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78 percent of tablets shipped will have 3G/4G modem in 2015, says In-Stat

Consumers of portable and computing devices require constant connectivity in order to access the Internet, engage in social networking, and share multimedia content. In fact, this consistent connected experience is imperative in today's digital lifestyle. New In-Stat research suggests that this trend represents an opportunity for mobile operators to move beyond the maturing handset market and into connecting emerging wireless device markets, like e-readers and tablets.

By 2015 for example, tablets will have the highest 3G/4G attach rate among all cellular-enabled portable and computing devices with 78 percent of tablets shipping with a 3G/4G modem, according to In-Stat.

"The emerging tablet market represents one of the strongest opportunities for embedded 3G/4G technology," says Stephanie Ethier, Senior Analyst. "Cellular connectivity will also continue to find its way into e-readers, as well. By 2015, 65 percent of e-readers worldwide will ship with an embedded 3G/4G modem."

Approximately 16 million portable and computing devices shipped with 3G/4G cellular connectivity in 2010. Over 50 percent of all 3G/4G tablets in 2015 will have LTE WAN connectivity and by 2015, 52 percent of cellular-connected portable and computing devices in Asia will be GSM devices according to In-Stat's latest report.

www.in-stat.com

Ofcom: 4G set to deliver capacity gains of more than 200 percent over 3G

The latest Ofcom research reveals that the next generation of mobile technology will deliver more than 200 percent of the capacity of existing 3G technologies, using the same amount of spectrum. This increased capacity is essential in meeting the UK's rapid increase in mobile traffic, fueled by the growth of smartphones and mobile broadband data services such as video streaming, email, messenger services, mapping services and social networking.

4G mobile technologies will be rolled out in the UK from 2013 and are set to deliver significantly faster mobile broadband services – approaching today's ADSL home broadband speeds. This will be achieved in part thanks to 4G using spectrum more efficiently.

Dr Stephen Unger, Chief Technology Officer at Ofcom said: "4G mobile technologies will be able to send more information than 3G, for a given amount of spectrum. This increased efficiency means that 4G networks will be able to support increased data rates and more users.

"The research that we commissioned indicates that early 4G mobile networks with standard configurations will be 3.3 times (230 percent) more spectrally efficient than today's standard 3G networks. To put this in context, a user on an early 4G network will be able to download a video in around a third of the time it takes today on a 3G network. It is anticipated that this efficiency will increase to approximately 5.5 times (450 percent) by 2020."

The research was conducted to understand the likely spectrum efficiency improvements that will be gained from 4G technologies, based on a review and analysis of both existing theoretical predictions and real-world trials in realistic deployments. This information provides a vital input into Ofcom's strategic spectrum management work. The research looked at a number of 4G technologies including Long Term Evolution (LTE) and later generations of LTE, which are still in development, such as LTE Advanced. It also considered emerging and later generations of WiMAX.

The research revealed that the capacity gain from the increased spectral efficiency of 4G technologies will not on its own be sufficient to meet the expected growth in demand for mobile data. As well as using existing spectrum more efficiently, more spectrum itself is also needed, some of which will be gained from the auction of new spectrum at 800 MHz and 2.6 GHz in 2012 – the largest ever single auction of additional spectrum for mobile services in the UK, equivalent to three quarters of the mobile spectrum in use today.

www.ofcom.org

IN BRIEF

GSA to work with MEMS Industry Group

The Global Semiconductor Alliance (GSA) industry body has announced that is has agreed to form an "organizational alliance" with the MEMS Industry Group (MIG) trade association.

The two groups have signed a memorandum of understanding undertaking that they will bring people and information together to promote the greater commercial use of MEMS and MEMS-enabled technology. GSA's newly-formed MEMS working group, co-chaired by Louis Ross, president, CEO and chairman of Virtus Advanced Sensors and Maarten Willems, CMORE business director at IMEC, will work with MIG on various events and initiatives.

"With an increasing number of semiconductor players entering the MEMS field as a potential high-value/high-growth market opportunity, it is pivotal that GSA provides a neutral forum for semiconductor companies, their suppliers and end customers to discuss pressing issues within the MEMS supply chain and establish an efficient and integrated ecosystem," said Jodi Shelton, president of GSA.

www.gsaglobal.org

Android wins 35% of Q1 smartphone market

Android led the market smartphones in the first quarter of 2011 with 35 percent market share and 35.7 million units shipped out of a total of 101.0 million shipped in total, according to market research firm Canalys Ltd.

Canalys (Reading, England) puts Android in the lead in smartphones for the second quarter running. At the same time, Canalys stated that Asia Pacific (APAC) became the largest smart phone market region, with year-on-year growth of 98 percent to 37.3 million units, putting it ahead of Europe, the Middle East and Africa (EMEA). On a country basis, mainland China, South Korea and India delivered strong volumes and registered triple-digit growth.

www.canalys.com

IN BRIEF

National Instruments to acquire AWR Corporation

National Instruments has announced that it has signed a definitive merger agreement under which NI will acquire AWR Corporation (AWR). AWR is a leading supplier of electronic design automation (EDA) software for designing RF and high-frequency components and systems for the semiconductor, aerospace and defence, communications and test equipment industries. Upon the closing of the transaction, AWR will continue to operate as a wholly owned NI subsidiary under the leadership of the existing management team.

By increasing the effectiveness of the integration between AWR design tools and NI software and hardware, NI and AWR together can significantly improve customer productivity through increased connectivity between design, validation and production test functions.

www.ni.com

£10 million funding for Nujira's smartphone vision

Nujira, the leading developer of technology to reduce power consumption in smartphone transmitters by 30 to 50 percent, has secured a further £10 million of funding for its growth plans.

The investment round, led by a new investor, Climate Change Capital Private Equity (CPE) and supported by existing investors Amadeus, NES Partners, Environmental Technologies Fund (ETF) and the angel investors, will reinforce Nujira's vision to install its Coolteq wideband Envelope Tracking technology into 800 million energy efficient 3G and 4G devices by 2016.

Nujira's technology has a compelling business case coupled with very attractive environmental attributes – a rare and exciting combination, according to James Hook, director of CPE. James will also be joining the Nujira board.

www.nujira.com

China and other developing markets to drive commercial telematics to $12 billion by 2016

Fleet management and trailer tracking system revenues will grow at a CAGR of 19.4 percent in the next five years, rising from about $5 billion in 2011 to exceed $12 billion in 2016.

ABI Research Telematics and Navigation Group Director Dominique Bonte comments: "While commercial telematics in developed markets such as North America and Western Europe is reaching maturity, especially in the trucking segment, the major growth in future is expected to come from developing regions where safety and security requirements are currently the main drivers. This trend is typified by mandates in Brazil (Stolen Vehicle Tracking legislation) and Russia (eCall on commercial vehicles by 2013)."

However, the biggest growth will come from Asia, with China leading the way as it moves from "developing" to "developed" status. While telematics in China has long been held back by small average fleet sizes, this is changing rapidly with a more organized and larger-scale transportation industry emerging. As fleets struggle to add a sufficient number of new vehicles to keep up with the surging economy, telematics becomes an important tool for optimizing the use of the limited available vehicle resources. International players such as Navman Wireless have already entered the Chinese market.

www.abiresearch.com

Rohde & Schwarz, Synopsys collaborate to boost LTE hardware design

With the LTE technology market approaching the stage of mass production, the demand for design support solutions is increasing. This in particular holds true for LTE Advanced technology. Measurement equipment maker Rohde & Schwarz and EDA software vendor Synopsys plan to get the ball rolling.

In a strategic collaboration, Rohde & Schwarz and Synopsys plan to exchange technological know-how which could enable design engineers to get their LTE and LTE Advanced designs done faster. At the same time, they will be able to verify their designs of base station, handset and dongle chipsets for the 4G mobile radio standard. The collaboration equally aims at the LTE Advanced standard for which currently no hardware is commercial available. The move also will help to improve standards compatibility, explained Markus Willems, Synopsys product manager for system-level solutions.

www.rohde-schwarz.com

Next generation scope powered by IBM's 8HP process

Tektronix has announced that test chips being manufactured for its next-generation oscilloscope, which will have more than 30 GHz bandwidth across multiple channels, are exceeding target specifications. Using IBM's 8HP SiGe BiCMOS specialty foundry technology, the ASICs are also expected to minimise the noise found in older chipsets.

The oscilloscope platform is intended to meet the need for accurate characterisation of high speed serial data beyond 10 Gbit/s, and enhance optical modulation analysis of 100 GbE where complex signaling requires accurate bit capture. It represents Tektronix' first commercial integration of its 8HP technology and promises that the new series of oscilloscopes will have the lowest noise and class-leading signal acquisition performance across multiple channels.

IBM's 8HP technology is a 130 nm SIGe process that offers twice the performance of previous generations. The first oscilloscopes using the ASICs are expected later this year.

www.tek.com

This month's cover depicts the two features in this issue — antennas and wireless networking. As 4G gains traction, the focus is now on deployment and costs. We are also getting an idea of what such networks will be able to offer in terms of capacity and efficiency.

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IN BRIEF

Skyworks to pay up to $275 million for SiGe

Analog and mixed-signal chip vendor Skyworks Solutions Inc., said it signed a definitive agreement to acquire front-end RF solutions provider SiGe Semiconductor Inc., for up to $275 million in cash.

Skyworks said the acquisition would complement the company's status in wide area front-end solutions. The compnay said it will be able to offer customers a comprehensive wireless networking product portfolio, supporting all key operating frequencies with architectural flexibility to address a variety of high growth applications.

Skyworks said it intends to immediately expand its addressable content opportunity within several strategic product areas including smart phones, tablets, gaming consoles, notebook PCs and home automation systems via the transaction.

Skyworks will pay $210 million in cash—plus an additional $65 million if certain performance targets are met over the next 12 months—to acquire SiGe. The transaction has been approved by Skyworks' and SiGe's boards of directors and is anticipated to close in June, the company said.

www.skyworksinc.com

Sequans, Ericsson in collaboration on LTE

Sequans Communications SA, a provider of chips for 4G communications, and Ericsson, the Swedish provider of technology and services to mobile operators, are now collaborating to develop and mature TD-LTE technology for the global marketplace.

"Our cooperation with Ericsson will yield valuable results for the LTE ecosystem," said Georges Karam, Sequans CEO, in a statement. "Both our companies are focused on developing LTE technology, specifically for the major TD-LTE operator trials coming soon to India and elsewhere."

www.sequans.com
www.ericsson.com

FCC TETRA ruling creates new opportunities in the US for TETRA suppliers

IMS Research reports that on the 26th April 2011 the US Federal Communications Commission (FCC) approved the use of TETRA products in the US market for industrial, business and transport users.

After considering the TETRA Association's application for a waiver for over 18 months, the FCC has granted its approval for products conforming to TETRA (Terrestrial Trunked Radio) standards for voice and data communications to be released in the U.S. This is a significant development and should open the doorway to a potential race for market share for current TETRA suppliers.

Thomas Lynch, Mobile Radio Market Analyst, IMS Research, states, "This is a significant step and interesting times for those already involved in the TETRA market. With immediate and direct demand in place we expect to see an increase in shipments of TETRA over the next few years"

IMS Research's latest information reports that there is immediate demand for TETRA solutions within the US market and that we should expect unit numbers to increase against previous expectations. This is partly due to the fact that TETRA provides a direct solution to the US market as this technology addresses current narrowband legislation offering 6.25 kHz channel efficiency.

However, there are still many hurdles for TETRA to overcome in the US and it will be some time before it becomes clear just how successful the technology will be. The US public safety market is already served by P25 and other digital technologies such as DMR have already made inroads in other application areas. Furthermore, TETRA has not yet been approved for use on public safety and channel bands 800 MHz where P25 dominates.

"Investigations into possible gateway systems that would allow for P25 and TETRA interoperability may extend the waiver beyond the current restrictions; however, it is unclear at this stage as to the time frame for this" states Lynch. Should an interoperability solution be developed it will certainly inject an interesting new dynamic to the US market with so many manufacturers currently reliant upon the success of P25.

www.imsresearch.com

Report defines the future of LTE femtocells

The Femto Forum, the independent industry and operator association that supports femtocell deployment worldwide, has published an operator friendly guide to the LTE femtocell architecture options in the 3GPP standard. The guide concludes that operators' choices will be driven by their existing infrastructure, how quickly they want to roll out femtocells and how widely they plan to deploy them.

Femtocells are important for LTE networks as they improve the operator business case, while also providing the best possible user experience. This has been validated with a number of operators recently making positive statements on LTE femtocells.

The report finds that the three femtocell architecture options outlined in the LTE standard comprehensively support a wide variety of operator deployment scenarios. It details exactly what operators need to consider in order to make the most prudent architecture choice, based on their specific business and technology circumstances. It finds that operator choice should be dictated by how quickly they wish to bring a femtocell service to market, their current network architecture and how widely they intend to deploy femtocells in the longer term.

The growing interest in LTE femtocells amongst the operator community is being driven by two principal factors as outlined in a Femto Forum whitepaper entitled 'The Best That LTE Can Be'. Firstly, LTE femtocells provide important performance advantages by ensuring more users receive peak data rates more of the time, both inside buildings where the vast majority of mobile broadband data is consumed and outdoors through metropolitan and rural models. Secondly, femtocells also allow operators to create a more compelling LTE business case as they can considerably lower the delivery cost per bit through significant savings in cell site installation, maintenance and backhaul costs.

www.femtoforum.org

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As 4G rolls out the focus is on small cells

To address spectral efficiency, small cells are key to the success of 4G networks. Already, femtocells and WiFi play a large roll in providing coverage at the home, but femtocells are also being proposed as part of a wider network strategy, whereby traditional macrocells are replaced with large numbers of much cheaper mass produced femtocells. Other solutions also come into play such as RAN technologies such as Alcatel Lucent's Light Radio.

What solution is implemented will largely depend on the needs of the operator, which in turn are dictated by the operator's network topology and spectrum constraints such as bandwidth and frequency. Today, operators tend to have a variety of spectrum allocations and topologies based on legacy and what they can afford. This implies that operators will look at implementing different strategies at different times — and a key discussion now in the small cell space is whether the intelligence migrates to the edge of the network or remains at the core.

However, operators will all need to have a strategy concerning small cells to address issues such as capacity, efficiency, costs and quality-of -service.

New generation picocells are also aiming at enterprise solutions and are specifically designed to provide ubiquitous mobile broadband coverage both inside buildings and outdoors in large venues. This generation typically supports all 4G frequency bands in the 700 MHz to 2.7 GHz range and often includes a WiFi radio to provide a single system for all carrier and enterprise wireless needs.

On the other hand, Alcatel-Lucent's Light Radio takes a new approach to a cellular network — it breaks up today's cellular architecture and reassembles it in a more space- and energy-efficient way. According to the company, this is done by creating a new architecture where the base station, typically located at the base of each cell tower, is broken into its component elements and distributed through the network or 'carrier cloud.' Further, the various cell tower antennas are combined and shrunk into a single, multi frequency, multi standard (2G, 3G, LTE) device that can be mounted on poles, sides of buildings or anywhere else there is power and a broadband connection.

Clearly a lot will change in the next few years.

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IN BRIEF

Fresco squeezes new life out of old analog

With the digital TV era now a worldwide reality, suppliers are winding down production and engineering resources for analog TV components, as they look for greener pastures flush with the promise of new growth. In other words, textbook business strategy.

Fresco Microchip, a fabless semiconductor company, however, is challenging that common wisdom. By going after analog TV and hybrid [analog/digital] TV markets, the startup has grown like a weed over the last 12 months.

Separately, Fresco is planning to launch this year its own silicon tuners, which Fresco promises will deliver "the lowest cost system solution," when paired with a TV SoC.

The secret to its success thus far, Fresco believes, is its almost fanatical focus on "serving 'the underserved market,'" as Mike Gittings, Fresco's vice president of marketing, tends to call it.

www.frescomicrochip.com

NGMN alliance joins 3GPP as partner

The Next Generation Mobile Network (NGMN) Alliance has joined 3GPP as a Market Representation Partner. With its high level representation from the world's leading operators and manufacturers, NGMN will support 3GPP to ensure that mobile broadband services continue to meet the expectations of end users.

The Partnership Agreement was signed in a ceremony at the recent 3GPP Project Coordination Group meeting in San Diego with Standards Organisations (ARIB, ATIS, CCSA, ETSI, TTA, TTC) and other 3GPP Market Representation Partners. In its role as Market Representation Partner, the NGMN Alliance will give advice to 3GPP and will contribute to 3GPP standardisation activities in the future.

www.ngmn.org
www.3gpp.org

Ubiquisys collaborates with Intel to develop intelligent small cells

Ubiquisys has announced a strategic agreement with Intel to develop intelligent basestation (BTS) computing platforms based on Intel architecture. This emerging generation of intelligent small cells (small base stations) will offer new levels of processing power, creating a cloud of IP-enabled "compute engines" much closer to mobile users.

Ubiquisys is collaborating with Intel on the development of a range of dual-mode 3G/LTE small cells, all featuring Ubiquisys application software and Intel processor architecture. Both parties plan to showcase the potential of this technology in late 2011 and the resulting reference designs will be made available to equipment manufacturers in 2012.

Demand for mobile data is rising inexorably, and small cells installed in enterprises, public spaces and metro locations will provide the capacity boost required. This major proliferation of small cells creates new opportunities and challenges for Service Providers. Intelligent small cells with powerful computing platforms, abundant storage and peer coordination effectively create a distributed pool of compute resources. This is an opportunity for Service Providers to transform the mobile data experience since media and user applications can be served much closer to the point of use. It also creates new opportunities for serving data-intensive local content locally, for example interactive mapping services or video advertising. Location-triggered applications can be similarly augmented, especially for video services.

With scalability from the Intel® Atom™ processor to the Intel ® Xeon ® Processor, and flexible software programming model and tool chains, the Intel platform is ideally suited to provide the significant amount of processing power required, with substantial headroom for value added services.

"This is the future of small cells — not just miniature base stations but powerful computing platforms bringing the IP cloud as close as possible to mobile users and machines," said Chris Gilbert, CEO Ubiquisys.

"Intel recognizes that intelligent small cells are a key network planning asset for service providers," said Rose Schooler, general manager of Intel's Communications Infrastructure Division. "By extending powerful cloud computing platforms closer to mobile devices, we are enabling a richer, more personal user experience."

www.ubiquisys.com

TV station reveals serious security flaws with RFID-equipped credit and debit cards

Commenting on a consumer TV report into the insecurity of RFID-equipped credit and debit cards, SecurEnvoy says that the apparent ease with which researchers have been able to create a `magic wand' that reads cards at a distance shows that more work needs to be done on wireless encryption.

"The report from the Portland, Oregon-based TV channel Katu, in which researchers found that $20-worth of electronics could read the card details of payment cards in people's wallets and purses, at a range of four inches, is very worrying," said Andy Kemshall, technical director of the 2 factor authentication company.

"Here at SecurEnvoy, we spend our time advising clients on their best options to better defend their data assets, yet here we apparently have a number of card associations issuing payment cards that can have their details lifted by waving a fraudulent reader at users' wallets, purses and pockets, as they walk past," he added.

The SecurEnvoy director went on to say that four inches may not sound much of a distance, but in a crowded subway, tube or bus — with people pressed up close to each other on their way to and from work — the possibilities for card fraud are significant. Although the RFID system seen on Visa Paywave and Mastercard Paypass are designed for low value transactions, once the card details have been downloaded into a reader wand's memory, they can then be used to make fraudulent online purchases.

www.securenvoy.com

Future of mobile 3-D media is a two-way street

From Avatar to Nintendo's 3DS, 3-D entertainment has been popular with consumers for some time now, but it's always been a one way street. Audiences have been able to consume media in 3-D, with the aid of glasses and parallax filters, but they have not been able to communicate back with their devices in the third dimension. XBox Kinect was the first consumer device to introduce depth to its input, and its record-setting sales are a certain indicator of the market's appetite for technology that interfaces in 3-D.

FaceTime may be the utility that grabs the most attention, but iPad and iPhone's forward-facing camera can do more than just video calling. These cameras act like a little eye that can be programmed to track our heads as we look left and right to produce some of the same movement effects seen with Kinect. But although the effect looks similar, it is a facade. Similar to closing one of our own eyes, these single forward-facing cameras can only create 2-D image maps and are lost with the addition of depth. Technically speaking, iPhone already employs depth sensing technology, and does it in the same fashion as Kinect. Buried inside the phone's ear piece is an infra-red (IR) LED measuring the reflectivity of objects placed in front of it. This is what allows us to press our ear to our phone without mashing on buttons and hanging up on callers.

Both the dual camera method and IR can achieve the same effect, but IR actually stands as the more beneficial of the two. The computing power it takes to translate two images into depth-of-field data is far more than it takes for IR data. In addition, IR functions just as well in the dark as it does in light, sort of like a technologically advanced version of the flashlight apps that clutters the app store's utility section. While most of us won't be stumbling through the dark with our smartphones, this begins to reveal some of the functionalities that depth sensing apps could bring to the market.

Just as though we had a second pair of eyes, a depth sensing input on our mobile devices can see anything we point it at. For the blind, this means that not only could they replace touch screens with gesture-based commands, but that their mobile device could potentially function as a visual assist. A group of university students in Germany have already put a Kinect on the head of a blind person and hacked it to serve as a navigational tool. Integrating depth perception into mobile would provide all the same benefits without requiring the cumbersome Kinect hats.

Depth-sensing interfaces will ultimately revolutionize how we interact with our devices. First the touch-screen came along and turned our own fingers and natural movements into a stylus, now Kinect has removed all the tools that stood between users and a device. GarageBand instruments in iPad can be played just by strumming fingers in the air, or an angry bird could be launched at a pile of pigs by plucking fingers away from the screen. When a mobile device can detect depth, the screen opens up into a multi-dimensional space that users can look deep beyond. For enterprise, this means that a mechanic could virtually look inside an engine as though it were in front of him, moving in for a closer look or peering to the far right or left corners of the workspace.

Despite the possibilities and popularity, the destiny of depth-sensing mobile devices is ultimately in the hands of manufacturers, and so far their interests in 3-D lie more in output than in input. Pre-orders are already being taken for the HTC Evo 3-D, expected to be the first glasses-free 3-D Android phone, and the LG Thrill is scheduled to be close behind. On Apple's end, speculation has already started that the iPhone 5 will contain 3-D camera and display. In addition, the company holds a number of patents on 3-D projectors and viewing techniques dating as far back as 2006.

IR and dual cameras are such young technologies that it's still difficult to predict how they will be adopted within other devices, but the success of Kinect will set a precedent for how depth is employed in the future. Kinect's hacker-driven open source project led to the discovery of thousands of new uses that went far beyond Kinect's original intention as a game, and with the release of the SDK this spring, there are soon to be thousands more. As the technology continues to get more refined and the public appetite continues to grow, the crossover between Kinect-like technology and mobile becomes increasingly inevitable.

The author, Ryan Engle is a Senior iOS Developer at Mutual Mobile where he specializes in bending depth sensory technology and augmented reality to enterprise uses.

www.mutualmobile.com

IN BRIEF

Graphene modulator tackles optics

The world's smallest graphene modulator was unveiled recently by researchers at the National Science Foundation (NSF) Nanoscale Science and Engineering Center at the University of California-Berkeley. The research team, led by professor Xiang Zhang, claimed its breakthrough will someday allow smartphones to download entire movies in a matter of seconds.

Today, optical modulators are used to speed communications by using electrical signals to switch a laser on and off for long-haul communications between systems. However, high-speed optical communications is migrating to short-haul communications and someday may even be used by mobile devices.

Unfortunately, today's optical devices are discrete, bulky and require III-V materials like gallium indium arseide. By fabricating modulators in graphene—pure sheets of carbon—high-speed optical communications will become small enough and cheap enough to be integrated onto mobile device chips, according to Zhang.

The team demonstrated a graphene-based optical modulator 100-times smaller than the typical III-V device, measuring just 25 square microns. The device worked by applying an alternating electrical field to an optical waveguide fabricated in graphene. When the electrical signal was at its peak and its trough, the electrical, the electrical field caused the graphene to become opaque, thus turning off the laser driving the waveguide. However, near the center of the modulation range, the graphene became clear thus switching on the laser.

In characterizing their device, the researchers discovered that graphene can also operate over a 100-times wider bandwidth, ranging over thousands of nanometers—from ultraviolet to infrared—compared to the narrow (10 nanometer) bandwidth of typical II-V modulators today.

http://xlab.me.berkeley.edu

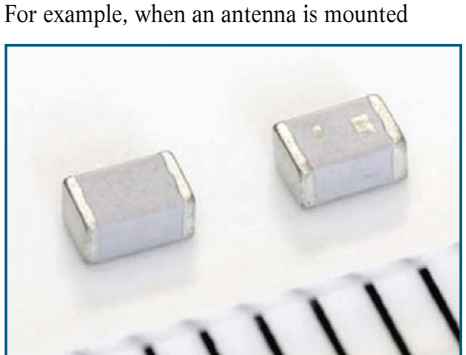
Small chip antenna widens design freedom of 2.4-GHz devices

By Yuta Saito, Antenna Product Engineering Section, Microwave Products Department, Murata

Since a chip antenna's frequency characteristics can depend on assembly into the end product, custom designed parts are often used. Murata has developed a standard miniaturised chip antenna whose frequency can by adjusted quickly and easily.

Manufacturers of electronic equipment, including mobile phones, are working hard to develop products with originality and multi-functionality in order to maintain their competitive edge. Based on this background, one of the important demands for electronic components is miniaturisation. Miniaturisation of electronic components enables higher density mounting of electronic components on the PCBs in the equipment, and this ultimately leads to better performance and expanded functionality of equipment. There is therefore a great demand for the miniaturisation of electronic components. Naturally, antennas are no exception to this demand – Murata believes that miniaturisation of antennas is a necessary challenge for an antenna manufacturer.

Another challenge is the caution is required for adjusting the frequency characteristics, such as resonant frequency and frequency bandwidth, which are specific requirements for each antenna product. This is because even if optimal frequency characteristics are obtained when a discrete antenna is evaluated, these characteristics often change and no longer conform to the required specifications when the antenna is actually assembled into the final product. There are several reasons why the frequency characteristics of an antenna change. For example, when an antenna is mounted on a PCB, the frequency characteristics change significantly depending on whether or not the ground plane is present immediately under the antenna.



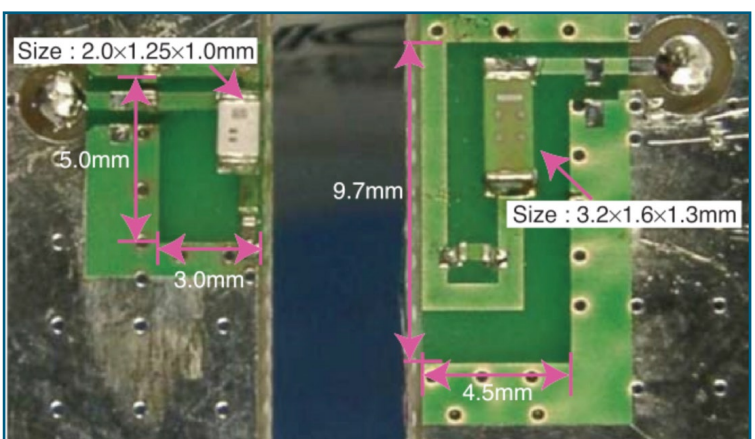
LDA21_K Series chip dielectric antenna.

Furthermore, when a high-profile electronic component is placed in the neighbourhood of the antenna's location, it can become a cause for change in the antenna's frequency characteristics. Obviously, a gap between the antenna and the housing or housing material has a considerable effect on the frequency characteristics of the antenna as well.

For these reasons, in many cases, an antenna to be installed in portable electronic equipment is custom-designed in accordance with the design specifications of the corresponding equipment. Custom-designed products, however, have a downside, that is, there is less flexibility in being able to change the electronic equipment's design. If the frequency characteristics of an antenna change and no longer conform to the required characteristics because of the design change, the prototype custom-designed antenna must be manufactured again. If the time to launch an antenna product into the market is delayed due to redesigning the antenna or to making another prototype, it could cause fatal damage to the production of the end product.

In addition to custom-designed antennas, Murata has developed antennas that enable electronic equipment manufacturers to freely set the required frequency characteristics themselves in order to quickly and flexibly respond to their individual requirements. The advantage of this type of antenna is that it can be adjusted to the required frequency characteristics by simply changing the characteristic value of a chip component that is externally attached to the antenna without replacing the antenna itself. The newly developed LDA21_K Series chip dielectric antenna has this advantage, while achieving size and profile reduction to meet market demands.

Figure 1: Size comparison of the LDA21_K and Murata's conventional product.



	LDA21_K	Conventional product	Comparison
Size	2.0×1.25×1.0mm	3.2×1.6×1.3mm	Reduced to about 40% of conventional product
Footprint on PCB	3×5mm	4.5×9.7mm	Reduced to about 35% of conventional product

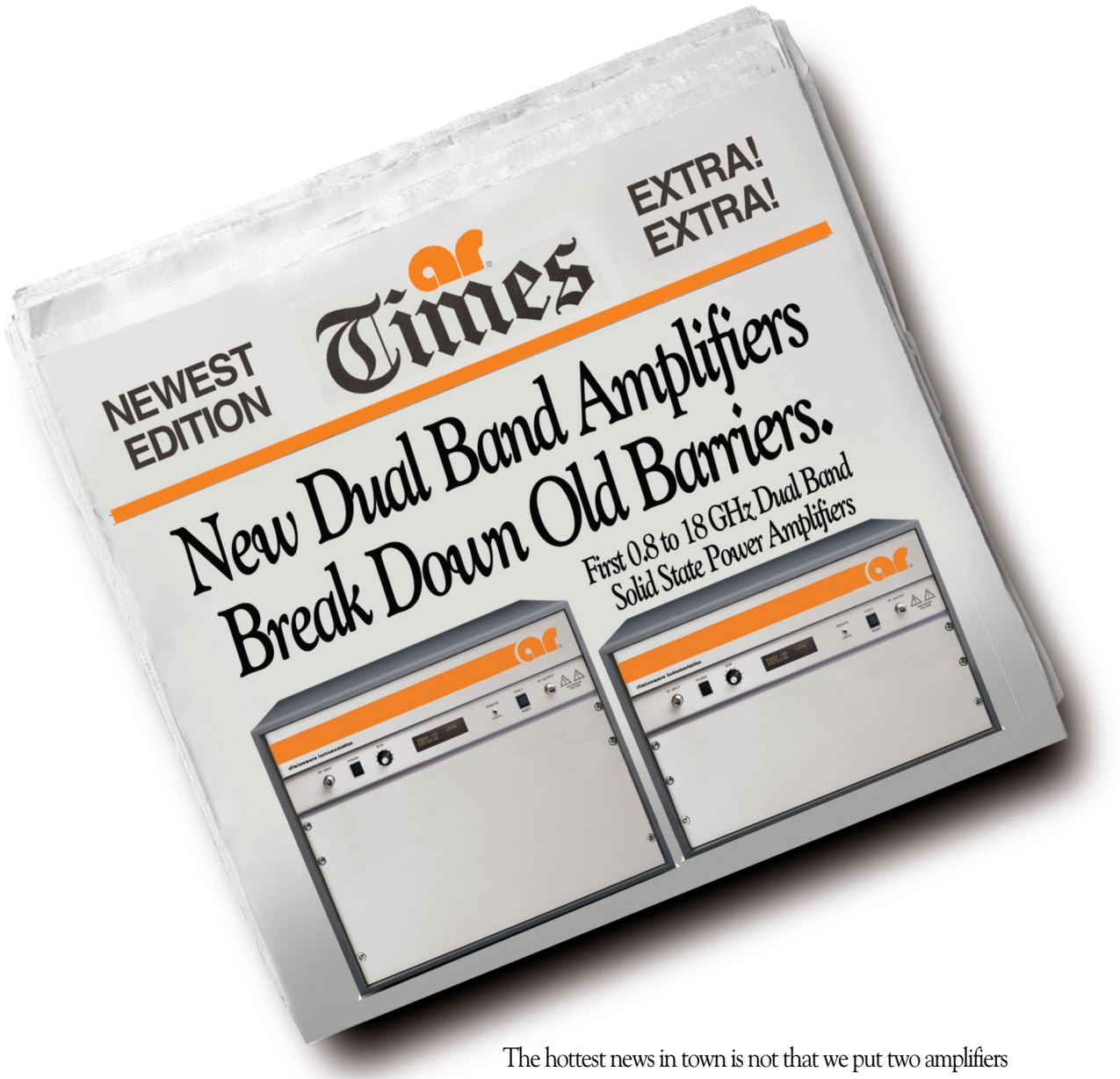


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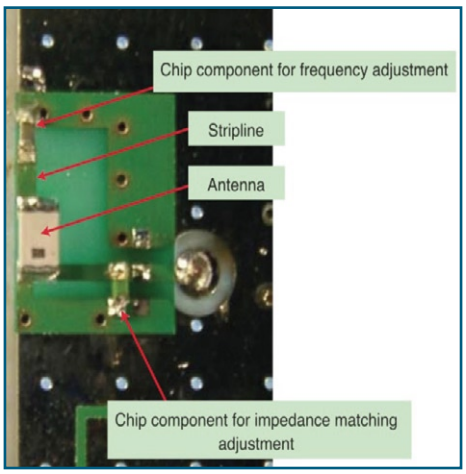
Figure 2: Example of LDA21_K antenna mounted on PCB.



Murata has developed the LDA21_K Series chip dielectric antenna, the industry's smallest size antenna for the 2.4 GHz band (2.0- × 1.25- × 1.0-mm) (Figure 1). The LDA21_K Series is connected to a printed circuit board (PCB) after removing the ground from the chip antenna placement location on the back of the PCB. It requires a minimum mounting footprint of 3- × 5-mm^2, which is the industry's smallest level for a chip antenna. While achieving characteristics equivalent to the company's conventional product, its antenna size and footprint on a PCB have been reduced to approximately 40 and 35 percent, respectively, compared to the conventional product. Murata's LDA21_K Series with compact and space saving design will contribute to the development of smaller and thinner equipment for all applications that use the 2.4 GHz band.

Features of LDA21_K Series

Major features of Murata's LDA21_K Series chip dielectric antenna include the following:

Table 1: Antenna lineup.

Part Number	Center Frequency (F0) [MHz]	Tolerance of F0 [MHz]	Nominal Band Width (at VSWR 4) [MHz]	Nominal Impedance [ohm]
LDA212G3110K-282	2310	+/-29MHz	--	50
LDA212G4410K-283	2460	+/-31MHz	84	
LDA212G6310K-284	2620	+/-40MHz	--	
LDA212G8610K-285	2860	+/-48MHz	--	
LDA213G1610K-286	3160	+/-58MHz	--	

the use of dielectric material with a high specific dielectric constant made from Murata's original ceramics; a structural design that applies multilayer technology, which is one of Murata's strong points; and an optimised antenna design that makes the most of simulation technology and years of accumulated know-how on antennas.

These features made it possible to reduce the antenna size to approximately 40 percent and the footprint size to approximately 35 percent of previous products, even while achieving equivalent performance characteristics (see Figure 1). The LDA21_K Series also offers the advantage of low cost compared to conventional product thanks to the antenna size reduction. Murata plans to supply the LDA21_K Series with compact size, low profile, small footprint, and low cost for the 2.4 GHz band market.

Frequency adjustment method

The method for adjusting the frequency of the LDA21_K Series antenna is described below. For frequency adjustment, the LDA21_K Series allows users to change the characteristic values of an external chip element as in the case of conventional products, as well as to select from five types of antennas with different resonant frequencies that are provided to cope with wider frequency changes (Table 1). The users can select a model suitable for the external environment.

Figure 2 shows an example of the LDA21_K Series mounted on a PCB. First, a stripline is placed from the antenna to the ground plane. Next, the optimal model is selected from five types of LDA21_K Series antennas to roughly adjust the resonance frequency. Then, the chip element is connected to the stripline in series for fine adjustment. As shown in Figure 3, by installing a chip element with different element values, fine adjustment of the antenna resonance frequency is performed by means of the change in frequency. Murata has application data on the detailed methods for designing a stripline and on the methods for adjusting the frequency using a chip element. Application data is also readily available.

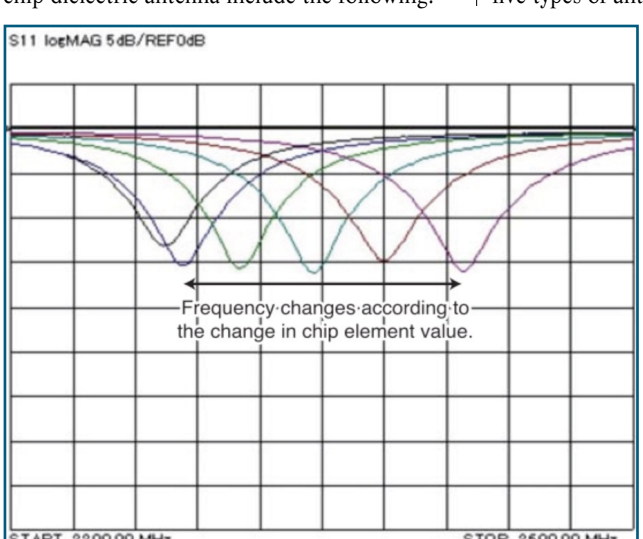


Figure 3: Example of frequency adjusted by component for fine adjustment.

Conclusion

Murata has always made an effort to provide a quick and flexible response to user requirements. Based on this policy, the newly developed LDA21_K Series antennas are designed to meet market demands for reduction in size and profile. The LDA21_K Series antennas are valuable for users who endeavour to introduce electronic equipment with expanded functionality and higher performance quickly to the market.

Murata intends to continue developing antennas and providing quick and flexible response to user requirements. As electronic equipment becomes more diverse, the requirements of individual users for antennas are becoming more complicated every day. Therefore, with an eye toward developing antennas to meet the specific requirements of each user, Murata also strives to provide antennas that can satisfy a wide range of customers.

Picocells and DAS belong together

By John Spindler, TE Connectivity

Small cells like picocells and femtocells are promising to deliver localised coverage and capacity inside corporate buildings, and in-building coverage will be critical for quality of service in 4G networks. But small cells aren't the beginning and end of the story. In this article, we'll look at the role of femtocells, picocells, and distributed antenna systems in delivering mobile network capacity and coverage within enterprises.

Coverage isn't the main issue

Distributed antenna systems (DAS) have been used to provide additional coverage inside buildings for many years. The DAS takes a mobile network signal and distributes it through a series of remote antennas to provide a blanket of coverage within the building. But as users have adopted smartphones, tablet computers, and other devices, the requirement inside buildings is shifting from mobile network coverage to mobile network capacity. Suddenly, all of those iPhones and other devices are straining the capacity of the in-building network, and this is changing the way capacity is provided.

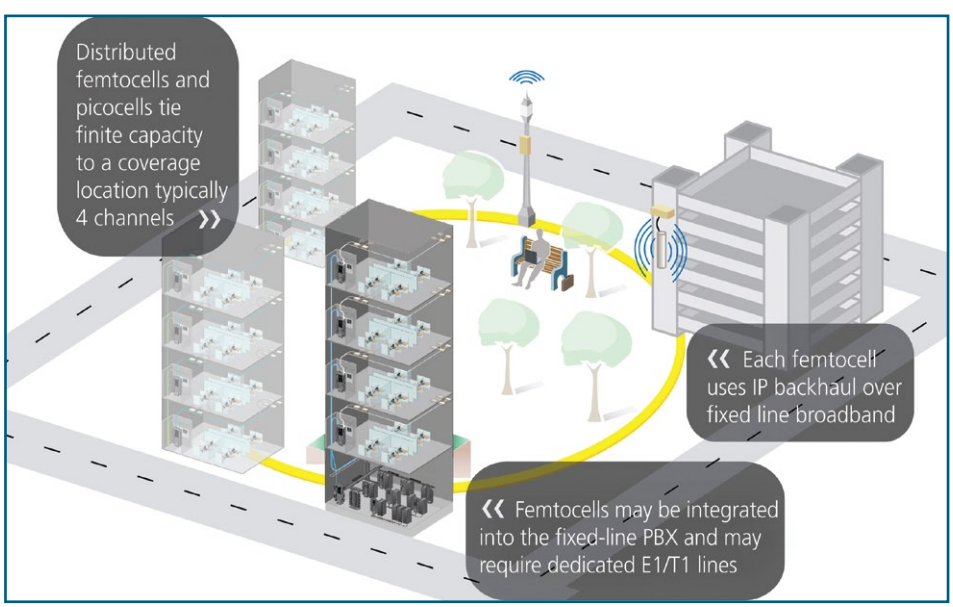
In the past, a DAS was fed by a rooftop antenna or repeater that pulled capacity from the local macro network and distributed it through the building. But now that network capacity is being strained everywhere, the DAS must have its own, dedicated form of capacity. Traditionally, localised capacity came in the form of a BTS supplied by the mobile carrier, but in many enterprise buildings a traditional BTS is overkill for the capacity needed, and much of its capacity ends up going unused.

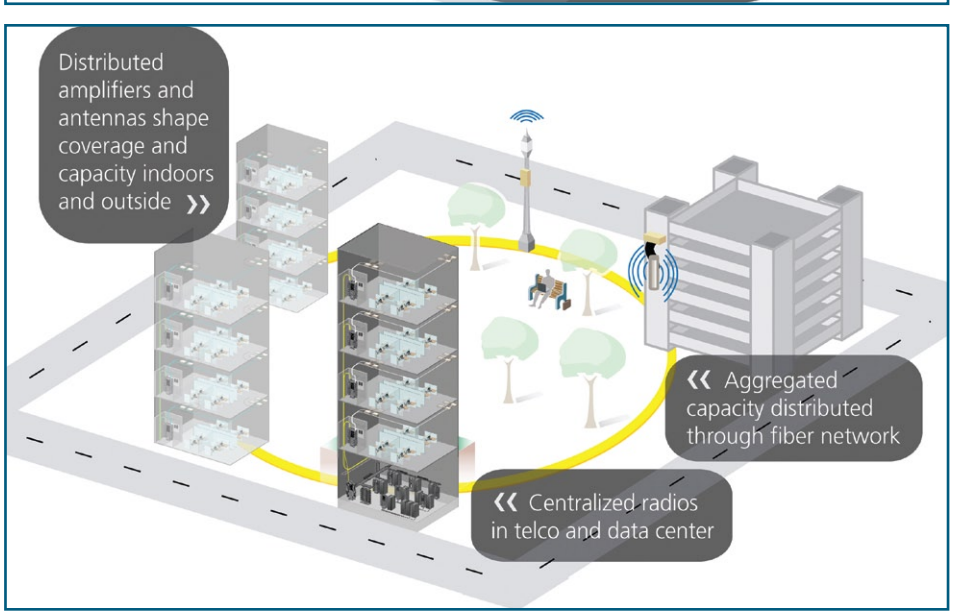
The age of small BTS in the form of femtocells and picocells provides a way to deliver the right amount of capacity in an enterprise. A femtocell delivers capacity over about 2000 square feet of coverage, while a picocell can cover 5000 square feet or more. But obtaining the right amount of coverage and capacity inside an enterprise isn't just about putting up small cells everywhere – the limitations of small cells dictate a hybrid solution that includes DAS.

Limitations of small cells

Picocells and femtocells were designed to provide coverage and capacity over a specific area. There is a lot to like about small cells. They cost a small fraction of what a standard BTS costs (hundreds or a few thousand compared with £15,000 or more for a BTS), they have small footprints that make them easy to deploy in wiring closets, on ceilings, or in other areas without special HVAC or power facilities; and they can use DSL or enterprise Ethernet for backhaul rather than requiring a dedicated T1 connection. If the building is small enough to be served by a picocell or femtocell, these units are an ideal solution for coverage and capacity. But when the building can't be covered by just one small cell, there are several problems

Distributed femtocells using DAS overcome limitations and reduce costs.





DAS is pretty much a set-it-and-forget-it solution.

with deploying multiple cells to achieve the desired coverage and capacity.

Each cell distributes one frequency. Femtos or picos are generally single-frequency devices, so if a building owner wants to provide coverage for multiple mobile operators, he must deploy a separate set of small cells for each frequency to be covered. Ceilings or wiring closets in enterprises that want coverage for three or four carriers will be positively festooned with femtos or picos in such a scenario.

Multiple cells introduce interference. When more than one femto or pico is used, there is the potential for interference between them, causing performance problems that degrade the quality of service. Like Wi-Fi access points, femtocells must alternate channels to avoid co-channel interference, and doing this requires carriers to use a lot of frequency in a small area given the relatively small coverage footprint of a femto or pico.

Devices hand-off between one cell and another. A mobile device that detects two relatively equal signal sources will hand off between the two, rather like a listener trying to monitor two conversations at once. Small cells have very low output power (milliwatts compared with 20 W for a macro cell), so users will find their devices hunting between equidistant cells, or between the nearest small cell and the macro network outside the building. As devices hand off they provide poor quality of service and drain their batteries more quickly. It is far better to establish a single dominant signal throughout the enterprise so that phones can connect to it and stay there.

Over-providing is inevitable. Each femto or pico provides capacity for a small number of users, so conference rooms, cafeterias, and other areas with high user density will need to be over-provisioned to provide enough network capacity for peak usage times. These investments in extra cells will go to waste during times of low usage.

Combining DAS with small cells

The way to overcome the limitations of using femtos or picos alone while providing strong and consistent mobile service in the enterprise is to combine these devices with a DAS: they provide the capacity, and the DAS distributes it throughout the building. Here's how this combination solves the problems of using femtos or picos alone.

DAS is multi-frequency. A DAS can distribute multiple cellular frequencies to serve more than one carrier, so just one set of remote antennas is required.

There is no interference. Since the DAS simulcasts radio channels throughout the building, there is just one large cell. This eliminates multi-cell interference along with the need to hand off from one cell to the next as the user moves about.

There is one dominant signal. One signal source means a single dominant signal. The DAS simply provides a uniformly strong signal throughout the interior of a building so user devices don't hunt between signal sources.

There is no need to over-provide. All antennas in the DAS have access to all of the feeder cell's capacity, so there's no need to add new cells for higher capacity requirements in certain areas. If additional capacity is needed throughout the building, additional cells can be added in a central location at the DAS head-end.

Deployment is less expensive. It is much less expensive to deploy a DAS for in-building coverage than to deploy dozens or hundreds of pico or femto cells.

Operating expenses are lower. A DAS is pretty much a set-it-and-forget-it solution, so once deployed it needs little maintenance. With multiple small cells, the cells will require continuous adjustment to function in an optimal manner.

Backhaul costs are lower. Since the DAS connects to a single femto or pico cell it can deliver service using a single RF source and backhaul connection.

There is a lot of talk about femtocells or picocells permeating the enterprise, but their single frequency, limited capacity, lower power, poor frequency management, and traffic engineering required makes multiple cells a poor solution for enterprise coverage. A far better idea is to combine the benefits of these devices and DAS to get lower costs, easier deployment, better quality of service, and multi-carrier coverage.

NXP demos car-to-x communications platform

As part of the Automotive Week 2011 which recently took place in Eindhoven (The Netherlands), chipmaker NXP demoed a car-to-x communications platform based on the company's software-defined multi-standard digital radio platform.

The platform has been co-developed with Cohda Wireless, an Australian expert company for RF transmission algorithms and protocols. In terms of hardware, NXP used the same platform as it does for its software-defined wireless multi-standard receivers. The implementation of the 802.11p wireless standard has been developed by Cohda Wireless.

In terms of functionality, the platform allows drivers to "see" around corners and other obstacles and recognize traffic blocks. In an operation demonstration on a normal street with two Car-to-x equipped vehicles drivers received early warnings from cars hidden from sight — for instance because they were approaching around corners. Experts such as Maurice Geraets, Business Development Manager for NXP, said they expect that one of the "early adaptor" applications will be warning transmissions from emergency vehicles which cause drivers to clear the road for the emergency vehicle.

At the opportunity of the event, NXP Automotive General Manager Kurt Sievers said that the goal of CO_2 reduction will change the automotive industry over the next few years much more than the industry has changed in the past 125 years since its inception. In order to reach that goal, electronics and algorithms will play a key role. Besides connecting vehicles to the outside world by means of GSM, UMTS and Car-to-x communications, NFC will also be an important enabling technology for the "smart" usage of vehicles: NFC-equipped smartphones will enable providers and users to "personalize" the vehicles.

The C2X communications demo was a result of NXPs activities within the SPITS research project (Strategic Platform for Intelligent Transport Systems).

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CHANGING THE STANDARDS

How to get smart about wireless backhaul

By Shai Yaniv, Ceragon Networks

Prior to the iPhone launch in mid 2007, AT&T hurried to rollout a major upgrade of its 3G mobile data service, in anticipation of a tenfold increase in network traffic. Appetite for mobile data and the number of smartphones and data-centric devices has only increased since then. In fact, data traffic over cellular networks is expected to grow almost 40-fold till 2015, and UK firm Coda Research anticipates that in the US, mobile video will account for over 60 percent of all mobile data usage. But can backhaul networks support such staggering capacities?

Network operators, utility companies, public safety organizations and enterprises are all struggling to meet the immense demands for data that are required by today's applications. At the same time, they must plan and prepare for the continued growth.

Fiber where you can – microwave everywhere else

When examining the wireless versus wireline alternatives, fiber's nearly unlimited capacity immediately stands out. However, the fiber option is not always practical. Whether due to deployment restrictions (rough geographical terrain) or regulatory restrictions (dense metropolitan areas) laying out fiber infrastructure may be too costly and time consuming. In such cases, wireless, or more accurately — wireless backhaul based on point-to-point microwave, emerges as the best solution.

Microwave backhaul solutions are capable of delivering high bandwidth, carrier-grade Ethernet and TDM services. Microwave is suitable for all capacities up to several Gbps over a single link — and may be scaled up to multiple Gbps using aggregated links techniques. Unlike fiber, wireless solutions can be set up quickly and are much more cost efficient on a per-bit basis from day one.

The end of the fat pipe era

Today microwave backhaul offers much more than fat pipes connecting two endpoints. Microwave has evolved over the years and has accumulated advanced service features such as service and network topology awareness — features that until recently were only available using expensive external boxes for switching and routing traffic.

Table 1: Microwave can support up to multiple Gigabit Ethernet over a single link, and real-life performance really depends on the available frequency resources.

Spectrum Channel Bandwidth	Microwave Radio Throughput	Ethernet Throughput with Enhanced Lossless Compression (up to Mbps)
10 MHz	60	160
14 MHz	85	235
28 MHz	185	500
30 MHz	197	530
40 MHz	254	700
50 MHz	336	920
56 MHz	365	1000

Modulation: 256QAM

As networks become more complex, and user experience and quality of service become major differentiators between operators, the role of microwave systems within those networks is changing. Microwave backhaul should be much more than a "dumb pipe." It must be smart.

The capacity characteristic of today's traffic requires different attributes from the legacy install based backhaul. One example could be the peak-to-average ratio. A 4:1 peak-to-average traffic ratio is not uncommon in backhaul networks. The microwave solution must be traffic aware in order to manage multiple applications with differentiated quality of service levels. For instance, voice calls consume relatively low bandwidths and require high priority with minimal latency. Web browsing or ftp downloads on the other hand, require high data volumes, but the user's quality of experience is less affected by latency issues.

Moreover, to ensure quality of service, a smart microwave backhaul solution should also be aware of network topology. It should integrate carrier Ethernet functionality and be able to independently re-route traffic in case of network failure.

Can microwave really support 4G backhaul capacities?

The answer to the question whether microwave can cope with future capacity requirements is a simple "yes." Microwave can support up to multiple Gigabit Ethernet over a single link, and real-life performance really depends on the available frequency resources, as depicted in the table below. Advanced microwave supports high spectral efficiency and can better utilize the available spectrum. This translates into much more capacity at a given channel. Other, more developed microwave systems offer advanced lossless compression techniques, as illustrated in the table below, that allow even more capacity over a given wireless link with additional support for burst peak-to-average issues.

In our non-perfect world, most backhaul networks are not "greenfield" cases, but rather backhaul networks that are evolving. This evolution requires a smooth and risk-free migration plan from legacy networks to next-generation, packet-based communications. This is paramount for network operators, but also common with electrical companies implementing smart-grid applications. Replacing legacy TDM networks with IP-based networks must be carefully planned as it involves a gradual process, with a hybrid network having to provide simultaneous support of TDM and IP/Ethernet communications.

What makes wireless backhaul smart?

Service aware traffic management

Service aware traffic management refers to the ability to differentiate packets by type. The transmitted data stream may be composed of E1/DS1s, ATM, IP, or Ethernet. These packets may come from multiple sources and may have

different quality requirements. Smart backhaul is able to prioritize the different flows and preserve the requirements of contractual service level agreements (SLA).

High system gain

The overall system gain of a backhaul system greatly affects capital investment and service quality. A sensitive receiver threshold performance will enable superior system gain, regardless of the transmission power. From a business standpoint, high system gain affects the capital investment. For example, high system gain allows operators to reduce the number of links required to cover a given distance. It also allows the usage of smaller, less costly, antennas (this can also reduce rent fees in cases where tower-space is leased from a third party). Last, high system gain provides superior network availability and quality of service in harsh weather conditions.

Power consumption

With the telecom industry taking its share of social responsibility and striving to conserve energy, power consumption is a key component of a backhaul solution. Obviously, low power consumption is also critical for achieving lower total cost of ownership targets, particularly in private networks.

A smart wireless backhaul will have advanced power consumption scheme, based on real-time usage and environmental conditions. Smart power consumption can provide up to 50 percent reduction in power consumption.

Minimal footprint

The common backhaul node integrates equipment from multiple vendors handling various wireless and wireline functionalities. The result is that physical space is scarce, particularly if environmentally hardened outdoor units are required. Equipment with minimal footprint design assists in squeezing the maximum capacity into physical rack space.

Resiliency and modularity

With network requirements constantly evolving, any microwave backhaul solution implemented today must be modular and inherently capable of supporting the new challenges and requirements of tomorrow. Topology awareness is an important feature as was explain above since a smart wireless backhaul will assure that the traffic will get from point A to Point B even if there is a network failure by recalculating an alternate path.

When high capacity is simply not enough

Operators today struggle with the ever increasing demand for more data capacity and the need to ensure high quality of service and user experience. Wireless backhaul solutions based on point-to-point microwave can support these requirements, but this will be done by systems that are more than mere "dumb pipes." Smart microwave solutions, which are network and traffic aware, and which address operators' needs for efficiency, reliability, low cost and power reduction — will help drive next generation services making them affordable and profitable.

About the author

Shai Yaniv is Vice President of Product Management at Ceragon, a leading provider of high-capacity LTE-ready wireless backhaul solutions. Mr. Yaniv has over 18 years of experience in the telecom industry in the fields of advanced communication systems, including wireless backhaul networks and broadband wireless access solutions.

Lowering the energy of Bluetooth low energy

By Geir Langeland, Nordic Semiconductor

The Bluetooth Special Interest Group's (SIG) Bluetooth Core Specification Version 4.0 is not something to turn to for a little light reading. It's a highly detailed document running to six volumes totalling 2302 pages. Adopted in June 2010, the specification describes how a silicon vendor can design and make Bluetooth v4.0 chips that will communicate seamlessly with another manufacturer's chips. That's the key point of Bluetooth wireless technology: it's an open standard that ensures interoperability between wireless devices from different manufacturers, encouraging mass uptake.

Bluetooth low energy is a hallmark feature of Bluetooth v4.0 and has been designed to operate from small batteries with limited capacity. For the first time, Bluetooth low energy allows compact, low duty cycle wireless devices to link to the Bluetooth "ecosystem."

Although there's no maximum permissible energy (or power) consumption for a low energy device detailed in the specification, because the operating characteristics of Bluetooth low energy are designed to aid low power operation, the Bluetooth SIG expects manufacturers to design transceivers that can operate from a coin cell such as the ULP RF engineer's favoured 3 V, 160-to-220-mAhr CR2032 battery. This requirement demands that the Bluetooth low energy transceiver operates at peak currents of less than 30 mA and average currents in the microamp range.

The SIG's confidence is well placed because a specialist group, including companies with years of experience designing coin cell powered-ULP wireless technology, drew up the specification for Bluetooth low energy. The company I work for, Nordic Semiconductor, was at the forefront of that group since it became a foundation member of Nokia's Wibree Alliance in 2006 (which merged with the Bluetooth SIG in June 2007).

While the publication of the specification allows any company to attempt the design of a Bluetooth low energy transceiver, only the established RF silicon vendors are likely to try (because RF engineering is a big challenge for the inexperienced). But even accounting for the expertise of these manufacturers and the adoption of a single standard, not all Bluetooth low energy chips will be the same. Some will consume less energy than others – and as the key point of Bluetooth low energy is low power consumption, this distinction will be very important.

If an OEM can select one Bluetooth low energy chip that, in a particular application, enables a battery life of nine months, or another that extends battery life to over a year, it's likely it'll chose the latter. Several manufacturers have now released their Bluetooth low energy solutions, and there are some big differences in power consumption even though all the devices are qualified to the Bluetooth v4.0 standard. A glance through the various data sheets shows the peak transmit (TX) and receive (RX) current (when the device uses the most power) of competitive chips from major semiconductor vendors can differ by as much as 14 mA (at 0 dBm output power and 1 Mbps bandwidth). That's a lot of extra current to take from a coin cell battery and will inevitably shorten its life.

Nordic Semiconductor specializes in ultra-low power wireless connectivity. The recently introduced nRF8001 Bluetooth low energy solution, for example, exhibits 12.5 mA peak RX current and 11 mA peak TX current and connected mode average currents below 12 µA (for one second connection intervals).

Our engineers have worked hard to minimise the power consumption of the company's Bluetooth low energy solution because customers say that battery life is one of the most important operating parameters for their applications.

Casio, one of Japan's leading consumer electronics companies, for example, has chosen a Nordic chip to power the wireless connectivity of its G-SHOCK Bluetooth Low Energy Watch. The company says the main reason for this choice was because it wasn't prepared to compromise on the key customer demand of up to two years of operation from the watch's CR2032 coin cell.

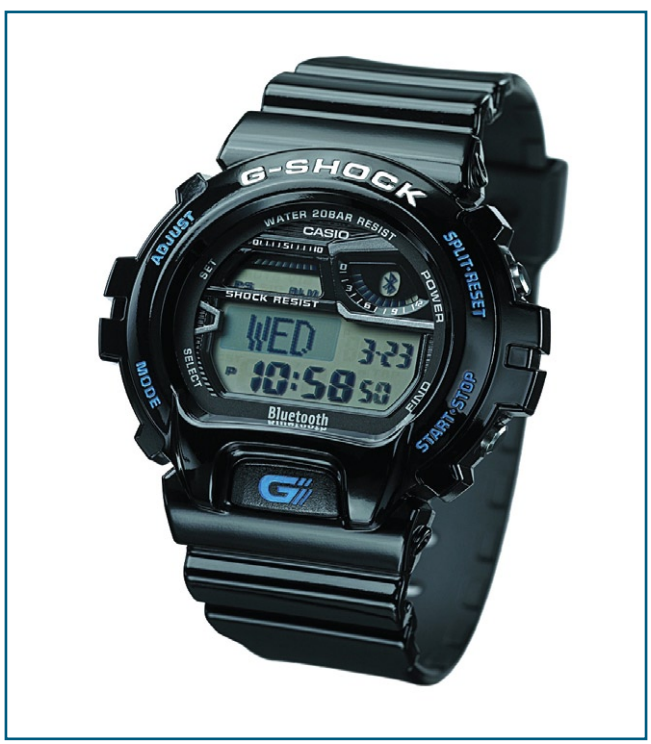


Figure 1: Casio's G-SHOCK Bluetooth Low Energy Watch uses a Nordic chip to keep power consumption down and extend battery life.

Precision, automated, high performance vector network analyzer measurements for R&D and production environments

By Anritsu, www.anritsu.com

As wireless communication networks become increasingly crowded, performing accurate analysis of all links in the communication channel chain becomes more important. From modeling active devices at the wafer level to verifying a satellite communication link, Vector Network Analyzers (VNA) provide a wide range of measurement capabilities and are an essential tool for the RF and microwave engineer. VNAs provide very accurate, high performance measurements due to their excellent dynamic range and frequency stability, and their ability to provide phase as well as magnitude information. Measurement accuracy of the VNA is dependent on the quality and care provided during the VNA calibration process.

The VNA calibration process consists of measuring impedance standards and applying correction algorithms internal to the VNA. Because the calibration process can be time-consuming and challenging, engineers often have to make a choice between accuracy and convenience. To achieve high accuracy, an engineer must spend a considerable amount of time and care connecting various impedance standards. Proper pin depth and torque settings and clean connectors all contribute to the success of the calibration procedure.

VNA performance specifications are provided as an indication of the level of accuracy possible when applying specific calibration kits and methods. The most common calibration method used to specify VNA performance uses the Short Open Load Thru (SOLT) technique while using a sliding load. Sliding loads provide the best directivity performance, which determines the overall accuracy of reflection measurements. However, sliding load terminations are fragile, especially when using connectors that operate at higher frequencies. So accuracy is often sacrificed by using more convenient fixed load terminations, resulting in degraded directivity performance.

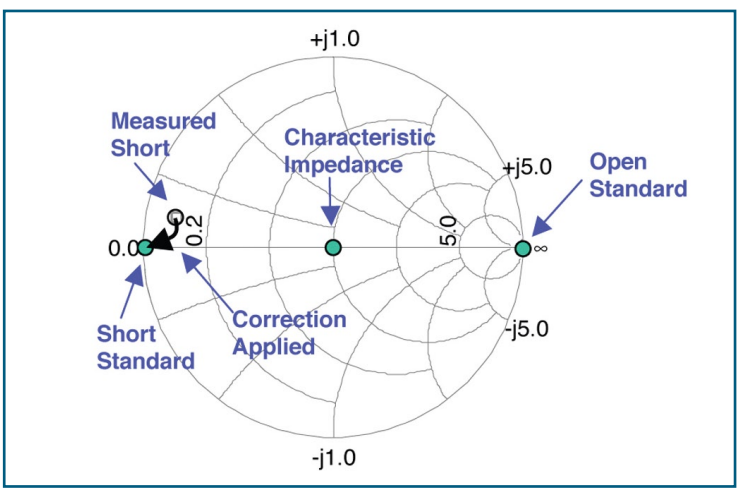


Figure 1: Calibration is the process of identifying the difference between the standard device defined and measured.

Automatic calibrators are designed to simplify the calibration procedure by including the impedance standards inside the calibration module. Using the automatic calibration module, impedance points are automatically switched between states during the calibration procedure. The result is a fully calibrated VNA requiring just a single connection to each port. The drawback to electronic calibrators is that calibration accuracy is usually less than that achieved using SOLT techniques with sliding loads. This paper will discuss a new automatic calibration technique that provides accuracy that is better than SOLT with sliding loads.

Summary of the calibration process

One of the important features of a VNA is the ability to measure the broadband characteristics of the device under test (DUT). Due to these characteristics, inherent accuracy is not optimum in the uncorrected state. For example, a coupler designed to cover a narrow frequency range can be optimized to provide directivity up to 50 dB. However, if the coupler must be designed to cover multiple octaves, then the uncorrected directivity is in the 10 dB range. Calibration improves the raw performance to near-narrow band conditions.

Calibration is the process of applying a well defined standard, such as a perfect short (see Figure 1) and measuring the device with an uncalibrated system. The difference is the result of the contribution of error signals within the VNA (e.g. directivity, source match, load match). The procedure is applied at defined frequency points and at a specific power level. The correction process subtracts the identified error vectors at each calibration point during the measurement process to improve the raw performance of the VNA. The resultant accuracy is the result of the residual errors of the calibration process. The more accurate the definition of the standard, the more accurately the Smith Chart can be mapped out during the measurement process.

Different methods are employed to calibrate the VNA. The choice often lies in the type of transmission media in which the DUT resides (such as wafer, coax) and the type of standards available. LRL (Line Reflect Line) is the most accurate method, because the reference impedance is determined by the line impedance. For a mechanical coaxial airline, the line impedance can be machined to very tight tolerances and achieve 50 ohm characteristic impedance very accurately. As a result, residual directivities of 50 dB can often be achieved.

The next level of achieved accuracy below LRL is the SOLT calibration (short, open, load,

thru). Opens, shorts and terminations define the Smith Chart and provide the information needed for an accurate calibration. However, as frequencies increase, the open becomes more of a challenge to accurately define. Also, the performance of the termination degrades at higher frequencies and increased frequency spans. A method of improving residual directivity due to limitations in the termination is to use a device called a sliding load. A sliding load repositions the termination at different electrical lengths during the calibration. The process of relocation provides multiple impedance plots that eventually define a circle whose radius is represented by the reflection coefficient of the termination at a particular frequency. The centre of the circle, therefore, defines the actual characteristic impedance of the transmission line. The resultant residual error depends on the quality of the movable mechanical device and the level of skill of the operator in setting a precise pin depth at the test port connection.

In an effort to simplify the calibration process, automatic calibration modules, a technique pioneered by Anritsu in the early 1990s, was developed as an alternative to measuring predefined standards. The automatic calibrator concept is also called an AutoCal. The automatic calibration module contains multiple impedance points spread throughout the Smith Chart map. If the impedance points within the module have excellent stability and repeatability, then the impedance points generated by the module can be defined by a data file associated with a specific calibration module. The result is a calibration system that uses defined impedance standards as previously mentioned. However, instead of relying on fixed defined standards (short, open, and termination), the calibration uses information from the measured impedance points provided by the module (see Figure 2). As previously described, the difference between the stated impedance and the measured is used to identify error terms and complete the calibration process.

The automatic calibration module requires only a single connection at each test port, and does not require sliding terminations that are difficult to connect. The AutoCal can therefore be used to quickly and easily calibrate a VNA while eliminating the need for multiple connections of various device standards. The automatic calibration module is therefore ideal for the manufacturing environment, where operators may not be skilled or trained in the use of sliding terminations. The drawback up to now has been that the process resulted in a calibration that was less accurate than an SOLT process using a sliding termination.

An automatic calibrator uses impedance points other than opens and shorts. This is because the inherent insertion loss of the calibrators prevents accurate measurements of opens and shorts. The insertion loss is due to the fact that multiple impedances must be available through switches, thereby eliminating the need for multiple connections. As a result, a short looks more like an attenuator than a short. In order to overcome this limitation, automatic calibrators must provide additional impedance reference points to properly calibrate the VNA. The problem

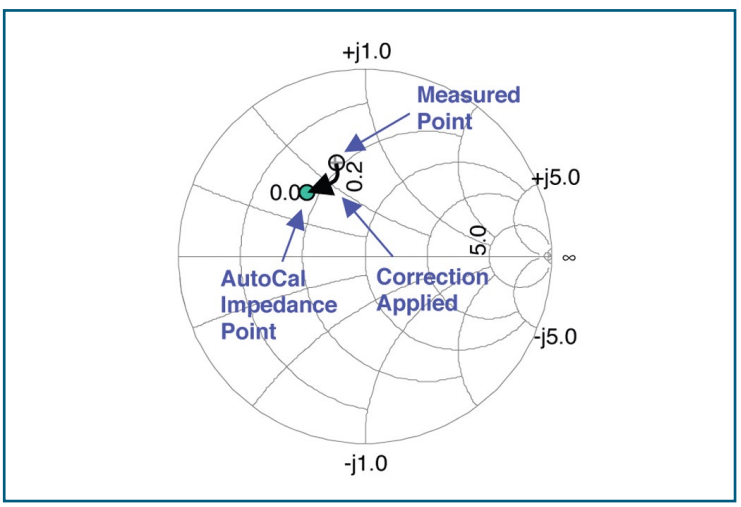


Figure 2: AutoCal calibration is the process of identifying the difference between the defined device impedance and measured.

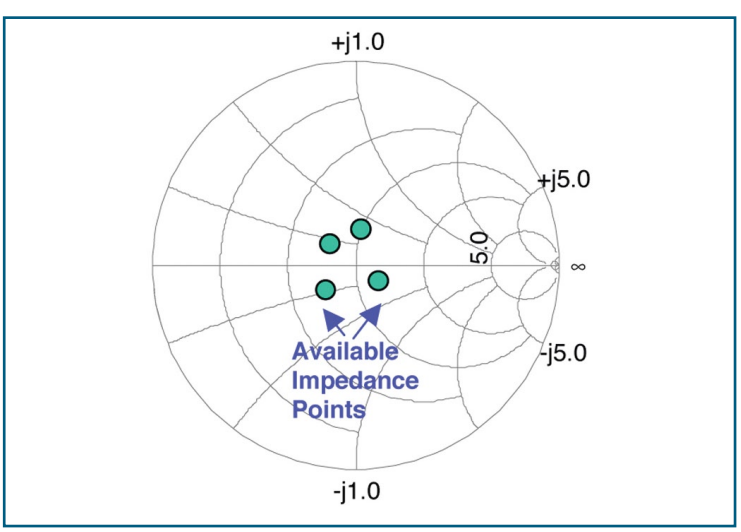


Figure 3: Automatic calibration modules with high insertion loss cannot provide enough impedance information to properly calibrate the VNA.

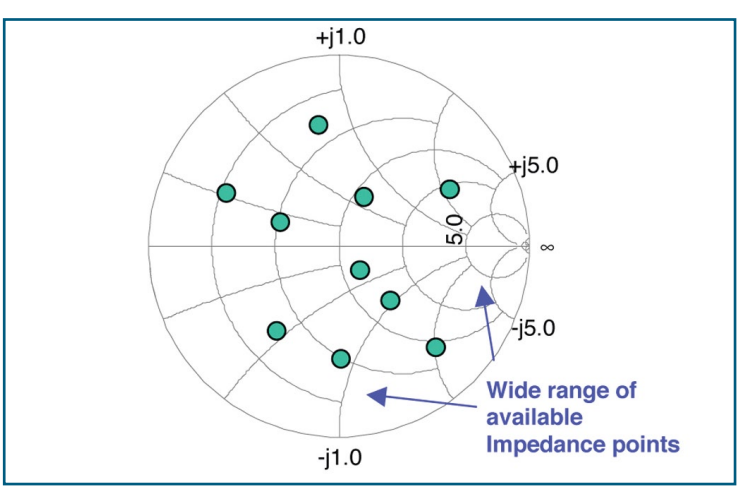


Figure 4: Hybrid technology and turnstile switching provides low insertion loss accessing many impedance points between the VNA test ports thereby providing the ability of better calibration accuracy.

Figure 5: Precision AutoCal measurement of airline transmission; note ability to handle low loss measurement.

is that the more impedance points supplied, the more switches are required and the higher the insertion loss. Figure 3 illustrates the problem when attempting to calibrate with an automatic calibrator with excessive insertion loss. The impedance points collapse to the centre of the Smith Chart and are difficult to properly map out.

Another consequence of high insertion loss in an automatic calibrator is the quality of the thru calibration. An ideal thru calibration requires a connection with zero loss and zero electrical delay. If the thru calibration contains too many approximations, then the quality of the transmission tracking suffers. This often results in the inability to measure low insertion loss devices and can result in the display of gain for low-loss passive devices. Although this limitation can be bypassed by measuring the actual thru connection of the two test ports, this is not possible when calibrating for a non-insertable device. This situation will be discussed further.

New process simplifies the calibration process while improving accuracy

Anritsu has now introduced a new automatic calibrator module design that improves the implementation of multiple impedance measurements to achieve accuracies better than SOLT with sliding loads. The new module, called Precision AutoCal, uses an over-determined algorithm and incorporates improved switching technology for better mapping of the Smith Chart during the calibration process.

Although it is possible to produce many impedance states using previous methods of switching, the result is lossy. Low insertion loss in the Precision AutoCal is achieved using a combination of new switched hybrid technology and turnstile switching. The turnstile switching method minimizes the number of switched connections thereby improving insertion loss between ports, especially at the higher frequencies. Figure 4 shows how low insertion loss using hybrid technology and turnstile switching provides the ability to cover a wider area of the Smith Chart for better calibration and accuracy.

Availability of a larger number of impedance states in the Precision AutoCal also provides other benefits. With a large pool of states to choose from, the calibration algorithm can choose the states that provide a better spread of impedance change as frequency is swept. This is especially important when attempting to calibrate over a broad frequency range. Because of the large number of impedance states available, the Precision AutoCal is capable of calibrating the VectorStar VNA over its entire frequency range of 70 kHz to 70 GHz. Providing 5 to 8 useful reflect standards at each port across the entire calibration range also helps avoid parasitic problems during the calibration. And multiple thru states provide the ability to incorporate an iterative load match scheme to further improve the transmission tracking calibration.

Now that it is possible to produce an automatic calibration module with low insertion loss and a high number of impedance reference points, the limiting factor in characterizing the module is the use of SOLT calibrations. With the potential to improve accuracy beyond that of SOLT with sliding loads, an improved method of characterization is required. The solution is in the use of a VNA that has been calibrated using the LRL technique. Since LRL calibrations exceed those of SOLT, using LRL-calibrated VNAs to measure the impedance points within the AutoCal provides the highest possible characteristic impedance measurements for use in generating the AutoCal reference file.

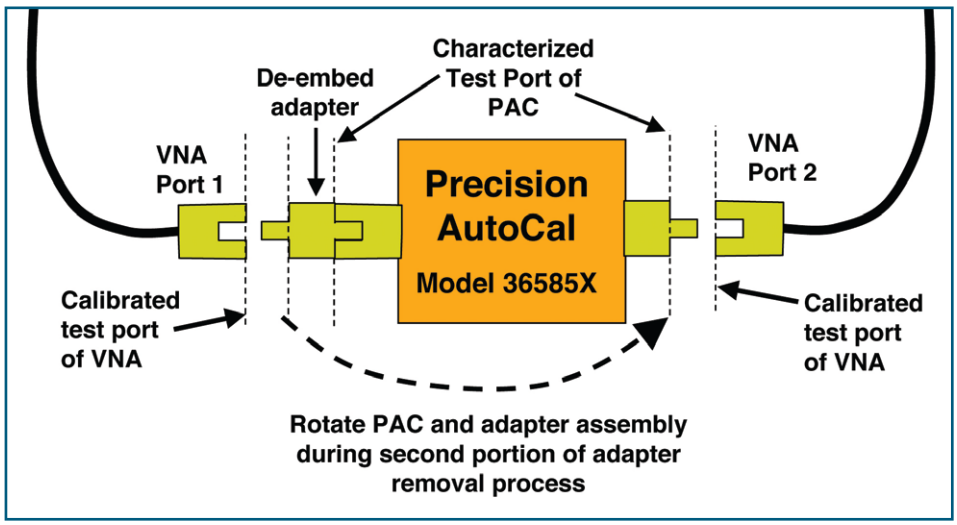
Calibration Setup Examples

Another advantage of automatic calibration modules is the ability to calibrate the VNA for both insertable and non-insertable devices. Since the calibration module can be made in any connector configuration arrangement, a module can calibrate the VNA test ports for a DUT with male/female, male/male, or male/female connectors. For the case of a male/female configuration (also called an insertable configuration) the test ports can be directly connected. Recall that the typical automatic calibration module (with high insertion loss) limits the accuracy of the transmission tracking calibration. The best method of overcoming this limitation is by directly connecting the test ports of the VNA during the thru calibration stage. This provides the best condition for the thru calibration.

Although traditional calibration modules can be configured for non-insertable DUTs (e.g. male/male or female/female), note that the thru calibration must be performed by the module since the test ports cannot be connected directly. While it would be possible to use an adapter to perform the thru calibration without the module, the inclusion of an adapter introduces additional errors since it is not an ideal zero loss/zero electrical length thru. And even though it is technically possible to provide some sort of characterization file describing the adapter during the thru calibration, note that the adapter is itself a non-insertable device and must therefore be measured by a VNA calibrated in a non-insertable environment.

One way to overcome this limitation is to use an SOLR calibration algorithm where

Figure 6: Adapter removal algorithm automatically measures and de-embeds adapter after rotation.



the thru is not well defined. Instead, the thru simply has to be a reciprocal device with some knowledge of the length of the device, usually to within half a wavelength at the highest frequency. The resultant calibration will not be as good as when a perfect thru is used, but it is better than to simply add an adapter with no characterization or incorrect characterization.

Another attempt to improve the calibration of a non-insertable setup is the use of phase equal insertables (PEIs). PEIs are phase equal adapters of different configurations. During the calibration process the correct configuration is used for the non-insertable DUT. Then, when a thru is required, the test port is changed to an insertable configuration and the thru is then measured. This method can provide good results up to 20 GHz. Beyond 20 GHz, the resultant calibration accuracy deteriorates due to the inconsistency in the return loss of multiple connections of the different adapters. The inconsistent return loss results in a degradation of the source and load match. This method is often used for SOLT calibrations.

Measuring non-insertable, low insertion loss devices is therefore one of the biggest challenges in VNA calibrations. So the benefit of using the Precision AutoCal to achieve calibration accuracy better than SOLT not only applies to insertable measurements, it also applies to non-insertable measurements when using the appropriate male/male or female/female configuration. Figure 5 is an example of a low loss measurement of an airline transmission line, one of the more challenging measurements, after calibration with the Precision AutoCal.

And if the correct version of Precision AutoCal is not available, an alternative technique can be used and still achieve excellent results. The technique uses the adapter removal algorithm provided by the VectorStar VNA and will automatically de-embed the effects of an added adapter. Figure 6 demonstrates the procedure of calibration. First the appropriate adapter is connected to the male/female version module. Notice that because of the adapter configuration, the module and adapter assembly is reversible. Since the module has been characterized at the test port of the module, adding an adapter extends the test port. During the setup of the calibration, input is provided to the VNA indicating which port the adapter is connected. The adapter removal calibration procedure is a two step process employing two complete calibrations. After the first calibration the assembly is rotated and calibrated a second time. The two step process provides all the information necessary to the VNA to accurately measure the characteristics of the adapter. Then, when the calibration is complete, the VectorStar VNA automatically de-embeds the effects of the adapter. The result is an accurate non-insertable calibration using an insertable calibration module.

Summary

Achieving fast and accurate calibrations are often in conflict and often accuracy is sacrificed. This is due to the difficulty in achieving good calibrations using sliding loads during the SOLT process. Automatic calibration modules provide a quick and easy method of calibration but have not in the past provided accuracies at the SOLT level. A new module design, coupled with a new generation VNA, can now provide accuracies better than SOLT using the Precision AutoCal.

Nvidia agrees to pay $367 million for Icera

Graphics and CPU company Nvidia Corp., is stepping into 3- and 4G communications by way of the purchase of Icera Inc., (Bristol England) for $367 million in cash.

Icera, founded in 2002, has received more than $200 million in venture capital investment over the years and has more than 550 patents granted or pending worldwide. The company has specialized in creating software modems that run on its own ICs for incorporation in dongles and mobile phones.

By acquiring Icera Nvidia will be able to combine its own GPUs and ARM-based CPUs with mobile communications technology to enhance its position as a provider of chips, chipsets and software for mobile applications, the company said.

Nvidia said it would combine applications processors and baseband processors although it also stated that it would continue to collaborate with existing baseband partners and respect customers' preferences in combining application and baseband processors.

The acquisition, for $367 million in cash, has been approved by both companies' boards of directors and is expected to be completed, subject to customary closing conditions, in approximately 30 days.

The market for baseband processors is one of the fastest growing segments of the technology industry, worth an estimated $15 billion a year.

"This is a key step in Nvidia's plans to be a major player in the mobile computing revolution," said Jen-Hsun Huang, president and CEO of Nvidia.

www.nvidia.com

Half-wave dipole antenna delivers high gain

Antenna Factor has introduced the OC Series antenna, a half-wave dipole antenna that delivers higher gain than a standard whip antenna, increasing the range and reliability of wireless links. Using loaded coil technology, the OC Series half-wave dipole antenna minimizes the length that would typically be required to achieve omnidirectional gain. Its articulating base tilts 90 degrees and rotates 360 degrees.

The antenna's internal counterpoise eliminates the need for an external ground plane and maximizes performance. Available in 916 MHz and 2.4 GHz, the OC Series antenna attaches with a standard SMA or Part 15 compliant RP-SMA connector. Custom colors and logo options are available for volume OEMs.

www.antennafactor.com.

MEMS oscillators

feature 600-fs of phase jitter

MSC is now offering the latest Encore-based SiT820X family of MEMS-based programmable oscillators from SiTime. The SiT820X family features a 600 fs of phase jitter in the critical range of 12 kHz to 20 MHz for SONET-applications and a continuous frequency stability of ±10 ppm from -40 to +85°C.

As with all MEMS-based oscillators from SiTime, the SiT8208 and SiT8209 programmable oscillators, which operate from 1 MHz to 80 MHz and 80 MHz to 220 MHz respectively with supply voltages of 1.8 V and 2.5 to 3.3 V, also deliver six decimal places of accuracy. The programmable drive strength of the device allows a very simple impedance matching and an effective EMI reduction. High-drive options that can be used to drive multiple loads without additional buffers result in a further reduction of the circuit complexity and thus a cost-reduction.

The SiT820X family comes with an array of programmable features, such as frequency, stability and supply voltage, and is suitable for use in telecom, networking, storage and wireless applications.

www.msc-ge.com

PCIe® high-speed digitizer family

combines fast ADCs with on-board FPGA technology

Agilent Technologies has announced several new options for its popular U1084A PCI Express® (PCIe) embedded ADC cards. The U1084A's digitizer technology combines fast analog-to-digital converters with on-board field programmable gate array (FPGA) technology allowing original equipment manufacturers (OEMs) to easily design-in high-speed signal acquisition and analysis.

The family is now available with three separate base versions. The top-of-the-line U1084A-001 features sampling rates up to 4 GS/s and a fully featured front-end with 1.5 GHz bandwidth. It's now complemented by two new versions that offer up to 2 GS/s (-002) and 1 GS/s (-003) sampling rates, respectively. All versions are dual-channel and have an interleaved single-channel mode for maximum sampling-rate performance. In addition, the units incorporate advanced triggering capabilities, including a 15 ps trigger time interpolator (TTI) for accurate timing measurements.

The U1084A architecture can perform specific post-processing tasks, which are easily uploaded into the FPGA under program control. They also redefine the way data acquisition can be performed, offering flexibility and easy reconfigurability.

The standard digitizer firmware (-DGT) enables the digitized data to be stored in large (up to 512 MB) on-board memory. The option also provides smart memory management with segmentation mode and trigger time-stamp functionality.

www.agilent.com

RF predistortion linearizers

improve system efficiency of 4G small cell base stations

SC1869 and SC1889 Second generation system-on-chip (SoC) adaptive RF Power Amplifier Linearizers (RFPALs), from Scintera Networks are based on broadly deployed and field-proven technology — and expand the company's power amplifier linearization solutions to address 3G and 4G heterogeneous network deployments.

The SC1869/89 RFPALs address the individual and distinct challenges faced in designing small cell base stations. They enable manufacturers to increase the efficiency of their linear RF power amplifiers by two to four times while at the same time reducing size, complexity and cost. The SC1869/89 improve on the performance offered by existing RFPAL products for CDMA and WCDMA and expands supported standards to include WiMAX, EVDO, HSDPA, LTE, TD-LTE and LTE Advanced.

The devices enable engineers to deliver future-proof designs that are scalable from 2G to 3G and 4G over all commonly used frequency bands from 698 MHz to 2800 MHz. These turnkey single-chip solutions ensure quick time to market and require no software or complex algorithm development.

The SC1869 specifically targets lower power amplifiers as typically found in emerging small cells required for data centric 4G cellular networks. It can be configured to consume less than 400 mW while delivering excellent linearization performance. The SC1869 provides a clear alternative to the widely accepted but inefficient method of operating the PA in backoff for PA's with output power as low as 500 mW. It reduces the cost of the final stage amplifier and reduces the cost and volume of the power supply and associated heat sinks in half or more.

The SC1889 shares many of the same characteristics as the SC1869 but targets a much wider range of applications, amplifiers and power levels.

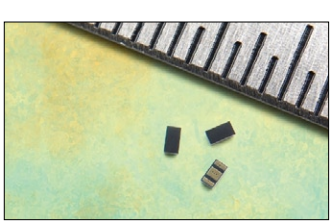
www.scintera.com

Avago Technologies expands family of smallest RF amplifiers

Avago Technologies has added VMMK-3xxx amplifiers to its family of the market's smallest RF amplifiers, which leverage the company's WaferCap chip scale packaging (CSP) technology to offer an ultra-small footprint of 1.0- by 0.5- by 0.25-mm. The amplifiers bring a host of new functionality to the existing VMMK-1xxx and VMMK-2xxx families, including a positive gain slope low-noise amplifier (LNA), a wideband LNA, a variable gain amplifier (VGA), and four directional detectors.

With miniature 0402 package dimensions and no wirebonds, the VMMK-3xxx amplifiers experience almost no signal loss and minimal parasitics. The devices take up 5 percent of the volume and uses only 10 percent of the board area of solutions using a standard SOT-343 package. In some cases, the miniature amplifiers can effectively reduce PCB area by more than 50 percent. The ultra-small package size and fully-matched surface mount design are optimized for 500 MHz to 12 GHz frequencies, making the high-performance devices ideal for a variety of radio architectures and space-constrained applications.

VMMK-3xxx LNAs and VGA can be used in UWB, WLAN, WiMAX, generic IF amp and gain block applications, while the detectors can be used in base stations, point-to-point radios and generic power control loop detectors, as well as for monitoring power amplifier output. The LNA family supports full surface

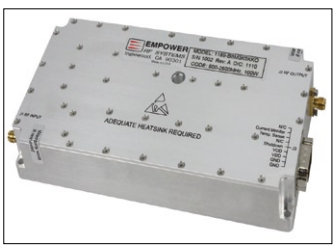


mount capability, requiring no special tooling for assembly. The amplifiers have all I/Os routed to the backside of the device wafer through via-holes, resulting in RF transitions suffering almost no signal loss and minimal parasitics.

www.avagotech.com

100 W broadband high power amplifie

features small form factor



Model 1189 from Empower RF Systems is a recent addition to the company's portfolio of building block designs incorporating the latest GaN device technologies and control functionality. The module delivers 100 W minimum, 125 W typical PSat over 500 to 2500 MHz at typical efficiencies of 45 percent.

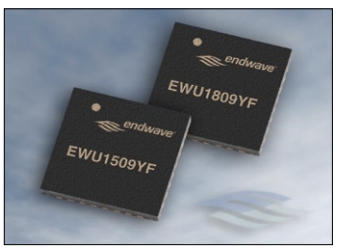
An industry leading, small form factor package (7.4- x 3.6- x 1.06-inches) allows for easy integration in compact system designs. This building block module is well suited for use in defense, communications, and test applications.

The amplifier module is suitable for broadband mobile jamming and band specific high power linear applications in the P/L/S frequency bands. High performance, long term reliability and high efficiency are achieved by employing advanced broadband RF matching networks and combining techniques, EMI/RFI filters, machined housings and qualified components.

www.EmpowerRF.com

Multi-function upconverter MMICs

integrated, extend to 24 GHz



The EWU1509YF and EWU1809YF frequency upconverters from Endwave Corporation operate over intermediate-frequency (IF) ranges of DC to 4 GHz and generate frequencies of 10.0 to 15.4 GHz and 17.0 to 24.0 GHz, respectively.

The lower-frequency model EWU1509YF GaAs MMIC upconverter operates over an IF range of DC to 4 GHz with LO signals from 6.0 to 19.4 GHz at a nominal level of +2 dBm to produce RF outputs from 10.0 to 15.4 GHz. It achieves typical conversion gain of 16 dB and +19 dBm typical RF output power at 1-dB compression. RF output levels can be adjusted in level by means of a 27-dB RF gain-adjustment range.

The higher-frequency model EWU1809YF GaAs MMIC upconverter accepts IF signals from DC to 4.5 GHz and LO signals from 8.5 to 12.0 GHz and nominally +2 dBm to produce RF output signals from 17.0 to 24.0 GHz with typical conversion gain of 5 dB.

www.endwave.com

Integrated wideband passive mixers target wireless infrastructure and SFDR

Analog Devices claims to offer the industry's most highly integrated wideband passive mixers for communications applications. The ADL5811 single-channel and ADL5812 dual-channel mixers deliver unmatched linearity for this class of device, low distortion and low noise combined with wideband frequency performance.

The devices enable multiband, single-board receiver designs by combining a wideband LO (local oscillator) amplifier, a programmable RF balun, a high-linearity mixer core, a programmable IF filter, and an IF amplifier.

These passive mixers extend across a 700-MHz to 2800-MHz frequency range in a single device while delivering input IP3 (third order intercept) of 24 dBm, an 11 dB SSB noise figure and 7 dB of power conversion gain. These performance specifications are maintained across the full operating frequency range. Both the ADL5811 and ADL5812 passive mixers are designed for wideband wireless infrastructure applications and software-defined radio applications, including multi-band/multi-standard cellular base station receivers, wideband radio link down converters, multi-mode cellular repeaters, and picocells applications.

"Wireless receiver designers typically have had to choose between an active mixer, which offers excellent wideband operation and moderate spurious-free dynamic range, or a passive mixer, which has greater SFDR performance but much narrower operating bandwidth," said Peter Real, vice president, Linear and RF products, Analog Devices. "The ADL5811 and ADL5812 passive mixers eliminate the need for this trade off by giving engineers the linearity, distortion and noise performance they need while also supporting true wideband frequency operation."

The high performance across 700 MHz to 2800 MHz of the new passive mixers is the result of three technical advances, most significantly the development of a limiting LO amplifier capable of generating a high-voltage, fast-rise-time, square wave over a wide bandwidth with no DC current penalty compared to existing narrow band mixers.

The second technique involves the integration of a tuned,RF balun structure to ensure a well-balanced RF signal is applied to the FET mixer. Previously, narrowband mixers incorporated an RF balun consisting of a magnetic or transmission line transformer, which provided low loss but only moderate bandwidth.

A third technique addresses the potential for the passive mixer's structure to generate a composite signal that could result in the early compression of the IF amplifier. ADI reduced the amplitude of the unwanted sideband into a load by designing a tuned filter network to provide the proper sum termination as a function of the RF and LO frequencies.

The frequencies of the ADL5811 and ADL5812 can be easily changed using a three-wire SPI (serial port interface), which allows designers to tune the mixers with no need for external impedance matching components. Performance can be further optimized by digitally adjusting the DC bias voltage to the passive mixer gates. To minimize power dissipation, each channel of the dual-channel ADL5812 can be enabled or disabled independent of the other. For DPD (digital pre-distortion) transmit observation receivers or non-diversity applications, the single-channel ADL5811 can implement a single receiver chain in a multi-channel or multi-band platform.

www.analog.com/rf

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20th - 26th June 2011
Paris le Bourget, Parc d'Expositions
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www.paris-air-show.com

Wireless Sensor Networks and RTLS Summit Europe 2011
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Holiday Inn Munich City Centre
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www.idtechex.com/wireless-rtls-europe-11

EMC 2011
14th - 19th August 2011
Long Beach Convention Center
Los Angeles, CA, USA
http://emc2011.org

Wireless Technologies 2011
27th - 28th September 2011
Schwabenlandhalle
Stuttgart-Fellbach
Germany
www.mesago.de/en/wireless/0

European Microwave Week 2011
9th - 14th October 2011
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www.eumweek.com

4G World 2011
24th - 27th October 2011
McCormick Place
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www.4gworld.com

Wireless Congress 2011: Systems & Applications
9th - 10th November 2011
Konferenzzentrum München
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www.wireless-congress.com

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