-power, small-footprint optics and transmission over single-mode fiber (SMF). It features on-chip hardware for analog/digital conversion interface to optics, DMT modulation/demodulation, FEC processing and high-speed SerDes electrical interface. The device is protocol agnostic (transparent pass-through of client data signals), supports multiple 100 Gbps-class clients (100GE, ODU4, OTU4, 128GFC) and provides support for CAUI-4/OTL4.4/CPRI on client-side interface.

The MB8AJ2060 100G DMT PHY provides flexible data rates: line side of 25G, 50G, and 100G, as well as client-side sub-rates of 4x25G, 2x50G, and 1x75G. Other features include selectable low latency on-chip FEC; Link Communication Channel (LCC); end-to-end link negotiation and management; hitless, in-operation link diagnostics and reconfiguration; integrated CPU subsystem; device initialization and link training; link management and non-real time DMT algorithms; and on-chip, low-speed DAC for optics control.

www.socionext.com

IoT gateway starter kit

Advantech's IoT Gateway Starter Kit includes a ready-to-run system (Intel Celeron J1900 platform and Windows 7 Embedded), IoT software platform service (WISE-PaaS), software development kit and technical support service. Additionally, Advantech's hardware is verified to work with the Microsoft Azure cloud platform.

The kit provides powerful turnkey building blocks to connect machines, devices and sensors, and unifies different protocols as IoT standard: MQTT, then empowers IoT application development for data streaming, analytics and prediction solutions. The package comes as a pre-configured system featuring an Intel Celeron J1900 SoC and WES7E with 4GB Memory and 500GB HDD.

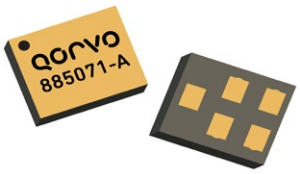
There are two gateways selected for the Starter Kit which have been verified through the Microsoft Azure Certified for IoT program; ultra-small: ARK-1123H or the multiple I/O: ARK-2121L. Both are designed to withstand harsh environments, with good scalability for networking and versatile I/O communication. Delivered with the package, software includes WISE-PaaS/RMM Pro version: IoT device remote monitoring and management software for data management, device monitoring/control and security.

As for IoT design-in services, Advantech provides gateway and security SDK, 100+ RESTful APIs, Node-RED logic editor design tools and documents. The kit includes three hours of online consulting services for customers to submit, manage, and track service status on their exclusive account.

www.advantech.eu/EmbCore

Automotive BAW coexistence filter

for WLAN/LTE applications



RFMW, Ltd., has announced design and sales support for an AEC-Q200 qualified bulk acoustic wave (BAW) filter designed for 2.4 GHz WLAN/WiFi/BlueTooth coexistence with 4G LTE and TD-LTE signals.

The Qorvo 885071-A offers high rejection in adjacent bands B7, B38, B40 and B41 allowing these various technologies to operate simultaneously and in close proximity. The 885071-A has a usable bandwidth of 100 MHz (2400 to 2500 MHz) and operates over a temperature range of -40 to +95 degrees C. With single-ended operation, the 885071-A comes in a hermetically sealed, 1.4 x 1.2 mm package capable of handling higher power levels than competing technologies.

www.rfmw.com

Qualcomm introduces Snapdragon virtual reality SDK

The Snapdragon VR SDK virtual reality (VR) software development kit (SDK) from Qualcomm Technologies, Inc., is designed to abstract the complexity of immersive virtual reality and provide developers with access to optimized, advanced VR features, to simplify development and to help them attain improved VR performance and power efficiency with the Snapdragon 820 for Android smartphones and upcoming VR headsets. The SDK is expected to be available in the second quarter of 2016 through the Qualcomm Developer Network.

The next generation of mobile virtual reality applications is complex, with extreme power consumption constraints

and challenging performance requirements that must be met in order for the VR applications to become truly immersive. Advanced heterogeneous processors like the Qualcomm® Snapdragon™ 820 processor are capable of supporting immersive VR experiences, but can also be difficult to fully utilize without the right set of tools for developers.

DSP sensor fusion: Utilizing the full breadth of technologies built into Snapdragon 820, the SDK enables developers to create more responsive and immersive experiences by easily accessing the right combination of high frequency inertial data from gyroscopes and accelerometers via the Snapdragon Sensor Core and predictive head position processing with the Qualcomm® Hexagon™ DSP.

Fast motion to photon: Supports asynchronous time warp with single buffer rendering for fast transformation of rendered images in 3D space, which helps reduce latency by up to 50% compared with not using the SDK.

Stereoscopic rendering with lens correction: Supports 3D binocular vision with color correction and barrel distortion for improved visual quality of graphics and video, enhancing the overall VR experience.

VR layering: Generation of menus, text, and other overlays so that they render correctly in a virtual world, reducing distortions that would otherwise make them difficult to read

Power management: Integration with the Qualcomm® Symphony System Manager SDK to provide cohesive CPU, GPU, and DSP power and performance management to help achieve stable frame rates for VR applications running in low-power, thermally-constrained devices – improving power efficiency compared to not using the SDK.

www.qualcomm.com

Low-power embedded Wi-Fi modules

target IoT market

Microchip Technology has announced four compact, low-power, highly integrated modules that allow Wi-Fi® and networking capability to be embedded into virtually any device, including Internet of Things (IoT) applications. These four modules provide complete solutions for 802.11b/g/n and are industry certified in multiple countries.

The RN1810 and RN1810E are standalone, surface-mount WiFly radio modules that include a TCP/IP stack, cryptographic accelerator, power management subsystem, 2.4-GHz 802.11b/g/n-compliant transceivers and 2.4 RF power amplifier. They can be paired with any microcontroller and configured using simple ASCII commands. WiFly provides designers with a simple data pipe for sending data over a Wi-Fi network, requiring no prior Wi-Fi experience to get a product connected. Once configured, the device automatically accesses a Wi-Fi network and sends and receives serial data. The RN1810 has an integrated PCB antenna while the RN1810E supports an external antenna.

The MRF24WN0MA and MRF24WN0MB are Wi-Fi modules that interface with Microchip's PIC32 microcontrollers and support Microchip's MPLAB® Harmony integrated software framework with a TCP/IP stack that can be downloaded for free from www.microchip.com/harmony. The modules connect to the microcontroller via a 4-wire SPI interface and are an ideal solution for low-power, low-data-rate Wi-Fi sensor networks, home automation, building automation and consumer applications. The MRF24WN0MA has an integrated PCB antenna while the MRF24WN0MB supports an external antenna.

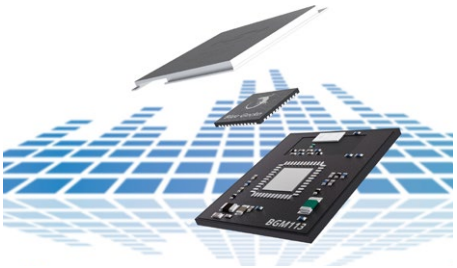
Each module is FCC (USA), IC (Canada) and ETSI (Europe) certified and supports multiple networking features including TCP/IP, Internet Protocol Version 6 (IPv6) and Secure Sockets Layer/Transport Layer Security (SSL/TLS 1.2).

www.microchip.com/wifi

Bluetooth module supports links up to 50 m

Silicon Labs has introduced a fully integrated, pre-certified Bluetooth module, only 9.2- x 15.8- x 1.83-mm in size, that delivers up to 3 dBm of output power for applications requiring up to a 50 m range.

The Blue Gecko BGM113 module combines a 2.4 GHz Blue Gecko wireless SoC (2.4 GHz transceiver with a 40 MHz ARM



Cortex-M4 core, 256kB flash and 32kB RAM) and a high-efficiency chip antenna into a complete, ready-to-use system. BGM113 modules are pre-loaded with Silicon Labs' Bluetooth 4.1-compliant software stack and are field-upgradable using device firmware upgrades to Bluetooth 4.2 and beyond. The BGM113 module frees developers from complex RF design or protocol decisions, allowing them to focus on the end applications.

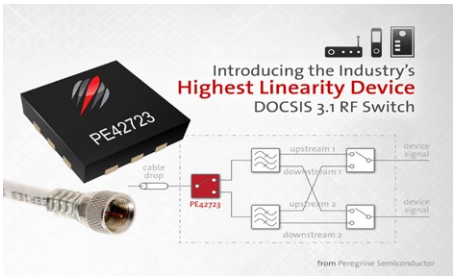
As a pre-certified solution, the module minimizes the time, effort and risk required for FCC/CE/IC certifications in North America and Europe and certifications for Japan and South Korea. The device is supported by Silicon Labs' Simplicity Studio development platform and wireless software development kit (SDK).

The module draws 8.7mA (peak receive mode) and 8.8mA at 0 dBm (peak transmit mode). It includes a hardware cryptography accelerator supporting advanced AES, ECC and SHA algorithms.

www.silabs.com

DOCSIS 3.1 RF switch

sets high linearity record



The UltraCMOS® PE42723, from Peregrine Semiconductor, is an RF switch that claims to offer the highest linearity specifications on the market today. An upgraded version of the successful PE42722, this latest RF switch offers enhanced performance in a smaller package.

Like its predecessor, the PE42723 exceeds the linearity requirements of the DOCSIS 3.1 cable industry standard and enables a dual upstream/downstream band architecture in cable customer premises equipment (CPE) devices.

Covering a frequency range of 5-1794 MHz, the UltraCMOS PE42723 is a reflective SPDT RF switch that delivers high linearity and exceptional harmonic performance. At 17 MHz, the second harmonic is -121 dBc and the third harmonic is -140 dBc. The switch's low insertion loss, 0.3 dB at 1218 MHz, preserves noise figure and receiver sensitivity and achieves superior signal quality, along with providing high isolation of 54 dB at 204 MHz. The PE42723 features 3 kV ESD protection on all pins. x

www.psemi.com

71 to 76 GHz waveguide bandpass filter

Sage Millimeter has released the Model SWF-74305350-12-B1 E-band, waveguide bandpass filter that is used to pass the frequency range of 71 to 76 GHz, while rejecting the frequency range of DC to 67 GHz and 81 to 90 GHz.

The nominal insertion loss of the bandpass filter is 2 dB and the typical rejection is 50 dB. The standard interface offers WR-12 waveguides with UG-387/U flanges. Since both low and high end cut off frequencies can be selected by modifying the design, various custom models are available.

The low cost waveguide bandpass filter is ideal for applications in communication systems, radar, and sub-assemblies. Typical passband VSWR is 1.2:1.

www.sagemillimeter.com

Multiband combiners

for expanding wireless networks

Microlab, a Wireless Telecom Group company, provides a full line of diplexers, triplexers, quadplexers, pentaplexers, and hexplexers to meet the needs of network expansion on existing and new antenna systems.

As the industry consumes more frequency spectrum there is a need to add new radios to existing antenna systems. These passive components combine the radios, with minimal insertion loss and high isolation between bands.

"These multiband combiners are essential in implementing multiple radios onto a common antenna transmission line", says Karl Hricko, Microlab Product Manager. "Not only are they stand alone products, they can also be used as building blocks in a customized DAS Point of Interface tray, fully integrated and fully tested by Microlab."

Microlab multiband combiners come with several options such as: indoor and outdoor models, pole/wall mount brackets, DC Pass options and common connector types including the new 4.3-10 low PIM connector. All Microlab low PIM products are 100% tested to meet a guaranteed level of PIM performance up to -161 dBc and better.

www.microlab.fxr.com

VNA test cables

rated to 50 and 67 GHz

Pasternack has introduced a range of durable, flexible precision VNA test cables rated to 50 and 67 GHz, depending on the series, that are able to withstand the rigors of test lab use where these cables are constantly flexed during common testing situations.

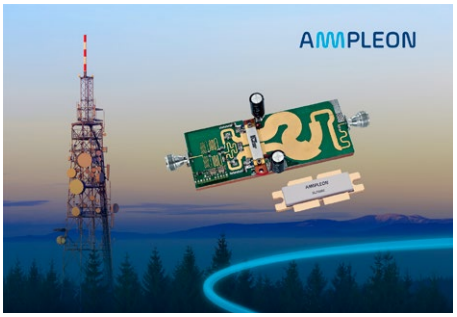
Designed for use as VNA test port extenders, the flexible VNA test cables claim excellent electrical properties including low VSWR of 1.3:1 at 50 GHz and 1.4:1 at 67 GHz as well as superb phase stability with flexure of ± 6° at 50 GHz with the 2.4 mm connectors and ± 8° at 67 GHz using 1.85 mm connectors. The braided stainless steel armoring surrounding the coax provides a rugged, but flexible cable with a flex life exceeding 100,000 cycles.

The rugged stainless steel 2.4 mm and 1.85 mm connectors provide up to 5,000 mating cycles when attached with proper care. Additionally, the flexibility of these cables makes it easier and safer to test a Device Under Test (DUT). A swept right angle connector option allows these cables to fit in tight spaces and can reduce the length of cable required in many applications.

www.pasternack.com

RF transistor

delivers over 50% efficiency at 150-W DVB-T



Ampleon has made available the BLF888E RF power transistor designed for DVB-T UHF asymmetrical wideband Doherty amplifier applications. Fabricated in a SOT539 package using a sixth generation high voltage LDMOS process, the transistor has greater than 50% power efficiency, this being typically up to 10% more efficient compared to previous devices.

With its high efficiency rating, the BLF888E helps reduce the energy consumption profile of the end-application. The average DVB-T power output is 150 W, representing typically a 25% increase in output power of previous devices making it one of the highest power levels available from a single transistor for such broadcast applications.

Also, the characteristics of the BLF888E provide a typical 120 MHz bandwidth per sub-band compared to the industry norm of 40 to 50 MHz narrow bands for similar applications.

To aid development of asymmetrical wideband Doherty amplifiers for UHF DVB-T applications a set of three evaluation boards are available on request that cater for the 470 to 590 MHz, 580 to 690 MHz and 650 to 790 MHz sub-bands. The amplifiers have a 1:1.5 main/peak power ratio and are driven from a 50 VDC supply. Three evaluation boards that cover the entire UHF band (470-800MHz) are also available.

www.ampleon.com



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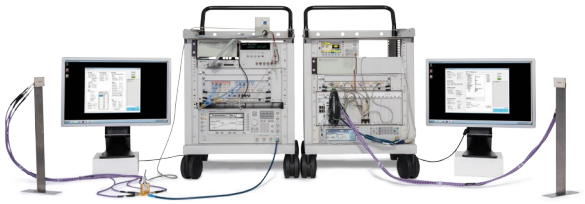
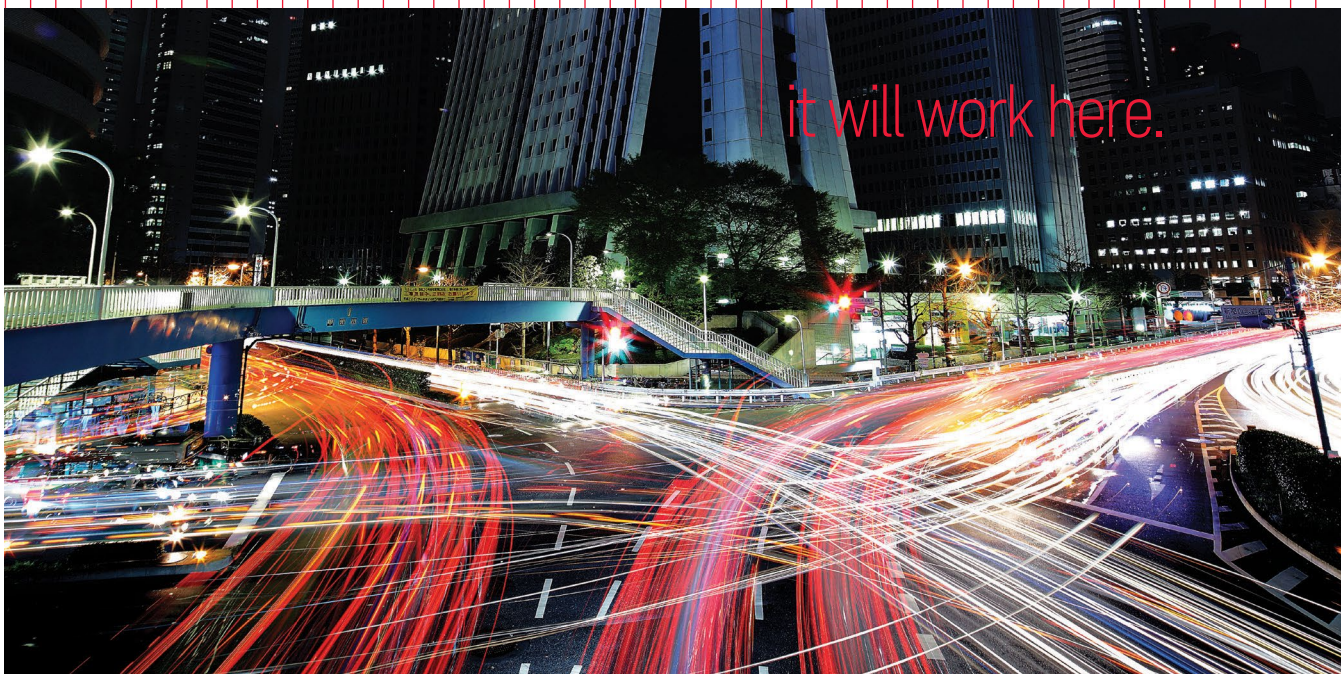
If your 5G idea works here...





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