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"Subconscious mode" for smartphones could extend battery life by over 50 percent

A proof-of-concept stage "subconscious mode" for smartphones and other WiFi-enabled mobile devices could extend battery life by as much as 54 percent for users on the busiest networks, described in a paper titled "E-MiLi: Energy-Minimizing Idle Listening in Wireless Networks."

Even when smartphones are in power-saving modes and not actively sending or receiving messages, they are still on alert for incoming information and they're searching for a clear communication channel. The researchers have found that this kind of energy-taxing "idle listening" is occurring during a large portion of the time phones spend in power-saving mode — as much as 80 percent on busy networks. Their approach could make smartphones perform this idle listening more efficiently. It's called E-MiLi, which stands for Energy-Minimizing Idle Listening.

To find out how much time phones spend keeping one ear open, University of Michigan computer science and engineering professor Kang Shin and doctoral student Xinyu Zhang conducted an extensive trace-based analysis of real WiFi networks. They discovered that, depending on the amount of traffic in the network, devices in power-saving modes spend 60 to 80 percent of their time in idle listening. In previous work, they demonstrated that phones in idle listening mode expend roughly the same amount of power as they do when they're fully awake.

E-MiLi works by slowing down the WiFi card's clock by up to 1/16 its normal frequency, but jolts it back to full speed when the phone notices information coming in. It's well known that you can slow a device's clock to save energy. The hard part, Shin said, was getting the phone to recognize an incoming message while it was in this slower mode.

When used with power-saving mode, the researchers found that E-MiLi is capable of reducing energy consumption by around 44 percent for 92 percent of mobile devices in real-world wireless networks.

E-MiLi requires new processor-slowing software on smartphones as well as new firmware for phones and computers that would be sending messages. They need the ability to encode the message header — the recipient's address — in a new and detectable way. The researchers have created such firmware, but in order for E-MiLi use to become widespread, WiFi chipset manufacturers would have to adopt these firmware modifications and then companies that make smartphones and computers would have to incorporate the chips into their products.

Shin points out that E-MiLi is compatible with today's models, so messages sent with future devices that use E-MiLi's encoding would still be received as usual on smartphones without E-MiLi. E-MiLi can also be used with other wireless communication protocols that require idle listening, such as ZigBee.

www.umich.edu

SK Telecom embeds NFC in SIM card

Mobile phone service provider SK Telecom (Seoul, South Korea) claims it has developed the first SIM card equipped with a Near Field Communications (NFC) chip which can be retrofitted to non-NFC handsets thereby enabling NFC-based services.

The company plans to launch the product in October 2011 for enterprise customers in Korea. This will be followed by roll out in overseas markets including China to accelerate the spread of mobile payment infrastructure.

NFC is already used with some automated ticket systems and is being included on the motherboards of mobile handsets and smartphones, so-called NFC phones, as a means of enabling "wave-and-pay" and other services. NFC can also be used to download information from passive tags, most usually in the form of a URL that can be used as a destination for a smartphone browser. It operates on a 13.56-MHz carrier and allows data exchange between two devices over a distance of about 10 centimeters.

SK Telecom's NFC-on-USIM is a special USIM (universal subscriber identity module) card embedded with a 13.56-MHz antenna, NFC chip and USIM chip. Details of the NFC-on-USIM application programming interface (API) to outside developers will follow.

www.sktelecom.com

IN BRIEF

U-blox acquires Fusion Wireless

U-blox announces the acquisition of San Diego based Fusion Wireless, a provider of CDMA wireless modules for consumer and M2M applications in North America.

Key terms of the transaction cover technology and modules in the area of CDMA wireless technology in several form factors; and integration of the Fusion Wireless business into u-blox's existing activities to leverage and further strengthen the mutual commercial activities as well as capitalize on technological synergies.

www.u-blox.com
www.fusionwirelesscorp.com

Universal mobile payments platform goes live

Luup claims to have launched the first universal mobile payments platform, which is the result of the integration of the Temenos T24 core banking application and Microsoft BizTalk with Luup's mobile payment services platform.

Luup CEO, Martin Wilson, explained: "Through Luup, banks have the opportunity to serve corporate and retail markets using a single universal mobile payments platform. They can now offer mobile payment services in developed and emerging markets anywhere in the world through any mobile device and on any network."

The integration of market leading applications with Luup's platform enables Luup to provide the most advanced mobile payments managed service available. It combines the scale to deal with large transaction volumes with the mission critical standards that banks require to meet regulatory and security requirements.

Luup's managed service model enables banks to implement the service easily and at low cost and to scale-up as customers' demand for mobile payments increases even further.

www.luup.com

IN BRIEF

SFR provides free femtocell offer to Europe

French mobile operator SFR has announced that it is to offer free femtocells to all of its 10+ million 3G customers. The service is the first of its kind in Europe and follows the world's first free model adopted by SoftBank Mobile in Japan.

The femtocell works as a standalone device to connect to standard ADSL routers from any ISP. But for users of SFR's latest multi-function ADSL device, the Neufbox Evolution, the SFR Femto converts into a click-on USB accessory, preserving a one-box solution with no extra cables. The French operator is using Ubiquisys' femtocell technology.

www.sfr.com

LTE sales overtake WiMax

Infonetics Research contends that LTE infrastructure equipment spending was greater than that of WiMax for the first time in 2Q11. The overall 2G, 3G, 4G infrastructure market showed equipment spending up 25.2 percent year-over year (2Q10 to 2Q11) and up 4.5 percent sequentially in 2Q11, the firm said. The cumulative total of nearly $250 billion is going to be spent on mobile infrastructure during the five years 2011 to 2015

In the 4G segment the global LTE equipment market was about $600 million in 2Q11 while the equivalent WiMax market was about $500 million, the firm reckons. The two markets together are set to show a compound annual growth rate of 46 percent over the five years from 2010 to 2015.

"Although LTE and 4G continue to make the headlines, GSM was definitely the 2Q11 reality, with massive capacity upgrades in China and India. In addition, 2G and 3G network modernization with multi-standard base transceiver stations (BTS) continues to be strong and will remain the main theme throughout the second half of 2011," said Stephane Teral, principal analyst for mobile infrastructure at Infonetics Research.

www.infonetics.com

Small cell backhaul to shift away from copper and fiber toward wireless backhaul

While outdoor small cells have received a lot of attention lately, small cell backhaul has yet to see the spotlight. The reason has been twofold – first, there hasn't been any significant outdoor small cell deployment yet, and second, operators are still in the process of trialing and testing small cell backhaul technologies, especially the newer contenders.

Due to its unique characteristics, there are numerous considerations that need to be taken into account for a small cell backhaul solution. These include product footprint, range, cost, Ethernet/IP support, and capacity. By 2016, an estimated 58% of outdoor small cells will be backhauled using wireless techniques.

While fiber, copper, and traditional microwave are currently being used to backhaul rooftop micro base stations, the emergence of wireless technologies like NLOS OFDM (sub 6 GHz), MMW (60 to 80 GHz) and also Wi-Fi backhaul solutions are likely to find preference due to their flexibility, low cost and ability to use point-to-multipoint (PMP) and point-to-point (PTP) techniques to backhaul clusters or rows of small cells.

"Small cell backhaul space is still in its early days, with a number of small vendors positioning their solutions, especially on the wireless backhaul side," says Aditya Kaul, practice director, mobile networks. "While the majority of small cell backhaul activity is concentrated in OFDM NLOS sub 6 GHz and to some extent in the MMW 60 to 80 GHz space, the cost of these solutions will need to come down to allow operators to make a favorable small cell business case."

www.abiresearch.com

Nvida ups ante with five-core mobile chip

Nvidia will pack five cores into its next-generation mobile CPUs using a novel technique it describes as Variable Symmetric Multiprocessing (vSMP) to claim a power efficiency edge over rivals Qualcomm and Texas Instruments.

The company's quad-core Kal-El processor first shown in February actually has a fifth core. The extra core takes over automatically when workloads permit running the system in a low power mode.

Nvidia described the vSMP approach in a white paper describing the chip, also known as Tegra 3. The device uses what Nvidia calls a CPU Goveror and CPU management logic to analyze system workloads and automatically switch between the one low power core, called a Companion core, or the quad-core complex as needed for maximum efficiency.

Both are based on the ARM Cortex A9. The Companion core running up to 500 MHz is made in a low power process technology; the quad core complex running up to a GHz is made in a general purpose or high performance process.

When using the quad-core complex, the Companion core is shut down and the device activates one to four of its main cores depending on the performance needs of the workload.

The chip can switch between the Companion and main cores in less than 2 milliseconds. "The Companion and main cores share the same L2 cache, and the cache is programmed to return data in the same number of nanoseconds for both Companion and main cores," according to the white paper.

Nvidia claims the approach provides power savings in all use modes ranging from 14 to 61 percent compared to a standard quad core. In a rare direct comparison with competing chips, Nvidia said the five-core chip consumes two to three times less power than chips from Qualcomm and Texas Instruments.

The Nvidia chip consumes 579 mW when performing at about 5,000 Coremarks and running at 480 MHz. By contrast the TI Omap 4 and Qualcomm Snapdragon QC8660 consume 1501 and 1453 mW respectively at roughly the same performance level attained when running at about 1 GHz, Nvidia claimed.

In addition, when running at 1 GHz the Nvidia chip performed 11,667 on the Coremark benchmark and still consumed less power than the competing chips at 1261 mW, it said.

Qualcomm announced plans for a quad-core Snapdragon in February, but has not released details of the chip. TI has described its plans for its Omap 5 using dual ARM Cortex A15 cores.

www.nvidia.com

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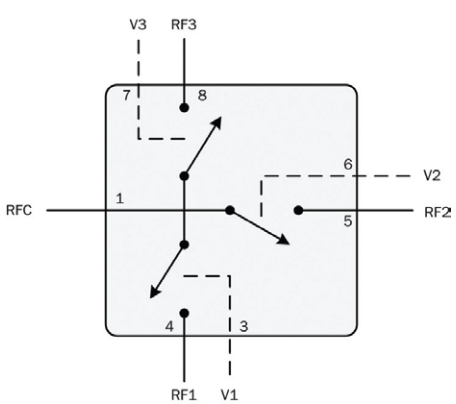

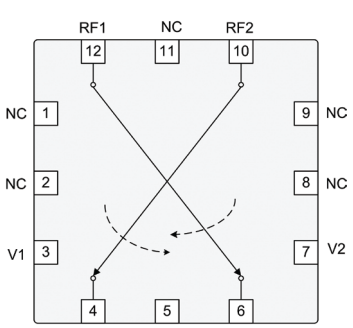

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IN BRIEF

Fast transition to 802.11ac

Following small shipment volumes in 2012 and a significant increase in shipments in 2013, IEEE 802.11ac will emerge as the dominant Wi-Fi protocol by 2014, according to ABI Research. Only a niche subset of 802.11ac will be single-band 802.11ac, using solely the five GHz band. Most will be 802.11n/802.11ac dual-band chipsets.

While 802.11ad products will make an early debut, with a Qualcomm Atheros and Wilocity partnership leading the way, 802.11ad will not reach the 50 percent mark until 2016. It will be used in dual- and tri-band chipsets. Because of their lower cost, 802.11n and 802.11ac chipsets with 1X1 will remain dominant until 2015, when they will be surpassed by both 2X2 and 3X3 chipsets. 2X2 chipsets for mobile devices that can fall back to 1X1.

www.abiresearch.com

Aeroflex endows €1 million lab at Lancaster University

Aeroflex Limited and Lancaster University have announced the inauguration of the Aeroflex Wireless Broadband Laboratory in the University's School of Computing and Communications at InfoLab21, Lancaster's world-class centre of excellence for research in information and communication technologies.

The new laboratory is equipped with just over €1 million worth of test equipment donated by Aeroflex, a leading US technology company with a large R&D and manufacturing facility in Stevenage, UK. The Aeroflex laboratory will enable Lancaster University to play a leading role in the development of the next generation of wireless broadband networks and user equipment, such as smartphones, tablet PCs and future mobile devices. Aeroflex already has a longstanding relationship with Lancaster University.

www.aeroflex.com

Holographic radar missile scoring passes proof of concept stage

Cambridge Consultants has demonstrated its holographic radar technology for target scoring in live firing trials under a US Department of Defense (DoD) program. The program is aimed at improving the projectile scoring capabilities of the US Navy and Army on land and sea surface ranges, to mitigate the high costs of live fire training and deliver more accurate data. The system is the first to align holographic radar and target scoring technologies.

Using its holographic radar technology, Cambridge Consultants developed the Land and Surface Target Scorer (LSTS) system. Installed on high-speed land or sea-surface target vehicles, the system uses receiver array panels combined with high-speed signal processing to detect and track small projectiles in the presence of very large radar clutter, such as that experienced on moving land and sea surface targets.

During recent trials at the NSWC Test Range, Dahlgren VA, the LSTS system successfully detected, tracked and located the splash point of inert 5 inch projectiles, and was also able to pinpoint the burst point of a high-explosive round. In a multiple shot burst, the system separately tracked four shells fired at three second intervals. Observers were able to see the results in near real-time on a laptop PC.

www.cambridgeconsultants.com

Wireless solution scheduled for airlines and airport authorities

Kontron has announced its partnership with Thales to design and manufacture the Enhanced Terminal Wireless LAN Unit (eTWLU) for the company's GateSync system. The Thales GateSync system is a high-performance wireless ground connectivity solution for airports and airlines. The eTWLU, a critical element of the systems onboard networking, is a small sealed ARINC-763 compliant wireless transceiver that supports multiple high speed wireless protocols allowing the GateSync system to be deployed at airports throughout the world.

The system enables airlines to wirelessly load and offload content and data while an aircraft is on the ground. In order to ensure maximum connectivity throughput and reliability to off-aircraft networks the Kontron eTWLU is integrated with multiple radios — two 802.16-2006 WiMAX radios supporting 10 MHz channels operating from 5.725 to 5.875 GHz, a single 802.11a/g Wi-Fi radio, and a GPRS/EDGE/HSPA-capable GSM radio.

www.kontron.com, www.thalesgroup.com

Low power RF technology enables intelligent hand hygiene system

Low-power wireless chip technology from NXP Semiconductors is being used in the HyGreen Hand Hygiene and Recording System, designed by HyGreen, to capture and transmit data on hand washing by healthcare workers, helping to improve hospital hygiene. The innovative solution actively reminds busy healthcare workers to wash their hands, and records all hand-washing events and patient-staff interactions in the hospital environment. HyGreen is using the NXP JN5139 wireless microcontroller and the JenNet wireless network protocol stack optimized for low-power, low-data rate, cost-sensitive applications, and plans to start using the JN5148 microcontroller later in 2011. Based on the IEEE 802.15.4 specification, JenNet enables a robust, self-healing network that helps HyGreen track all hand-washing events, as well as which patient bed each healthcare worker has visited.

www.hygreeninc.com

This month's cover depicts the wireless world we live in. As wireless technologies evolve, test is getting more and more complex due to increased complexity and data rates driven by ever more ambitious standards. Smartphones are set to drive data requirements much higher.

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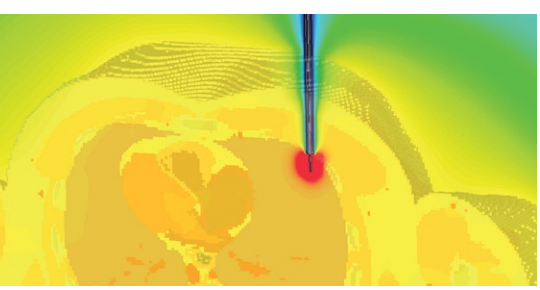

Simulation of cancer treatment by RF thermoablation.

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In-Flight Wi-Fi coming to a plane near you

According to In-Stat, over the past year there has been significant growth in both the usage rates of in-flight broadband and number of planes deployed. Additionally, In-Stat contend that what has been a US-centric market has started to see an expansion of borders with deployments in Europe growing over the past year and new activity in the Middle East. New In-Stat (www.in-stat.com) research, forecasts that in-flight Wi-Fi revenues will surpass the $1.5 billion mark in 2015.

As smartphones become an indispensable tool for many, whether for business, social networking or gaming, users are expecting a connection virtually everywhere. This is especially true when travelling, and planes, trains, busses and personal vehicles are getting connected.

What is interesting about WiFi on planes, is that we are still told to switch off our devices while flying, at least the radio part of the phone. This is apparently for safety reasons, though I suspect at such a high altitude most phones are not be near enough to connect to any cells. Hopefully, the airlines are still making sure flying is safe, and not attracted too much to the forecast revenues that in-flight WiFi might generate.

“While airlines initially viewed in-flight broadband as a competitive differentiator, it is now simply viewed in the US market as a competitive requirement,” says Amy Cravens, Senior Analyst at In-Stat. “The future of in-flight Wi-Fi will be less about convincing airlines of the merit and more about leveraging the network to provide a broader breadth of services. As in the hotspot market, Wi-Fi access is likely to become a commodity in the in-flight market, with the revenue opportunity resting on the services and features, not the connection.”

After all, travellers have a lot of time to kill on flights and the possibility of downloading a film to a tablet for personal use is quite tempting. There is a lot of opportunity for manufacturers and service providers.

For, example, Kontron recently announced a partnership with Thales to design and manufacture the Enhanced Terminal Wireless LAN Unit (eTWLU) for the company’s GateSync system. The Thales GateSync system is a high-performance wireless ground connectivity solution for airports and airlines.

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IN BRIEF

Motion algorithms lift MEMS-based remotes

Armed with a new deal to integrate its MEMS sensor algorithms into Texas Instruments's ZigBee-based radio frequency for consumer electronics (RF4CE) hardware platform—RemoTI—Hillcrest Laboratories, hopes to penetrate further into the fast growing markets for MEMS-based motion-control interfaces for Smart TV, streaming video, motion-based gaming and 3-D gesture control.

Last year, Hillcrest Labs announced the integration of its MEMS sensor algorithms—the Freespace MotionEngine—with Broadcom's digital-TV on-a-chip and Bluetooth on-a-chip, as well as major design-wins with the LG's Smart TVs, SMK's Smart TV remotes, and most recently for the second-generation of the popular Roku set-top box for Internet protocol television (IPTV). The company also licensed its intellectual property to Playstation-maker, Sony, and "amicably resolved" a dispute with Wii-maker Nintendo regarding its motion-processing algorithms.

http://hillcrestlabs.com

1.5M LTE base stations ship by 2015

Carriers will deploy as many as 1.5 million LTE base stations by 2015 with Ericsson the leading supplier and Alcatel-Lucent and Huawei battling for second place, according to a new report from In-Stat.

"Ericsson and Alcatel-Lucent have become the early LTE leaders as a result of modernization contracts with Verizon and AT&T," said In-Stat analyst Chris Kissel.

The report projects the top five vendors in global LTE routers and gateways in 2012 will be Alcatel-Lucent, Cisco, Ericsson, Huawei, and Nokia Siemens Networks. From 2011 to 2015, revenues for LTE radio access networks (RANs) will grow 41 percent on a compound basis, it said.

www.instat.com

Compression across base station fiber optic links can save industry up to 25 billion USD

Samplify Systems was granted a patent by the United States Patent and Trademark Office (U.S. Patent #8,005,152) on August 23, 2011 that covers the use of compression across fiber optic links, including those using the CPRI (Common Public Radio Interface) and OBSAI (Open Base Station Architecture Initiative) protocols, within wireless base stations.

"With the deployment of 4G LTE beginning early this year, we have seen wireless operators and equipment vendors become much more sensitive to the rising deployment costs for both macro-cell and distributed base stations," says Tom Sparkman, CEO of Samplify. "Wireless operators will benefit from our Prism IQ™ compression technology from multiple equipment vendors which we believe can save as much as $25B in the deployment of 4G LTE."

With 4G LTE, the capacity of fiber optic connections using CPRI and OBSAI between remote radio heads and baseband units increases from 614 Mbps to 10 Gbps. To support this faster speed, more expensive optical transceivers and field programmable gate arrays (FPGAs) are required at each end of the fiber link.

For distributed base stations, using centralized baseband processors and metropolitan-area fiber to connect to radio units, the operating costs associated with 10 Gbps wavelength services are many thousands of dollars per month. In fact, Bell Labs estimates that in 2010, wireless operators spent over $200B on capital and operating costs for their existing networks. As operators roll out 4G, these costs will only escalate.

The company's Prism IQ compression technology has continually been optimized specifically for critically sampled I/Q baseband data to support increased bandwidth demands by wireless networks. Given this legacy, the mobile industry can be assured that Prism IQ delivers the highest performing compression technology available for wireless infrastructure applications, achieving up to 4:1 compression on 4G LTE signals while maintaining signal quality in terms of error vector magnitude prescribed by 3GPP.

Prism IQ is available from Samplify to wireless equipment companies as intellectual property for FPGAs and ASICs.

www.samplify.com

Gennum and Altera demonstrate 4 x 25 Gb/s ICs for 100 Gb/s networks

Bolstering the ecosystem for next-generation 4 x 25 Gb/s based optical transceivers, Gennum and Altera have demonstrated interoperability of Gennum's 25 to 28 Gb/s PHY with Altera's 28 Gb/s enabled Stratix® V GT FPGA at the European Conference and Exhibition on Optical Communication (ECOC). The demonstration featured Gennum's GN2425 and GN2426 module clock and data recovery (CDR) integrated circuits communicating with an Altera linecard/host-based Stratix® V GT FPGA operating at 25 to 28 Gb/s over an OIF CEI-28G-VSR compliant electrical link. The link had greater than 10 dB of loss at the Nyquist data rate and comprised host board traces, module board traces and a Molex zQSFP+ interconnect system. The link exceeded CEI-28G-VSR IA requirements and operated at a bit-error-rate (BER) of less than 1E-15.

The GN2425 and GN2426, now in pre-production, are designed to support 25 to 28 Gb/s data streams for next-generation 100 Gb/s pluggable fiber-optic modules, line cards and direct-attach copper cables using the 25G-QSFP+ and CFP2 form factors. They provide exceptional jitter performance with low power consumption.

By resetting the jitter budgets within the module in both the transmit and receive directions, Gennum's CDRs enable robust operation for new systems such as 100GBASE-LR4 optical modules. In the transmit direction they drive EML, DML or MZM drivers with very low jitter, allowing clean, wide-open transmit eyes. In the receive direction they remove jitter from the recovered optical signals, promoting error-free reception by a downstream receiver on the host board. The GN2425 and GN2426 CDRs include the equalization capability demanded of the new CEI-28G-VSR IA, providing a robust VSR link.

www.gennum.com, www.altera.com.

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Low power 2.4 GHz SoCs help wireless muscle stimulator to offer consumers pro athlete technology

By Nordic Semiconductor

The world's first wireless muscle electro-stimulator, which is used by HTC-Highroad, the professional cycling team of top 2011 Tour de France sprinter and new world road race champion, Mark Cavendish, now employs Nordic nRF24LE1 proprietary 2.4 GHz System-on-Chips (SoCs) from ultra low power RF specialist Nordic Semiconductor ASA.

The Compex Wireless stimulator, which targets professional athletes and serious consumer sports and fitness enthusiasts such as marathon runners and keen cyclists, employs mechanical biofeedback ('mi-SCAN') technology to automatically and safely adjust the stimulation settings to the specificities of each muscle. The stimulator can be used safely and effectively to enhance training regimes and accelerate post training/racing muscle recovery via one of 50 downloadable wireless programs targeting both professional athletes and consumer sports and fitness enthusiasts

The Compex Wireless is the world's first electro-stimulator to the offer the convenience of wireless to maximize application freedom and comfort without the risk of users getting tangled up in trailing cables. It also gives non-professional users the ability to access the benefits of muscle stimulation on a regular basis, by making it possible for them to set training objectives and download relevant muscle stimulation programs and ready-to-use schedules from a dedicated website.

In operation, a Nordic nRF24LE1 2.4 GHz SoC with on-board microcontroller running a Compex-developed wireless networking protocol is located in each of up to four compact wireless circular stimulators (5.5 cm diameter, 1.8 cm thick, 50 g weight). These communicate with another nRF24LE1 located within a wireless controller featuring a 6.1 cm color LCD screen and simple user interface used to set up and control the Compex Wireless. Each stimulator can operate for an entire day between recharges from a built-in 450 mAH lithium-ion polymer rechargeable battery under highly demanding (two training programs at high power and three recovery programs) usage conditions.

Electro muscle stimulation has long been used by elite professional athletes both during training (to stress key target muscles) and between training sessions and competitive events (to accelerate recovery cycles and treat common intensive training ailments such as lower back pain).

"When we began development of this project we weren't RF specialists so we decided to recruit an experienced RF engineer and discuss what we were trying to do with a number of local independent wireless design and development labs," says Nicolas Fontaine, R&D Team Manager and Senior Firmware Engineer at Compex Médical in Switzerland (a division of DJO Global) that developed the Compex Wireless. "They all recommended Nordic Semiconductor because of the technical capability of its solutions, quality of service and support, competitive pricing, and operational reliability."

Fontaine continues: "But making this product wireless was still a big challenge. For user comfort all stimulators have to be precisely synchronized within milliseconds of each other at all times and the whole wireless network demanded very low latency so that should the system need to stop (e.g., due to a low battery level in one of the stimulators or by instruction from the user), it stopped immediately and simultaneously rather than disorderly over a few seconds. Finally, the product had to work reliably even in challenging RF environments shared with other Compex Wireless users in close proximity (e.g., during races) and other active 2.4 GHz sources such as Wi-Fi and Bluetooth wireless technology. We achieved all of this while meeting all relevant product specifications, compliances and regulations thanks to the dedication of our development team, and support from both Nordic and it's local European distributor Rutronik."

The nRF24LE1's radio is a fully featured nRF24L01+ 2.4 GHz transceiver core including Nordic's proven Enhanced ShockBurst™ hardware link layer. It delivers true ULP operation with peak currents low enough to run on coin cell batteries.

It integrates an enhanced 8051 mixed signal MCU core featuring fewer clock cycles per instruction than legacy 8051 devices. Most instructions need just one or two clock cycles leading to an average performance improvement of 8X using the MIPS benchmark. This high performance combined with 16-kbytes of on-chip flash and 1-kbytes of SRAM ensures the processing platform is powerful enough to run both the RF protocol stack and application layer with ease.

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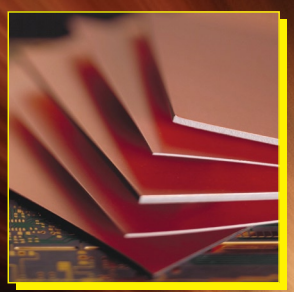

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100-Gigabit Ethernet CMOS PHY targets next generation line cards

By Paul Buckley

The next generation 100 GbE line cards targeted for data center and enterprise networks face several design challenges when they look to retain a lower carbon footprint while they upgrade to 100 GbE networks.

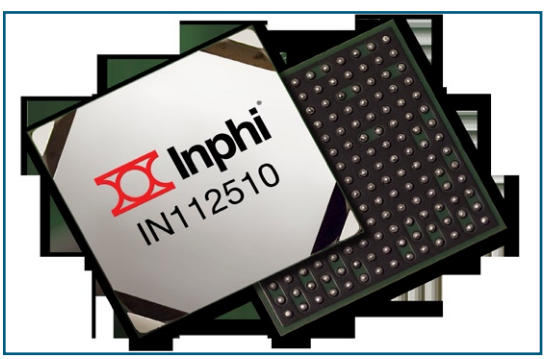
Inphi Corporation has unveiled what the company claims is industry's first, lowest power 100 Gigabit Ethernet (GbE) CMOS PHY solutions that support the IEEE 802.3ba standard and target next generation high density 100G line cards. The company's 100 GbE CMOS chipsets are looking to deliver three times less power and twice the levels of integration compared to what is already on the market.

Inphi's IN112510 100 GbE CMOS Gearbox (GB) and IN012525 100 GbE CMOS Clock Data Recovery (CDR) chipsets have been developed to accelerate time-to-market for higher aggregate bandwidth systems while containing costs of next generation 100 GbE line cards targeted for data center and enterprise networks.

Based on Inphi's iPHY architecture announced in March 2011 the cost-effective, energy-efficient 100 GbE links are aiming to become essential tools for data center and service provider networks, which are struggling to satisfy the global economy's relentless hunger for more bandwidth. With service providers and data centers demanding technology with low power consumption, Inphi's latest iPHY CMOS PHY solutions will enable them to easily upgrade to 100 GbE networks while retaining a lower carbon footprint. By integrating multiple channels along with transmit and receive functions on a single IC, Inphi claims the company is able to double the levels of integration available from existing 100 GbE PHY and CDR offerings.

The iPHY IN112510 is a single-chip, low-power PHY for 10:4 gearbox applications for 100 GbE and OTU4 high-density 100 Gbps line cards with 25-28 Gbps electrical interfaces. The iPHY IN012525 is a low-power CDR for 100 GbE and OTU4 next generation 100G modules, which will typically reside inside a CFP-2 module.

Siddharth Sheth, Vice President of Marketing for Inphi's high-speed connectivity products comments, "We essentially own the link with this chipset solution and that allows us to de-risk the design — our customers will find it very attractive because of the use of a CDR chip solution inside a module that talks to a chip that we guarantee works over that channel. That's the big attraction from a design risk or design development standpoint on the system side. The other advantage is that we are the first vendor in the market place to have a CMOS solution for 100 GbE PHY and 100 GbE CDR."



CMOS advantages

Using CMOS solution offers a lot of advantages over existing SiGe solutions. Current solutions on the market are based on SiGe process technology, which is typically high power and is not as area optimal. In addition, SiGe does not offer as high a level of integration as CMOS.

The key advantage CMOS offers is much lower power. It is almost three times less than what is available on the market today. Current SiGe solutions are about 8 W but the Inphi solution comes in at about 2.5 W.

Existing SiGe solutions have typically been two-chip solutions. They typically have a transmit chip and a receive chip. Inphi have integrated the transmit and receive chips into a single chip making it like a true transceiver and that obviously saves area specially for enterprise and data center applications where area is a scarce resource.

Signal integrity

According to Sheth, "Signal integrity is always a huge challenge when you transition from one key step of the Ethernet to another and this is the other part of the equation. The design would not be a successful without us having done a lot of design work that had already be done on the signal integrity side. Over the last two years before we even got started with the design we had a team of core signal integrity experts who were working with our customers and partners to create a link simulation set-up."

"When you move to data rates of 100 GbE you realise that you are not just going to build a point solution and put it out into the field and expect it to work. That is a 'Hail Mary' approach. That might have worked at 1 GbE and may have even worked at 10 GbE but was never going to work at 100 GbE. So you need to pre-empt all of that ahead of time and take the chip models."

"We took all the parameter models of our customers' channels and data connector models from our connector vendor and went to optics vendors and got their optics models. We recreated the whole link from our chip to the receiving chip with all the elements in between and then put it through a detailed signal integrity simulation tool. We created this tool floor that took about a year and half for our design team to build. The tool allows us to take all of the different parameters and plug it into the model and then extrapolate how our chip would perform in our customers' environment. We have various knobs we can turn in that tool floor."

"The tool is a statistical simulator as opposed to an actual simulator so it will statistically simulate all the different corners and extrapolate how the chip would perform in a customers' environment without having to physically to do each and every simulation."

"That saves you a lot of time and gets you a lot of data and although it is not the real thing it still gives you a great deal of confidence in terms of how well the chip is going to perform. That is the basis of how we designed our transmitters, our driver circuits and our receiver circuits. A lot of this work was done before we started putting the design together."

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Qualcomm looks to smartphones to drive growth

By Jean-Pierre Joosting

Mobile computing, in many instances, is taking over from PCs and in some cases laptops. This trend is been driven by the smartphone revolution, still in its infancy and to a lesser extent the emerging tablet platform. Smartphones today have been responsible for stressing the capacity and QoS of many mobile network operators around the world. It is not about to get any easier, Strategy Analytics estimate that operators will experience data growth of roughly ten fold by 2015.

This success can be attributed to the smartphone's capability to combine graphics and computing in a small portable form factor. However, to achieve this, smartphones rely on highly integrated processors, such as Qualcomm's SnapDragon SoC to efficiently combine a multitude of technology components, including CPU, GPU, LAN, WAN, DSP, GPS, connectivity, software, power management, RF, and multimedia. The Snapdragon MSM8x60 family of mobile processors for multitasking tablets and smartphones, offers two asynchronous processor cores; an integrated Adreno 220 GPU with twice the processing power of its predecessor; and support for up to a 16 megapixel camera.

At a recent Qualcomm event, in Istanbul, Dr Paul Jacobs, Chairman and CEO of Qualcomm remarked that mobile can change the world and cited some examples such as healthcare, citizen news reporting, education, and e-government. Emphasizing the importance of mobile today, Dr Paul Jacobs added that mobile is the largest technology sector, generating revenue of around 1.3 trillion USD, representing 2 percent of global GDP.

The smartphone revolution is in its infancy, and as handsets get cheaper, market penetration will increase. One goal, the industry is looking at is to produce an entry level smartphone for $100. Further trends include augmented reality, gaming, mobile healthcare, 3D mobile, and faster mobile processors, rising from dual-core 1.5 GHz today to quad-core, 2.5 GHz around 2014.

Healthcare

Mobile healthcare is potentially one of the biggest markets available to the smartphone platform. Not only can wireless healthcare improve communications between doctors and patients, but it can significantly reduce costs in healthcare systems, and can also provide a very cost-effective way of monitoring patients with specific ailments or the elderly, that once required specialist equipment — now all that is needed is a smartphone, sensors and an app. Examples include wireless glucose meters, blood pressure monitoring, wireless ECG, temperature measurements, and elder care systems.

To illustrate this idea, Qualcomm Incorporated, through its Wireless Reach™ initiative, and Life Care Networks, along with the Community Health Association of China, has recently launched the Wireless Heart Health project for the prevention and care of cardiovascular diseases (CVDs) in underserved communities in China.

Using China Telecom's 3G EV-DO wireless network, this project aims to explore a new health care solution to enhance the CVD diagnosis and prevention capabilities of community health clinics in China.

The 3G system includes smartphones with built-in electrocardiogram (ECG) sensors; web-based, electronic medical record software; and 3G wireless workstations located within the clinics. Each workstation includes a computer terminal with Internet access, providing health care workers with instant access to electronic patient records, including ECG data. The project also includes training sessions for all participating community health center clinicians.

"3G wireless technologies offer new channels for improving access to health care, particularly within underserved communities," said Shawn A. Covell, vice president for Qualcomm Government Affairs.

Gaming

Smartphones have the potential to double up as handheld gaming platforms, especially as the industry brings 3D displays, gesture control and augmented reality to the market.

Earlier this year Qualcomm introduced the Snapdragon™ Game Pack, which is an optimization program initially featuring more than 100 mobile games that represent the first installment of a growing collection of the latest console-quality and casual games optimized and enhanced for Snapdragon-based mobile devices. This milestone conveys the depth of support and collaboration among Qualcomm and top gaming publishers and developers that are using the advanced graphics capability of the embedded Adreno™ GPUs in Snapdragon mobile processors to bring a better gaming experience to mobile users. Future phases of the Snapdragon Game Pack will be able to take full advantage of next-generation Snapdragon mobile processors that will feature quad-core Adreno GPUs and will be optimized for larger display devices, such as tablets. According to Qualcomm, more than 60 percent of smartphone users regularly play games on their mobile devices.

Augmented reality

Augmented Reality (AR) is the concept of superimposing virtual content (such as

graphics) on top of a view of the real world as seen through a camera. Typical applications range from gaming and interactive media/ marketing to instructional how-to/aid. Juniper Research estimates that revenue from AR will rise from a negligible amount today to over 700 million USD by 2014.

To this end, Qualcomm offer an augmented reality (AR) platform for Android smartphones, via their online developer network. Developers can now build, market and commercially distribute applications based on the Qualcomm AR platform. The platform's rich feature set enables developers to build high-performance, interactive 3D experiences on real world images, such as those used in print media (books, magazines, brochures, tickets, signs) and on product packaging.

The platform supports multiple development environments. The Qualcomm AR Android SDK supports native Android development with the Android tool chain, including the Android SDK and NDK. The Qualcomm AR Unity Extension supports rapid development with the Unity 3 game development tool. A web application is also included for creating and managing image resources that can be used with either development environment.

Performance is achieved through Qualcomm's innovations in advanced computer vision algorithms and close integration of hardware and software. The effect of this performance is a higher fidelity user experience in which graphics content appears more real against the real world background.

Gesture control

AR offers a users a different way of visualizing the real world on the smartphone or tablet screen. Combined with gesture control, new and innovative interfaces for the relatively small screen of a smartphone will enable users to interact more intuitively with the device. For example, a shelf of DVDs, might be represented on a phone as a sliding view of box covers. The user would use a hand movement to scroll through the titles, or touch the screen to play the DVD. An historic building or site might be viewed first on the smartphone using gesture control — the user might rotate the building or site to see it from all angles, or go through a door or passage to see what is inside. In gaming, gesture control combined with AR promises new ways users can interact with the game interface.

To ensure a lead in gesture control, Qualcomm recently acquired certain assets from GestureTek, a developer of gesture recognition technology. GestureTek has more than 25 years of experience implementing gesture-based technologies in mobile devices, entertainment facilities, healthcare systems, retail locations, and public and private venues. The acquisition gives Qualcomm ownership of certain intellectual property assets related to gesture recognition, as well as key engineering resources. Gesture recognition technology will be integrated into Qualcomm's current and next-generation Snapdragon™ processors, giving OEMs the capability to produce smartphones, tablets and home entertainment devices with user interfaces based on natural human gestures.

802.11ac Wireless LAN: what's new and the impact on design and test

By Mirin Lew, Agilent Technologies, Inc.

Introduction

The first popular standards for wireless LAN (IEEE 802.11a and b), and later 802.11g, were designed primarily to connect a laptop PC in the home and office, and later to allow connectivity "on the road" in airports, hotels, Internet cafes, and shopping malls. Their main function was to provide a link to a wired broadband connection for Web browsing and email. Since the speed of the broadband connection was the limiting factor, a relatively low-speed wireless connection was sufficient. 802.11b provided up to 11 Mb/s at 2.4 GHz, and data rates increased to 54 Mb/s with 802.11a at 5 GHz and 802.11g at 2.4 GHz, all in unlicensed spectrum bands. However, new usage models with the need for higher throughput were recognized: data sharing amongst connected devices in the home or small office and wireless printing as examples. A study project was set up which produced 802.11n in 2009. It improved the maximum single-channel data rate to over 100 Mb/s, and introduced MIMO (multiple input, multiple output or spatial streaming), where up to 4 separate physical transmit and receive antennas carry independent data that is aggregated in the modulation/demodulation process.

Today, there are further usage models, summarized in Table 1, that require even higher data throughput to support today's "unwired office".

To cater for these, a new IEEE working group (TGac) aims to specify 802.11ac to deliver "Very High Throughput" (VHT) as an extension of 802.11n, providing a minimum of 500 Mb/s single link and 1 Gb/s overall throughput, running in the 5 GHz band. Bearing in mind the huge number of existing client devices – laptops, netbooks, tablets and smartphones - backward compatibility with existing standards using the same frequency range is a "must". The goal is for all the 802.11 series of standards to be backward compatible, and for 802.11ac to be compatible at the Medium Access Control (MAC) or Data Link layer, and differ only in physical layer characteristics (see Figure 1). 802.11ac is scheduled to be finalized by the end of 2013, however devices complying with draft versions of the standards may appear before this.

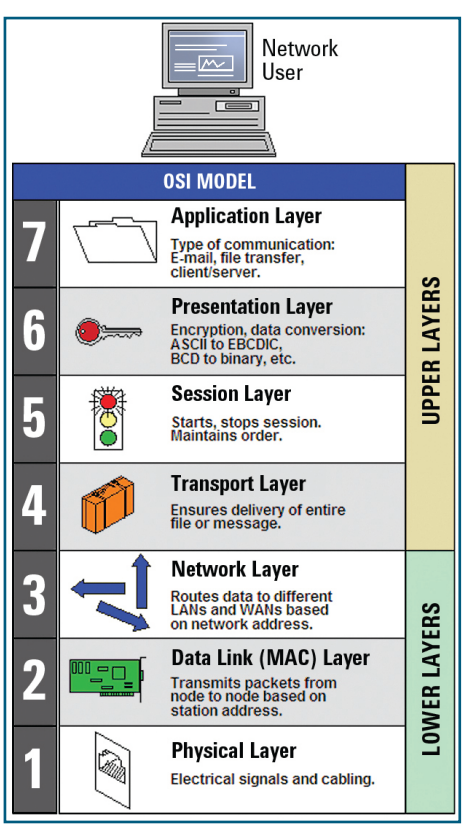


Figure 1: OSI 7-layer model.

Figure 1 from Computer Desktop Encyclopedia. Reproduced with permission. (c) 2011 The Computer Language Company Inc.

Technical differences from 802.11n

The 802.11ac physical layer is an extension of the existing 802.11n standard, and maintains

Category	Usage Model
1. Wireless Display	• Desktop storage and display • Projection to TV or projector in conference room or auditorium • In-room gaming • Streaming from camcorder to display • Professional HDTV outside broadcast pickup
2. Distribution of HDTV	• Video streaming around the home • Intra-large-vehicle applications (e.g. airplane, ferry) • Wireless networking for office • Remote medical assistance
3. Rapid upload/download	• Rapid file transfer / sync • Picture-by-picture viewing • Airplane docking (manifests, fuel, catering, . .) • Downloading movie content to mobile device • Police surveillance data transfer
4. Backhaul	• Multi-media mesh backhaul • Point-to-point backhaul
5. Outdoor campus / auditorium	• Video demo /tele-presence in auditorium • Public safety mesh (incident presence)
6. Manufacturing floor	• Automation

Table 1: New WLAN usage models.

backward compatibility with it. Table 2 shows the physical layer features of 802.11n, and Table 3 shows how this is extended for 802.11ac. The theoretical maximum data rate for 802.11n is 600 Mb/s using 40 MHz bandwidth with 4 spatial streams, though most consumer devices are limited to 2 streams. The theoretical 802.11ac maximum data rate is 6.93 Gb/s, using 160 MHz bandwidth, 8 spatial streams, MCS9 with 256 QAM modulation, and short guard interval. A more practical maximum data rate for consumer devices might be 1.56 Gb/s which would require an 80 MHz channel with 4 spatial streams, MCS9, and normal guard interval.

The new wider mandatory channel bandwidths are shown in Figure 2. While 160 MHz and 80+80 MHz modes are both included as optional features in the 802.11ac standard, it is likely that first devices will have a maximum of 80 MHz bandwidth, and no more than the maximum 4 spatial streams specified in 802.11n.

For 20 and 40 MHz channels, the number of subcarriers and pilots and their positions are the same as in 802.11n. New values are defined in 802.11ac for 80 MHz channels, and a 160 or 80+80 MHz channel is defined in the same way as two 80 MHz channels.

Within the frame structure, the preamble and training fields make it possible for the receiver to auto-detect the physical layer standard being used. 802.11n and 802.11ac preamble frames are shown in Figure 3. The first 4 fields in both preambles are intended to be received by non-HT and non-VHT stations for backwards compatibility. The initial Legacy Short and Long Training Fields (L-STF and L-LTF) and signal

Table 2: IEEE 802.11n key specifications.

Feature	Mandatory	Optional
Transmission method	OFDM	
Channel bandwidth	20 MHz	40 MHz
FFT size	64	128
Data subcarriers / pilots	52 / 4	108 / 6
Subcarrier spacing	312.5 kHz	
OFDM symbol duration	4 ms (800 ns guard interval)	3.6 ms with short guard interval
Modulation types	BPSK, QPSK, 16QAM, 64QAM	
Forward error correction	Binary convolutional coding (BCC)	Low density parity check (LDPC)
Coding rates	1/2, 2/3, 3/4, 5/6	
MCS supported	0 to 7, 0 to 15 for access points	8 to 76, 16 to 76 for access points
Spatial streams and MIMO	1, 2 for access points direct mapping	3 or 4 streams Tx beamforming, STBC
Operating mode / PPDU format	Legacy/non-HT (802.11a/b/g) Mixed/HT-mixed (802.11a/b/g/n)	Greenfield/HT-Greenfield (802.11n only)

Feature	Mandatory	Optional
Channel bandwidth	20 MHz, 40 MHz, 80 MHz	160 MHz, 80+80 MHz
FFT size	64, 128, 256	512
Data subcarriers / pilots	52 / 4, 108 / 6, 234 / 8	468 / 16
Modulation types	BPSK, QPSK, 16QAM, 64QAM	256QAM
MCS supported	0 to 7	8 and 9
Spatial streams and MIMO	1	2 to 8 Tx beamforming, STBC Multi-user MIMO (MU-MIMO)
Operating mode / PPDU format	Very high throughput / VHT	

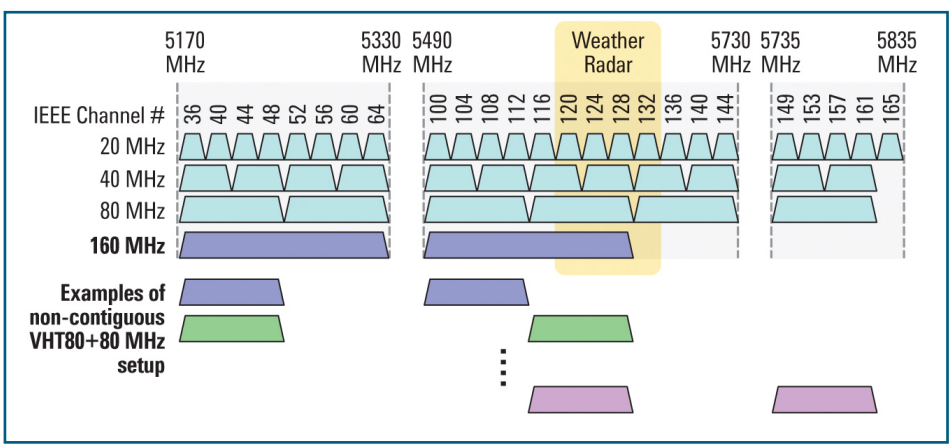
Table 3: IEEE 802.11ac key specifications.

field (L-SIG) are similar to the same fields in 802.11a/b/g, while the difference in the 4th field (symbols 6 and 7) identifies the frame as either 802.11n or 802.11ac.

Examining the VHT preamble in more detail, for channels wider than 20 MHz, the legacy fields are duplicated over each 20 MHz sub-band with appropriate phase rotation. Subcarriers are rotated by 90 or 180 degrees in certain sub-bands in order to reduce the peak-to-average power ratio (PAPR). To signal VHT transmission and enable auto-detection, the first symbol of the VHT-SIG-A is BPSK, while the second symbol is BPSK with 90 degrees rotation (QBPSK). This differs from the HT-SIG for 802.11n where both symbols use QBPSK modulation. The VHT-SIG-A field contains the information required to interpret VHT packets — bandwidth, number of streams, guard interval, coding, MCS and beamforming.

The remaining fields in the preamble are intended only for VHT devices. The VHT-STF is used to improve automatic gain control estimation in Multiple Input Multiple Output (MIMO) transmission. Next there are the long training sequences that provide a means for the receiver to estimate the MIMO channel between the transmit and receive antennas. There may be 1, 2, 4, 6 or 8 VHT-LTFs depending on the total number of space-time streams. The mapping matrix for 1, 2 or 4 VHT-LTFs is the same as in 802.11n, with new ones added for 6 or 8 VHT-LTFs. The VHT-SIG-B field describes the length of the data and the modulation and coding scheme (MCS) for single or multi-user modes.

Figure 2. IEEE 802.11ac frequency allocation for Europe/Japan/Global regions.



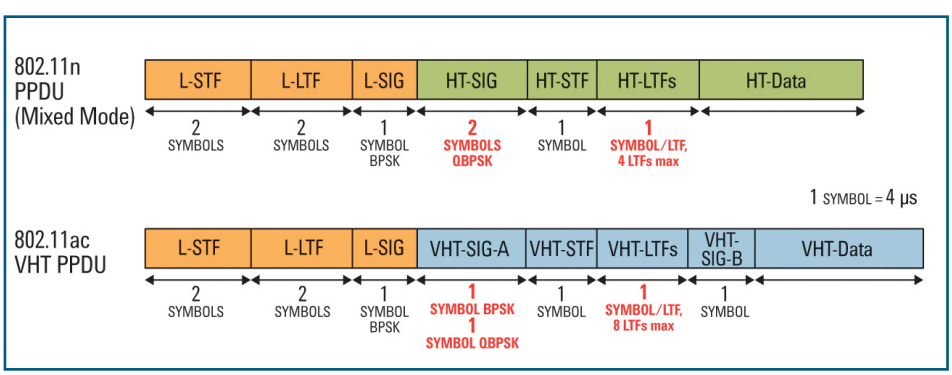


Figure 3: Comparison of 802.11n and 802.11ac frame formats.

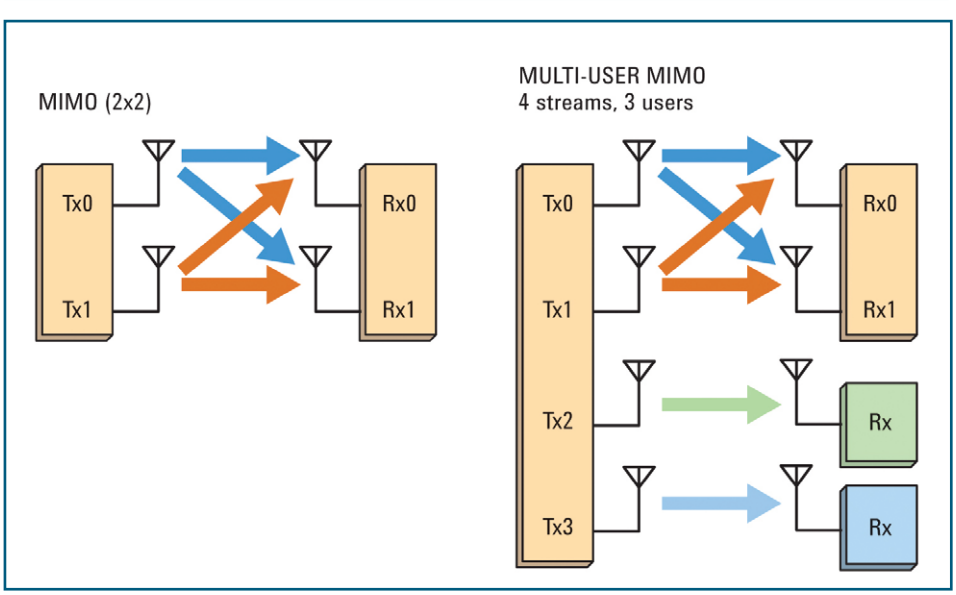


Figure 4: MIMO configurations — throughput to an individual device, MU-MIMO is designed to re-use resources to improve efficiency, though the data rate to any individual device is unchanged.

MIMO re-visited

In the legacy WLAN standards, there was only one stream of data between the access point and a device. MIMO transmission was first introduced in 802.11n, and included new requirements where the access point and device communicate using two or more completely separate transmit/receive chains and take advantage of cross-coupling between them. The primary goal was to increase the data rate that a single user could expect from their wireless connection.

In the specifications, the terms "input" and "output" refer to the medium between the transmitters and receivers, including the RF components of both — known as the "channel". Thus an access point with two transmitters provides two inputs to the channel — the "MI" part, and a device with two receive chains takes two outputs from the channel — the "MO" part. For true MIMO, the data transmitted by each chain must be independent, and not just a copy of the same data.

True Multiple Input Multiple Output, shown in Figure 4 with two transmitters and two receivers with independent data content, is also known as spatial multiplexing. Each receiver sees a combination of the outputs from the transmitters. Using channel estimation techniques, the receivers use matrix mathematics to separate the two data streams and demodulate the data. In ideal conditions, with maximum de-correlation between the streams, data capacity is doubled, though there is a premium to be paid in a requirement for better signal to noise ratio.

Typical 802.11n consumer devices support two or three spatial streams rather than the maximum four specified in the standard. 802.11ac extends this to a maximum of eight streams, with likely first implementations supporting up to four. New in 802.11ac is the concept of multi-user MIMO (MU-MIMO). As opposed to "normal" (i.e. single-user) MIMO, which improves data (Figure 4).

Test requirements

The high volumes for WLAN devices call for strict attention to manufacturing costs, and the use of innovative design techniques to maximize repeatability and minimize cost of test. This leads to the need for exhaustive testing during the design and pre-production stages of development.

The 802.11ac standard transmitter and receiver tests are similar to the tests for 802.11n, with new definitions and specification limits added to cover the new features. See Table 4. The latest version of the 802.11ac specification is available for download to subscribers from www.ieee802.org. In addition to these tests, designs will need to pass conformance tests and additional functional tests to verify performance and prove interoperability.

Design and test challenges

Some of the new features in the 802.11ac standard result in new challenges in design and test. One of these is the use of 256 QAM modulation, which requires excellent error vector magnitude (EVM) or constellation error in the transmitter and receiver. Vector signal analysis provides insight into causes of poor EVM, and equipment such as Agilent's 89600 VSA software provides detailed analysis of 802.11ac signals.

Table 4: Transmitter and receiver tests.

Transmitter tests	Receiver tests
Transmit spectrum mask	Minimum input level sensitivity
Spectral Flatness	Adjacent channel rejection
Transmit center frequency tolerance	Non-adjacent channel rejection
Packet alignment	Receiver maximum input level
Symbol clock frequency tolerance	Clear channel assessment (CCA) sensitivity
Modulation accuracy – Transmit center frequency leakage – Transmitter constellation error (EVM)	

Figure 5: 89600B VSA with Option BHJ 802.11ac. Modulation Analysis supports all bandwidths and modulation types, up to 4x4 MIMO.

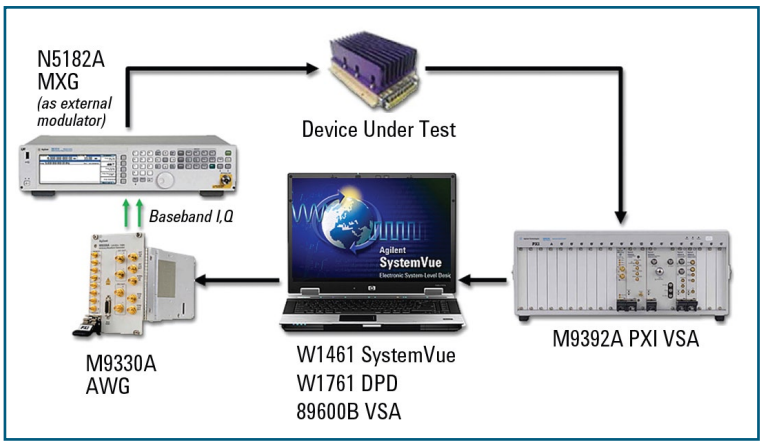


Figure 6: Digital Predistortion system.

Another difficult challenge is digital predistortion to improve the linearity of power amplifiers, which typically requires generation and measurement of signals that are 3 to 5 times the bandwidth of the amplifier being linearized. Agilent's SystemVue software provides an application that automates digital predistortion design. The software generates a stimulus waveform which is downloaded to an RF signal generator and applied to the power amplifier. The amplifier's response is captured using a signal analyzer and compared with the desired signal to create the predistortion matrix. The predistorted signal is then sent to the power amplifier and the response checked. An example setup is shown in Figure 6.

The continuing need for more speed and bandwidth of wireless LAN connections, and the increasing complexity of the standards to support it, bring major challenges for the test and measurement community. Comprehensive design and test capability is critical to the successful implementation of mass-market VHT WLAN products. System simulation tools and the generation and analysis of the wider 80 and 160 MHz bandwidth signals for 802.11ac are key to testing components, transmitters and receivers. Close attention to design for manufacturing will help minimize cost of test and ensure that access points and clients meet consumers' price and performance expectations.

About the author

Mirin Lew is an Applications Specialist for the Microwave and Communications Division of Agilent Technologies, focusing on product planning and marketing of signal generation software and solutions for wireless connectivity markets. For the past few years, Mirin has been responsible for defining, marketing, and supporting products for WiMAX, WLAN, fading channel emulation, and GPS. Since joining Hewlett-Packard/Agilent Technologies in 1987, Mirin has had a variety of marketing roles related to network analyzer, signal generator, and signal analyzer products.

Fujitsu and Autotalks to develop vehicle-to-vehicle communication processor

Fujitsu Semiconductor Europe (FSEU) and Autotalks have reached an agreement to co-operate on Autotalks' communication processor, to be developed by Autotalks and manufactured by Fujitsu Semiconductor. The combined efforts of the two technology leaders will provide OEMs and Tier1s with a vehicle-to-vehicle communication processor by next year.

Autotalks' vehicle-to-vehicle technology, which combines optimised vehicular modem, advanced security, enhanced positioning and safety application processor, utilises Fujitsu's silicon technology solutions and production facilities. By providing complete and enhanced feature sets for OEMs and Tier1s, this partnership will enable deployment of vehicle-to-vehicle communication units.

Autotalks' Integrated Vehicle-to-Vehicle Communication Processor uses its own technologies, developed to increase communication reliability, and provides the most accurate information for safety applications. The technology was tested in many field trials worldwide.

The communication processor supports the US, EU and Japan specifications, and will be available in 2012

www.fme.fujitsu.com
www.auto-talks.com

Signal/spectrum analyzer features minimum phase noise and 160 MHz bandwidth

The high-end FSW signal and spectrum analyzer comes in three models that cover the frequency ranges 2 Hz to 8 GHz, 13 GHz or 26.5 GHz. FSW was specially designed to meet the requirements of development laboratories in the aerospace, defense and communications industries.

The practical 12.1" touchscreen features a MultiView function that allows users to display the results of different applications on the touchscreen at the same time, enabling them to keep track of even the most complex signal analyses and find errors more easily. An additional benefit is the elimination of time-consuming switching between measurement applications.

At 10 kHz carrier offset, the FSW achieves a phase noise specification of less than -137 dBc (1 Hz), which is up to 10 dB less than comparable instruments on the market. This is especially important for developers of RF components and complete systems for radar applications. By taking advantage of the analyzer's excellent phase noise specification, they can achieve more stable radar signals.

Equipped with the FSW-K6 option, the FSW also supports comprehensive analysis of pulsed signals, e.g., for radar applications. Its broad analysis bandwidth of up to 160 MHz allows the FSW to measure wideband, hopping and chirp signals, which makes it ready today for the requirements of tomorrow's wireless standards such as the 802.11ac. Developers can also detect spurious emissions extremely quickly with the signal/spectrum analyser thanks to its low inherent noise and its ability to rapidly analyze wide frequency ranges, even when using narrow resolution bandwidths.

The FSW ideal for developers of wireless communications base stations and components. They especially appreciate the analyzer's broad 160 MHz demodulation bandwidth and multi-standard radio analysis function: The combination of these two features in a single instrument makes it possible for the first time to simultaneously measure multiple mobile radio and wireless standards at different frequencies. Users can easily spot signal interaction among the standards.

Josef Wolf, Director of the Spectrum Analysis, Network Analysis and EMC Subdivision at Rohde & Schwarz, points out: "These measurements are essential for multi-standard base stations of the future. That is why we have integrated the multi-standard radio analyzer into the FSW. This feature, combined with the large touchscreen display, provides functionality that is unique on the market."

www.rohde-schwarz.com

Cadence expands verification IP portfolio to target emerging mobile standards

By Paul Buckley

"The need for increased computing power and sophisticated video, audio and storage on mobile devices has given rise to new standards that improve performance and power, while reducing development time and cost," said Ziv Binyamini, corporate vice president, research and development, System Realization Group at Cadence. "In order to leverage these standards, our customers need solutions that can accurately test the functionality of their design and ensure manufacturing success. Our extensive protocol expertise, combined with our track record of effectively verifying thousands of designs for over a decade, gives customers a proven path to success in the mobile market."

"MIPI Alliance continues to advance mobile interface standards with processor and peripheral protocols that streamline system development and expand the sophistication of today's mobile devices," said Joel Huloux, chairman of the board, MIPI Alliance. "By ensuring verification support for these protocols at the earliest stage possible, companies such as Cadence enable mobile designers to embrace the latest standards and deliver products that transform the consumer's mobile experience."

Earlier this year, Cadence became the first company to add support for ARM Ltd.'s AMBA 4 Coherency Extensions protocol (ACE), speeding the development of multiprocessor mobile devices, and the DFI 3.0 specification , which defines an interface protocol between DDR memory controllers and PHYs.

Cadence has expanded the company's VIP offering for mobile applications with support for the following standards:

- LPDDR3: This low-power version of the pervasive DDR3 memory standard enables customers to meet the high bandwidth and power efficiency requirements of mobile systems;
- MIPI CSI-3: Providing an advanced processor-to-camera sensor interface, MIPI CSI-3 enables mobile devices to deliver the bandwidth required to enable high resolution video and 3D;
- MIPI Low Latency Interface (LLI): This interface cuts mobile device production cost by allowing DRAM memory sharing between multiple chips;
- USB 3.0 On-The-Go (OTG): Providing 10x the performance of the previous USB specification, USB 3.0 OTG allows consumers to rapidly transfer data, such as video and audio content, as well as quickly and effortlessly charge devices;
- Universal Flash Storage (UFS): A common flash storage specification for mobile devices, UFS, a JEDEC standard, is designed to bring higher data transfer speed and increased reliability to flash memory storage;
- eMMC4.5: Designed for secure, yet flexible program code and data storage, eMMC4.5, a JEDEC standard, enables high bandwidth, low pin-count solutions that simplify system design;
- cJTAG: With its support for reduced pin count, power management and simplified multichip debug, cJTAG enables efficient testing of mobile devices, a key requirement for delivering high volume, high quality mobile devices.

The new memory models and protocol VIP will be available this month as part of the Cadence Verification IP Catalog. Among the most comprehensive and robust in the industry, the catalog features support for over 30 complex protocols and models for over 6,000 memory devices. The offering also provides maximum flexibility to customers by ensuring open support for all third-party simulators and design methodologies including UVM, OVM, and VMM.

www.cadence.com

Security on the wireless mobile highway

By Vishal Khemani, Marvell Semiconductor

Aside from the living room, automobiles have become the epicenter of multimedia activity for consumers. Today, connectivity technologies that enable intracar communications are a critical concern for automotive and technology companies alike. The automotive industry has made a priority of developing wireless technologies that let consumers listen to music on a car's audio system, watch movies on an integrated LCD screen, surf the Web or simply access an address book on the car's head unit.

Recently, innovative automotive companies have begun paving the way for a new era of wireless connectivity. The new Audi A8, for example, comes with the option to create a mobile hotspot in the car, and other carmakers are poised to offer similar capability. Enhanced wireless technology, meanwhile, is replacing the expensive cables needed for communication between various components in the car, saving carmakers money and reducing the overall weight of their vehicles, which lowers fuel consumption.

To meet consumers' expectations, automotive companies must deliver in-vehicle wireless security rivaling that of wired systems. In wired systems, cables serve as secure communications links, requiring the user to have physical access to the vehicle in order to access the data. Carmakers wishing to enable wireless connectivity must use alternative mechanisms to ensure secure communications.

Enabling technologies

Several technologies will be essential for guaranteeing security on the mobile highway, especially as wireless connectivity in automobiles evolves beyond in-vehicle communications to offer vehicle-to-vehicle comms.

Within the car, WPA2-AES can be used for encrypting the 802.11 data transferred from a laptop or a similar consumer device to the car's head unit, which functions as an access point. AES encryption is highly secure and is widely used.

To boost security further, and to reduce air congestion, wireless devices in cars will also use lower transmit power, thereby reducing the range of wireless coverage.

Wi-Fi Direct, launched by the Wi-Fi Alliance in 2010, uses the widely deployed WPA2-AES security protocol and provides significant ease of use in connecting 802.11-enabled devices to connect to the car securely.

Wi-Fi Display, meanwhile, is a protocol that is being designed for securely transmitting video over a Wi-Fi link. The technology uses HDCP 2.0 to encrypt transmission and allow playback only on an authorized receiver.

Finally, creating multiple independent wireless networks provides another layer of security. A secure network can be created that allows a driver to check the image captured by a rear-view camera, monitors the sensors from the engine or lets a fleet driver communicate with a dispatcher.

At the same time, a separate network, secure or otherwise, can be created for the passengers' use. This separation of wireless networks prevents inadvertent or deliberate interference with the more critical in-vehicle communication systems. New enhancements from leading wireless technology providers allow multiple independent but simultaneously operating networks to be created using the same wireless device, avoiding replication of wireless systems.

About the author

Vishal Khemani is a senior product marketing manager in the Embedded and Emerging Business Unit at Marvell Semiconductor's Wireless Division.

Avoiding coexistence problems and simplifying designs with integrated RF modules

By Allen Chien PhD, Product Marketing Manager at Avago Technologies

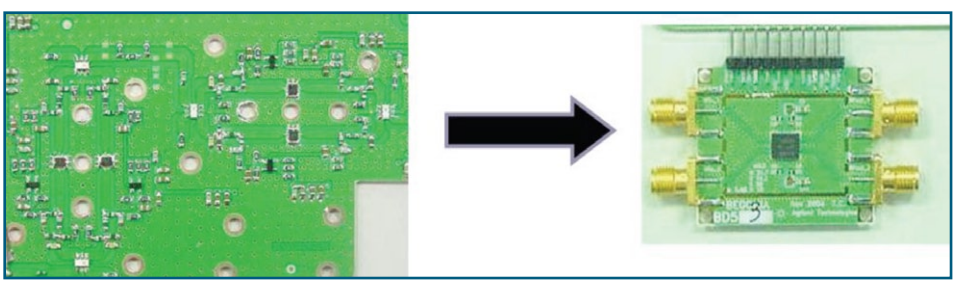
Applications for portable wireless data communications have been booming in the last few years. For designers, these applications pose the challenge of designing multiple high-efficiency, low-noise RF channels in as small a space as possible. One approach to meet this challenge is to leverage integrated RF modules that can provide superior coexistence faster and more efficiently than use of discrete components.

Wireless is becoming the preferred method for consumer and commercial data communications of all kinds. WiFi networks abound in the home, supporting such devices as PCs, tablets, smartphones, gaming systems, and even televisions. Public WiFi "hotspots" are also plentiful, used for web surfing, messaging, and creating femtocells for the off-load of cellular network IP traffic.

There are also many other wireless data links in use beyond WiFi, including Bluetooth for remote headsets, ZigBee for home automation networks, WiMAX and LTE for wireless broadband, and cellular telephony. In addition, transportation and utility industries are working to employ many of these same network technologies for applications such as the smart power grid and traffic management. Similarly, other industries seek to employ wireless networks for machine-to-machine communications to automate various elements in production and commerce.

This growing dependence on wireless data communications places a two-fold burden on equipment developers. First, their designs must provide extremely high quality transmit and receive channels. Transmit channels must meet strict power, spectral, and linearity standards, providing sharp bandwidth filtering while avoiding amplifier distortions and the reflections caused by impedance mismatches. Receive channels must be efficient to avoid signal loss and must eliminate as much noise as possible in order to maximize data rates while dealing with very low received signal strengths.

Figure 1: An example of the simplification of an RF design using an integrated front-end module.



While addressing these RF design challenges developers must also deal with the burden of channel coexistence. Many systems need not one but two or more wireless links, each corresponding to different standards. A laptop computer, for instance, might incorporate both WiFi and WiMAX connectivity in its design. A smartphone will include WiFi with Bluetooth as well as GSM, 3G, and LTE. Such portable systems also require the RF designs for the various channels to be as compact as possible and the different channels are typically interwoven on the circuit board.

This physical and spectral proximity places stringent demands on receive filters. For example, a WiFi design may need to operate over a 2.4 - 2.5 GHz band while rejecting signals from a nearby 3G transmitter at 2.1 GHz. Such tight frequency spacing requires filters with extremely steep roll-offs.

Integrated front-end modules (FEM) for RF coexistence can provide independent transmit and receive paths with in-line filters and amplifiers along with signal switches for sharing antenna connections. Utilizing an integrated module rather than pursuing a discrete-component design allows developers to significantly reduce their design effort and costs while creating highly precise and efficient RF subsystems. The modules save board space, as well, compared to discrete designs (Figure 1).

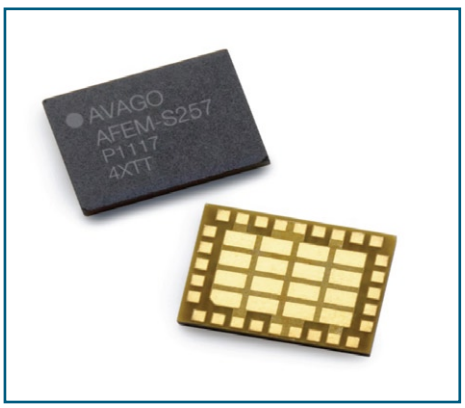
Integrated FEMs achieve these benefits through a number of key design features. First, the modules provide developers with a fully-designed and optimized configuration of layout and components. As an example, Avago Technologies carefully designs modules with matched 50 Ω impedances and uniform phase delays on all signal paths. All active and discrete components in the modules are carefully matched and the design tuned to provide optimum operating characteristics along the entire RF path.

Another key feature of integrated FEMs is that they bundle everything into a compact form factor (Figure 2). All of the critical design and layout tasks are already done, with no tuning or tweaking necessary. Designers only need to deal with a few connections to a single component when laying out the front end of their RF subsystem, greatly reducing design time.

The integrated FEMs not only help eliminate the front-end RF design task, they help speed other development stages. Because the modules are fully assembled, optimized, and tested, for example, they eliminate the need for front-end design validation. Later in the development effort, these same characteristics reduce time and effort needed for regulatory and standards compliance testing of the finished design. All this reduction in development time equates directly to quicker time-to-market as well as lower development costs.

The integrated FEMs also help lower production costs. The single FEM replaces numerous discrete components in the production bill of materials (BOM), reducing the cost of BOM management and inventory handling. Because the FEM is pre-tested, the

Figure 2: Amplifiers, switches, and filters are all encapsulated in a single package for simple layout.



design's RF section will also have a better production yield than products using discrete component designs.

The advantages that integrated FEMs bring to designs needing wireless coexistence can best be understood by examining a module's capabilities in detail. The Avago AFEM-S257 WiMAX coexistence FEM supports reception and transmission of 16 quadrature amplitude modulation (QAM) WiMAX in the presence of WiFi and other nearby RF channels, and offers dual receive channels to allow reception of two simultaneous signals or support RX diversity reception. It leverages Avago's proprietary film bulk acoustic resonance (FBAR) filters to achieve steep roll-off characteristics to provide high out-of-band rejection. The low insertion loss of FBAR filters ensures maximum receive signal strength and minimal waste of transmit power, helping maximize battery life in portable devices.

The S257 module integrates a linear power transmit amplifier, low-noise receive amplifiers with pre-selector FBAR filters, band-pass filters, and RF switches with 50 Ω impedance on all RF ports (Figure 3). The design is optimized for operation in the 2.5 to 2.7 GHz band of WiMAX with a supply voltage of 3 to 5 VDC. All the amplifiers in the S257 module have exceptional tolerance to supply voltage and temperature variations because of the GaAs pHEMT process technology.

The module's transmit amplifier has a selectable gain, allowing operation in low power mode to reduce the module's demand on a battery supply. In low power mode the amplifier delivers 0 dBm to the antenna output while the module typically draws 95 mA from a 3.6 V supply. The amplifier has a 23 dB gain step, so in high power mode the amplifier produces 24 dBm while the module typically draws 420 mA. The transmit amplifier's total gain is 34 dB in high-power mode.

Typical gain flatness for the transmit amplifier is 1 dB over any 10 MHz band, with a gain variation of no more than 1 dB over the full supply voltage range. This allows the transmit channel to fully meet WiMAX QAM mask specifications with a typical error vector magnitude (EVM) of -34 dB (2.5%) in high power mode.

The low-noise amplifiers in the module's receive pathways provide a gain of 15 dB, typically producing 10 dB of overall gain from antenna input to receive path output. In the presence of strong input signals the receive amplifier can be bypassed, reducing current draw from 10 mA to 0.25 A per receiver. Even with the amplifier engaged, the module exhibits a maximum 3.5 dB noise figure between an antenna input and its receive channel's output.

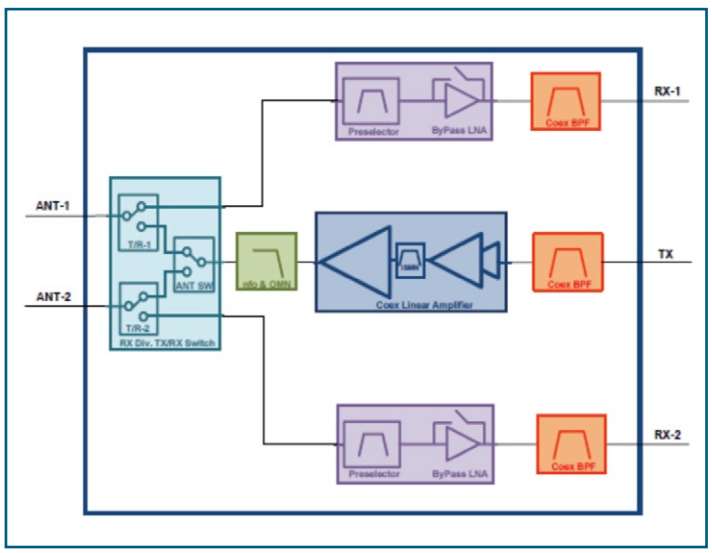


Figure 3: The AEFM-S257 is a complete WiMAX coexistence front-end module with dual receive channels in the 2.5 – 2.7 GHz band.

Frequency Band	Transmit Path Out-of-Band Rejection (dBc)	Receive Path Out-of-Band Rejection (dBc)
698 – 720 MHz	80	70
800 – 915 MHz	70	70
1574-1576 MHz	50	35
1805 -1880 MHz	40	30
1930 – 1990 MHz	30	30
2110 – 2170 MHz	10	35
2400 – 2468 MHz	35	30
2451 – 2473 MHz	25	30
3300 – 3800 MHz	30	30
5000 – 5380 MHz	60	-
>7200 MHz	60	-

Table 1: The sharp roll-off characteristics of FBAR filters permits strong out-of-band rejection of neighboring transmitters.

In support of multi-channel coexistence the switches and filters provide substantial isolation between the various signal pathways and operating frequency bands. Isolation between the two receive channels as well as either receive channel and the transmit channel is 25 dB to prevent cross coupling of signal pathways. The FBAR band-pass filters provide substantial out-of-band rejection on both transmit and receive pathways (Table 1), with at least 35 dB of rejection relative to carrier at the WiFi ISM band for the receive channel.

This entire RF front end is packed into a space-saving 5- x 7- x 1-mm sealed package, representing at least a 25 percent savings in board space relative to a discrete component design. Transmit and receive ports are arranged on one side of the module with antenna connections on the opposite side for convenient signal routing, with ground pads between signal lines for isolation.

Creating an effective front-end for designs requiring coexistence of multiple RF channels at nearby frequencies represents a significant challenge, even for the most experienced RF design engineers. For developers creating today's multi-radio mobile devices, integrated FEMs such as the Avago AFEM-S257 are an opportunity to side-step those design challenges. By utilizing an integrated FEM, developers can bring their devices to market quicker at less expense while obtaining a highly compact design with state of the art performance.

Touch-transfer technology will complement NFC

Toshiba has announced it will launch a single chip IC that is compliant with the TransferJet standard for close proximity wireless transfer technology. Samples will start shipping at the end of January 2012 and mass production is scheduled to begin in the second quarter (April-June) of 2012.

Toshiba says its advanced RF-CMOS integration technology has enabled incorporation of an RF circuit and RF switch for TransferJet in a wireless IC for the first time in the industry. The product achieves receiving sensitivity of -78 dBm, surpassing the requirements of the TransferJet specification.

Using its 65-nm process, Toshiba has reduced the chip size and decreased the number of external RF circuits and peripheral components required.

The spread of mobile products is spurring demand for simple yet high-speed ways of sharing large image, video, and audio data among individuals, says Toshiba. It is addressing this demand by supporting the close proximity wireless transfer technology that allows data transfer simply by selecting on the screen of a mobile device the data file to be transferred and "touching" the receiving device with the mobile device.

TransferJet is a close proximity wireless transfer technology standard promoted by the TransferJet Consortium whose membership consists of 53 companies (as of September 2011), including Toshiba. TransferJet has a maximum specified transmission rate of 560 Mbit/s and maximum effective rate of 375 Mbit/s.

www.toshiba.eu

How femtocells will solve data capacity

By Steven Brightfield, Qualcomm

Data traffic is overwhelming mobile operator's networks. Projections from major operators confirm this trend, with recent reports ranging from data capacity doubling every 3 months (KT/ Korea) to 12 months (Vodafone).

If we project these sustained rates of data growth to future mobile network capacity, the current network capacity will represent less than 10 per cent of what is needed by 2016. Future network deployments will, in fact, be handling the vast majority of data capacity requirements for mobile network operators. If we were to scale today's mobile network architectures to handle this tsunami of data, the cost to deploy would be too high. Future mobile network architecture therefore needs to change, by not only scaling to handle the much higher data loads, but also by scaling cost effectively so that mobile operators can afford to deploy it.

Why femtocells?

They deliver on the promise of providing the next leap in performance for wireless networks by bringing cell sites closer together, providing coverage, capacity and service delivery platform to subscribers. To realize this vision the industry has had to address the challenges of interference mitigation and mobility requirements from operators and subscribers. But to make this transition, what are the issues that this technology faces? What innovations need to take place? How will they alter the topology of mobile networks and, what will this landscape look like when the roll out of femtocells reaches its apogee?

It is the rapidly rising rate of mobile data which has propelled the development and deployment of femtocells. By 2014, monthly worldwide mobile data traffic will exceed the total for 2008. The pattern of usage has equally inspired this technology with 70 per cent of all mobile use in 2008 done whilst at home or in the office. But the most important factor today impacting mobile broadband performance and use is coverage, particularly in rural areas, and the differences between the performances of operators' 3G networks. The mass deployment of femtocells should solve this problem resulting in ubiquitous coverage, indoors and out, with faster connection and download speeds.

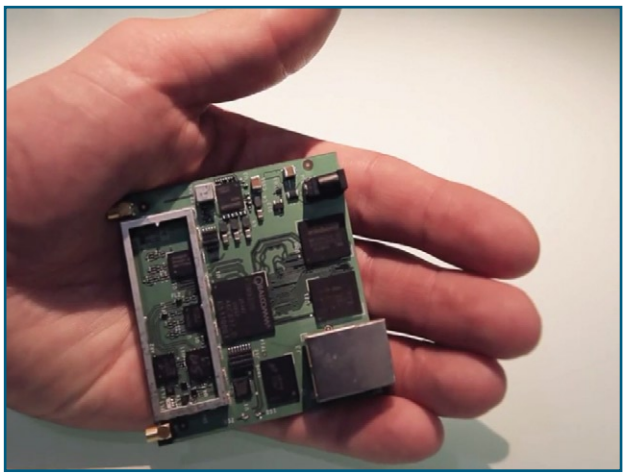
For operators, the key advantage of femtocells is that they are able to offload resource-intensive over-the-air data traffic onto an IP backbone, reducing both capital (less macro sites) and operational (less backhaul costs) expenditures while creating a branded operator point of presence in either the home or the work environment. As femtocells increase signal strength and provide excellent coverage indoors, they also contribute to a better user experience, with improved coverage/peak data rates and quality of service. As mobile users are offloaded to femtocells, data traffic load and signaling load on the macrocell reduces.

Interference management

Since femtocells are being deployed in configurations and topologies that were not originally anticipated by 3G standards, one of the challenges that has required additional research and development to overcome is how to minimize downlink and uplink interference to macrocells and neighbouring femtocells when femtocell RF frequency channel overlaps with that of macro cellular transmissions. Femtocells are therefore now being designed to self-configure so that they seamlessly integrate and operate satisfactorily with the existing femtocell-macro network and provide excellent performance irrespective of their location in the residence, enterprise or the macro network. Femto solution providers, Qualcomm included, have developed algorithms for 3G femtocells to enable co-existence with macro network. These advanced interference mitigation technologies minimize the impact of the femtocells on the macro network. They use RF measurements by the femtocell and associated handsets to adapt their operations (e.g. channel of operation, femto transmit power, associated handset transmit power cap) to minimize impact on the macro network.

Qualcomm has had an active R&D program in this area for four years, resulting in the UltraSON suite of algorithms that provide for interference as well as mobility management of femtocells. The UltraSON algorithms provide effective downlink power calibration and uplink interference management as well as reliable mobility between macrocells and femtocells. In addition to using mobile handset measurements, femtocells that use UltraSON algorithms require a key additional hardware function, network listen. Network listen is an RF receiver module which resides in the femtocell and "sniffs" the surrounding RF environment, to provide inputs to the UltraSON algorithms which then compute the initial downlink transmit power, frequency channel and scrambling code prior to the femtocell transmitting its RF signal. Subsequent to initialization, the network listen can continuously monitor the RF environment to make dynamic changes as needed to avoid transient interference scenarios.

3G small cell interference management has had to be performed in an isolated cell environment without explicit co-ordination with the macro network, since these small cells were not anticipated as part of the original macro network deployments. LTE, the next-generation mobile air interface network technology, however has incorporated support for interference management of small cells in the Release 10 and Release 11 versions of the LTE standard. As operators upgrade their LTE networks from the initial Release 8 macro deployments, they can support femtocell deployments in a coordinated fashion utilizing the X2 and other signalling messages defined in the subsequent releases of the LTE specification.



A femtocell board designed around one of Qualcomm's chips.

A cellular access point in every home

The femtocell landscape is changing as operators develop new business cases for femtocell deployment. One trend that we anticipate is the integration of femtocell technology into existing consumer networking products, such as Wi-Fi access points, set-top boxes and integrated access devices. Every operator will have their own business model for deploying femtocells and these will evolve over time, depending on the operator's technical and business needs. Some may choose to subsidise the full cost as they are off-loading capacity.

Others will seek to share the cost with the consumer and provide them with additional service benefits such as free talk time or data downloads in the home/enterprise in exchange. Some will use femtocells to enable replacing the wire line phone service in the home. What's clear is that femtocells are being established as part of a very sophisticated network topology, whether it is indoors in combination with afore mentioned wireline and Wi-Fi solutions, or outdoors, incorporating metro-femtocells and carrier grade Wi-Fi solutions into the macro network and picocells, to become a natural extension of the operators' network.

Femtocell discovery

Another challenge requiring some attention is a reliable method for legacy mobiles to discover and camp on femtocells in idle mode and to perform handover from a macrocell to a femtocell in active mode. Operators however, have been reluctant to modify the configuration and planning of their macro networks to accommodate femtocells. Even if the macrocell has good channel quality or the handset is operating on a different carrier on macrocell, it is still desirable to move the device from macrocell to femtocell in order to continue the network service as seamlessly as possible. The reason being that heavy traffic users can be connected on the macro network for a very long time, continuing to consume significant amount of macro network resources before transitioning to idle mode. This kind of adaptability and efficiency is important to ensure the migration of as many users as possible to the femtocell and reduce the traffic pressure off the macro network. This is why Qualcomm recommends that a beacon signal is transmitted on the macro carrier that redirects the mobile user to the femtocell carrier frequency. Beacons work reliably with legacy handsets and do not require any macro changes.

Femtocell power-saving advancements

The power-efficiency of femtocells has also been recognised as a challenge which will impact both residential and enterprise uptake and needs to be considered as part of refining the user experience. Qualcomm has developed its femtocell chipset to be small and consume less than 5 W for a residential deployment, which meets EU green guidelines

and enables Power–over–Ethernet (PoE) so you don't have to route power from a wall socket.

One device to rule them all

With M2M and the Internet of Everything just around the corner, the next step in this already game-changing technology is merging Wi-Fi and femtocells to create one single intelligent gateway and coordinate the services delivery via either access technology. Recently, we announced the availability of a Femto-Wi-Fi hardware incorporating our FSM9216 enterprise chipsets, fully-integrated system-on-chip (SoC) solution for femtocell development, with the Qualcomm Atheros 802.11n Wi-Fi AR9350 and AR9344 access point solutions.

This will allow operators to design access points that let their enterprise customers connect to both Wi-Fi and cellular networks. Currently designed to support 32 active users, it can be scaled down to support residential and home applications or scaled up to suit outdoor urban metro-femto-Wi-Fi combinations or cover larger areas. With over 90 per cent of smart phones equipped with Wi-Fi accessibility, the fusion of Wi-Fi and femtocells onto one platform will help with a variety of service issues: improve connection management and solve mobility issues that plague Wi-Fi handsets; aid network side management, resulting in a combined interactive secure gateway into the home.

This advance will see the ability to manage Wi-Fi as well as cellular traffic. Based on RF channel quality and QoS requirements of different applications, the system can select the most suitable technology (Wi-Fi or femtocell) for each traffic flow. As an example, files transfer may be offloaded to Wi-Fi while a voice call is still made through the femtocell.

Within the home environment, if the femtocell is equipped with location based services, it can recognise individual users and offer them personalised content and apps. The femtocell home zone could know what your favourite TV program is, and automatically download it onto your mobile when you enter the zone, or allow users to use their phone to control appliances around the home from lights, air conditioning to the TV — all through the femtocell which could also be accessed remotely. The femtocell location-based services can also be used in retail environments where the users can trigger a personalized offer based on their proximity with the store. The major benefit for using femtocells in this use case is that virtually all handsets could be supported without requiring certain applications to be installed or run on the handsets.

Disruptive models for deployment are enabled by the fact that existing wireless networks need new topologies to handle the anticipated demand. The solution of using smaller cells closer to the subscriber results in the incorporation of a large number of smaller cells, with each small cell requiring a backhaul. Since wire line backhaul is a crucial ingredient in this network topology shift, one could argue that we are closing the circle from a wire-line telecom era to a wireless telecom era and now back to a mainly wire-line with last link being a short wireless hop.

About the author

Steven Brightfield is Director of Product Management at Qualcomm CDMA Technologies — www.qualcomm.com.

Overcoming the challenges of wireless audio distribution

By Tim Whittaker, Cambridge Consultants

It may seem like a contradiction but there is a huge demand to provide personal feeds of sound in public spaces. This is especially important for people whose hearing is impaired for venues like theatres, cinemas, public meetings, places of worship and so on. It's even mandatory in many countries for public venues to provide these facilities. International conferences — and countries with multiple languages — need simultaneous translation.

More unexpectedly (to those who don't fall into this category) there is a demand for sight-impaired cinema-goers to hear a narrative track to help them follow some details of the plot, and this content is being included in new films today. The cost and inconvenience of providing wiring to every possible user position is such that wireless technologies are being almost universally adopted for these sound feeds.

Several popular technologies around

Induction loops around auditoria are fed from a current amplifier, which is fed from the audio amplification system, or from special microphones. All hearing aids include a pick-up coil that can be selected as alternative to the internal microphone. Loops are relatively cheap because the user provides half the system, but they are prone to interference — the 50 or 60 Hz mains power and its harmonics fall well within the pass band — and they are limited to a single sound channel.

Infra-red systems comprise a number of LED emitter units which are fed either directly with audio (again with interference concerns) or with a modulated carrier, which can deliver multiple audio channels for stereo or for user selection, or both. Both analogue — pulse frequency modulated — and digital QPSK systems are used, generally with carriers in the range 2-6 MHz. Multiple channels are possible for conference and public systems. Infra-red equipment is fairly low-cost, with the disadvantage of needing a direct line of sight, or at least a good reflection, between the emitter and each receiver. Reflective surfaces are unfortunately undesirable in auditoria for many reasons. This means that multiple emitters have to be installed, making the total cost of a system quite high. Retro-fitting infra-red systems can be an especially tricky and expensive operation.

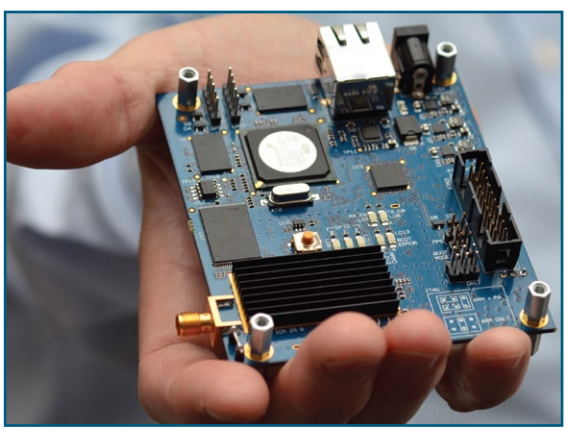
Radio systems classically rely on licence-free pieces of spectrum (bits around 30 MHz, bits around 174 MHz, 863-865 MHz, 1795-1800 MHz are allocated in most of Europe) or on licensed spectrum, commonly in unused television channels. Radio has the advantage of not needing a line of sight, but many of these VHF and UHF systems are under pressure either from governments who want to sell the spectrum, or by potential interference from other systems — like radio microphones — which share the same allocations.

Wireless audio distribution often takes place in dynamic, noisy environments, often close to many other competing wireless signals. How can these issues be overcome to deliver a better wireless audio experience in public venues? What is needed is a radio system with a reasonably generous licence-free allocation of spectrum, very low component cost and digital modulation to avoid interference.

Digital enhanced cordless telecommunication - DECT

Those parameters almost exactly describe a very mature radio system — DECT, or Digital Enhanced Cordless Telecommunication. Standardised in the mid-1990s, DECT now has a frequency allocation of 20 MHz around 1.9 GHz in almost every country (10 MHz in the USA). This allows up to 10 RF carriers, each bearing 1152 kbit/s using a simple GFSK modem. DECT then allocates 24 time-slots, each carrying 32 kbit/s of user data, plus various signalling and overhead data. In its original, cordless telephony application, one time-slot is used in each direction, delivering 3.4 kHz audio bandwidth with a simple ADPCM codec.

The DECT Salix reference design.



DECT telephony has proven highly successful, and DECT chips come pretty cheap at $2.50 or so in 10,000s. In addition, they are now very capable, integrating powerful processors with all the radio parts on a single device. Included on-chip is a capable DSP, which has allowed manufacturers to incorporate many additional functions such as telephone answering machines, modems for calling-line identification, echo cancellation for loudspeaker phones, better quality speech for VoIP and so on.

This confluence of advantages — dedicated spectrum, spectrum etiquette, robust interference mitigation, availability and low cost — makes DECT very attractive for wireless audio distribution. Indeed, the potential to develop a system that was far superior to existing solutions led Cambridge Consultants to look at developing a commercial solution. The result is a reference design, Salix.

The design processr

Although DECT lends itself well to audio distribution, there were several factors that needed to be tailored in order to deliver the best possible performance. For example, for entertainment and all-day conferencing, the audio bandwidth must be better than 12 kHz. To provide this the open-source codec CELT was ported on to DECT chips from Dialog Semiconductor.

CELT, 'Constrained Energy Lapped Transform,' delivers very low latency whilst supporting stereo at 32 kHz sampling rate, with a fixed bit-rate of 64 kbit/s. To keep the bill of materials low, the CELT decoder is ported on to the on-chip DSP core in the receiver unit. A great deal of optimisation of the open-source code was needed to achieve this, but the cost saving per unit makes this worthwhile. The CELT encoder is more complex, and therefore runs on an external DSP in the transmitter board.

To deliver the required data rate the design uses a double time-slot in DECT, which allows for a 16-bit CRC word to protect each 64 bits of data. A packet loss concealment algorithm is triggered by the CRC pass/fail bits. Digital audio is then sent to an external DAC/ headphone amplifier, which delivers stereo audio to a standard jack socket.

One of the 'standard' problems with a UHF radio is that of drop-outs in reception, as the receiver passes into a null resulting from multipath effects that occur in almost any environment. To overcome this issue the Salix receivers are designed with two antennas, and take advantage of DECT's extended synchronisation sequence, which is long enough to allow each antenna to be tried in turn, and the one with the better signal selected. This space diversity improves link margins by about 10 dB, and is unusually cheaply implemented at a cost of one CMOS switch and less than 5 square centimetres of board.

One of the main advantages of DECT is of course that multiple systems can co-exist in one place due to a DECT's robust spectrum etiquette scheme. In order to translate this capability to a wireless audio distribution application the new system uses the DECT functionality of first scanning all time-slots in all channels, building a map of received signal strengths, then choosing the quietest for use. This map is maintained in the background.

The receivers each send an occasional message upstream to report received signal quality. The system knows how many receivers are present (the transmitter broadcasts this number), and the receivers adjust their period between messages accordingly. A quality assessment algorithm in the transmitter uses the upstream messages to decide whether to move to another channel to improve performance. A seamless channel move is done by establishing the new channel first, then switching over, prior to clearing the old channel.

It was also important to ensure that the system is easy to manage, with straightforward connection. Connection of a receiver to a transmitter is done (for most conference and cinema use) by plugging the receiver into a configuration unit, and keying in the auditorium number, or other channel number, on this unit. A simple text-based serial interface into the receiver sets the identity of the transmitter to be used; the transmitter broadcasts this identity in a beacon. Alternative selection schemes, perhaps using the push buttons on the receiver, can easily be implemented.

Lastly, in addition to DECT allowing multiple co-located transmitters, the very simple GFSK radio modem means that a signal to interference ratio of only 9-10 dB is needed for an acceptable bit error rate. Hence DECT radio resource can be re-used after only a few tens of metres (or less in some types of building), allowing an essentially unlimited total number of systems in a large facility.

Wireless power transmission for consumer electronics and electric vehicles

By Dr Peter Harrop, IDTechEx

Over the next decade, the most vibrant Wireless Power Transmission (WPT) markets will be the contactless charging of portable and mobile equipment, in particular consumer electronics and electric vehicles. This is the focus of a new IDTechEx report, "Wireless Power Transmission for Consumer Electronics and Electric Vehicles 2012-2022. The research carried out for this report describes technologies that will be a stepping stone to contactless power for a high proportion of static consumer, industrial and military electronics and electrics.

For now, it primarily concerns wireless charging of batteries in portable consumer electronics and in electric vehicles. Both travel considerable distances and ready availability of standard, convenient, contactless, charging capability are key to their further growth in adoption. For example, the user will enjoy ever greater functionality and longer hours of use of mobile phones despite the on-going shortcomings of their batteries.

Our research concerns transfer of watts up to high power of the order of kilowatts at ranges of about one millimeter to about 60 centimeters. The WPT of concern usually involves static transmitters and a larger number of receivers incorporated in what is usually portable or mobile equipment. The transmitters are usually hard wired to AC mains or energy harvesters such as photovoltaics, there being a trend towards multiple energy harvesting. It will only become a mass market if more comprehensive standards are widely adopted and the manufacturers of the portable and mobile equipment incorporate the receivers during manufacture. We forecast the demand by power level and consider other criteria such as technology, range and region of adoption.

The extreme inconvenience of the proliferation of electrically charged products each with an incompatible charging power supply, must be overcome. Three to four billion units are made every year — a potential market for wireless charging pairs of up to ten billion dollars yearly, given market growth and an allied market of wireless power to electronic and electric consumer products that do not need charging. Indeed, the massive disposal of non-standard external power supplies for consumer electronics is an environmental outrage of concern to governments. Only 15 to 20% by weight of electronic products including laptops, cell phones and their power supplies are recycled. A typical user of electronic devices now carries at least three different chargers and at least an equal number of cables for energy charging and data transfer functions. However, we all know about the cordless electric toothbrush and there is now a consumer demand to charge mobile devices wirelessly, eliminating most wiring.

Traction batteries are not improving fast enough either. Those using pure electric cars seek to avoid range anxiety in some other convenient way. Standing in the rain to plug in an electric cable which then trips off for safety reasons does not qualify though almost all the investment in vehicle charging infrastructure is currently going into just that. Convenient electric top up of hybrid electric cars is also an important market driver as they become capable of all electric range of more than 100 kilometers, creating the opportunity to pay one fifth as much for "fuel" due to a quirk in the taxation system (electricity is cheap) and to save the planet as power stations get cleaner. It has been established that, as with gasoline pumping, a high proportion of women in particular find it unpleasant and even dangerous to get out of the vehicle and plug in for electricity. With WPT they stay clean and safe inside the vehicle.

WPT for consumer electronics and electric vehicles is in its infancy. Most production consists of a transmitter and receiver pair, though the receiver will increasingly be sold as part of the original equipment. In the following decade, the number of transmitters sold may somewhat exceed the number of transmitters as architects, coffee shops and others widely deploy them for consumer electronics as a convenience for the public, emulating the spread of WiFi, for example. Indeed, the leading producer of standards for WPT aimed primarily at consumer electronics, the Wireless Power Consortium (WPC), specifically models its work on the success of WiFi. Interestingly, it and its members have ambitions for the smaller electric vehicles being charged with its technologies and to its standards.

There are huge uncertainties in forecasting the adoption of WPT in consumer goods. For example, Apple, which steers clear of most standards making, could adopt it for its products creating a multi- billion dollar business very rapidly. Consumer goods are becoming electronic and here just one leading brand could take one billion receivers yearly. On the other hand, the need to increase the cost of highly price sensitive consumer products in order to offer something that may not be valued is a severe damper as is the lack of standards for more than five watts.

Historical lessons of both consumer electronics and electric vehicles are that infrastructure-related change is slow. Consider Near Field Communication (NFC) in mobile phones, where standards were globally adopted some time ago but adoption is grindingly slow outside Japan, the one country that got its act together. Contrast the even worse situation with wireless charging of phones, where virtually no infrastructure is in place and the standards

are recent and disputed. We therefore forecast modest business until a tipping point is reached around 2020 when it is seen as a realistic solution to drained batteries when on the move. In other words, by then, many devices will be chargeable on standardised publicly available wireless chargers.

As with contactless charging of cars, there is little incentive to buy the facility if it can only be used at home. The primary benefits of contactless charging relate to being able to use it wherever the need arises but there is also a potential cost advantage to the user, though not to the supplier, in removing the plethora of non-standard external chargers of consumer electronics. That said, there is now an agreement to standardise wired power supplies to a mini-USB port in much of the world — a threat to contactless charging. Low power devices will be first with WPT adoption: there is a widely accepted standard in place.

Electric vehicles have something of the same chicken-and-egg problem of consumer electronics of, "Why buy it if you cannot yet use it in public places?" versus, "Why install public stations if the equipment is not widely available to use it?" However, with electric vehicles, there is a substantial fleet market that can be early adopters, some even using the dynamic form (continuous charging from laid cable) not seen or needed with consumer electronics ie equipment being continuously charged by wiring in the road.

Electric vehicles purchased by the public differ from consumer electronics in that they are not an impulse buy and designs change only slowly. We do not therefore see a tipping point where cars, for example, suddenly have contactless charging widely adopted in public places. This is despite the fact that most plug-in charging stations are currently funded on a non-economic basis by government and electricity generating companies as part of their green image. Such largesse is unlikely to be widely repeated with contactless vehicle charging, which will widen adoption because it is more convenient but which wastes more power, so it is less green. Indeed, it has a higher installation cost in many cases, involving digging up roads, and it awaits standards whereas at least there is one standard for the lower power charging of consumer electronics.

For electric vehicles, the transmitters (charging stations) are by far the largest element of cost and therefore the main focus of attention. We forecast them, with the assumption that standards for up to 10 kW will be written and widely adopted within the next five years. Meanwhile, fast vehicle charging with contacts is being standardised and practised up to over 20 times that figure. This is detailed in the IDTechEx report, "Electric Vehicle Charging Infrastructure 2011-2021". In 2020, over 3.6 million vehicle charging stations will be installed, contacted and contactless, residential and public. Mostly this will be for hybrid cars because they will still outsell pure electric cars and have useful all electric range in these later years, so plugging in becomes more worthwhile, saving significant cost. Already, a surprisingly large number of organisations are involved in WPT for both consumer electronics and vehicles and the report profiles many of them.

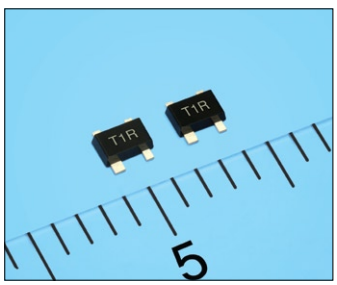
Dr Peter Harrop is Chairman of IDTechEx — www.IDTechEx.com/WPT.

SiGe:C heterojunction bipolar transistor

low-noise performance for wireless LANs

Renesas Electronics has introduced a SiGe: C heterojunction bipolar transistor, the NESG7030M04, for use as a low-noise amplifier transistor for wireless LAN systems, satellite radios, and similar applications. The device uses a process that adopts newly-developed silicon-germanium: carbon (SiGe:C) materials and achieves industry-leading low-noise performance.

The SiGe:C HBT amplifies a weak microwave signal received wirelessly to an appropriate level and achieves a noise figure of 0.75 dB, which is the industry's top level for the 5.8 GHz band used by wireless LANs and other applications. The fact that it amplifies with such low noise means that it can increase communication sensitivity in end products. Since it can reduce signal transmission errors, it can achieve operating power consumption as low as one-quarter of that of the comapny's existing products while maintaining equivalent performance. The device achieves a gain at the minimum noise level of 14.0 dB.



The NESG7030M04 claims to achieve both the industry's best low-noise performance as well as stable performance over a wide frequency range from a few MHz to the 14 GHz band.

In earlier silicon-based heterojunction bipolar transistors, it was not possible to avoid a reduction in the collector-emitter withstand voltage in exchange for reducing noise, and this limited the range of applications for which these devices could be used. In this device, Renesas has optimized the collector-base profile, making it possible to guarantee a withstand voltage rating of 4.3 V which increases the range of supply voltages that can be used and enables stable operation over a wide frequency range.

www.renesas.eu

Dolby goes Mobile

with approved DSP core implementation

Ceva claims to be the first to offer a Dolby approved DSP core implementation of Dolby Mobile. Based on its CEVA-TeakLite-III DSP, the implementation of the third generation Dolby Mobile technology, including support of Dolby Digital Plus for mobile, targets designers of mobile audio processors incorporating Dolby's latest mobile audio enhancements.

Dolby Mobile is designed to give consumers a rich, full-impact audio experience on portable devices. Designed for easy, flexible implementation, Dolby Mobile allows device makers to enable a multitude of stunning audio settings, including full 5.1-channel HD audio, mobile surround and natural bass.

Many of these features require DSP-intensive, audio post-processing techniques to be performed in real-time on the mobile device, and call for a high-performance DSP-based audio processor architecture for efficient implementation. The CEVA-TeakLite-III DSP based implementation consumes up to 5x less power than today's CPU-

based alternatives, delivering critical power savings and extending battery life for Dolby Mobile-enabled devices, such as smartphones and tablets.

The provision of the third generation of the Dolby Mobile was achieved using actual CEVA-TeakLite-III silicon, providing CEVA customers with a silicon-proven hardware and software solution that aims to streamline the overall design cycle for advanced mobile audio processors. The DSP solution includes a configurable cached memory subsystem, a comprehensive set of optimized HD audio codecs, and complete software development kit, including software development tools, prototype boards, test chips, system drivers and RTOS.

www.ceva-dsp.com

Variable gain amplifier RFICs reduce component count and board space

Analog Devices has unveiled two highly-integrated VGA (variable gain amplifier) RFICs for broadband communications systems. The ADRF6516 incorporates dual-channel, programmable, 6-pole low-pass filters and VGAs in a single chip, while the ADL5336 integrates two IF VGAs and a pair of programmable rms (root-mean-square) detectors.

The ADRF6516 is a flexible, single-chip, matched pair of variable gain amplifiers with programmable low pass filters ideal for baseband A/D converter driver applications. The 65-dB amplifier gain-control range is split between a 15-dB digital VGA input stage and a 50-dB analog VGA output stage. Using SPI control, system designers can select the corner frequency of the 31-MHz, 6-pole Butterworth filter in 1-MHz resolution.

The integration of the programmable filter reduces the board space and discrete components required to implement a discrete filter. Flexible gain setting and filter programming allows the ADRF6516 to support a receiver with a variable signal bandwidth and gain.

The ADL5336 is a cascadable analog dual IF VGA with two integrated rms detectors that can replace up to four discrete RF components plus additional passive discrete components. The RFIC can operate independently or as two cascaded amplifiers, while the rms detectors can be programmed for independent gain control for each VGA. When it is configured in a cascaded VGA mode, the device provides a continuous gain control range of 48 dB. Individually, each VGA provides a gain control range of 24 dB. The maximum gain for each amplifier can be programmed via SPI control.

www.analog.com

2.4-GHz wirelessUSB transceiver

for remote controls and Human Interface Devices

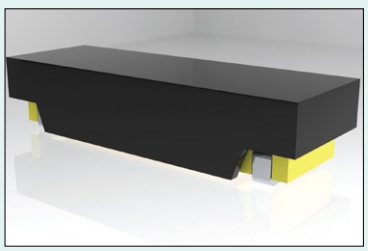
Cypress Semiconductor has introduced its next-generation 2.4-GHz WirelessUSB™ Radio-on-a-Chip. Designated WirelessUSB NL it delivers robust performance along with low power consumption for wireless keyboards, mice, remote controls and other Human Interface Devices (HIDs). The devices are offered in 4 x 4 mm QFN packages, in bare die, and in wafer form.

WirelessUSB NL boasts -87 dBm receive sensitivity at 1 Mbps. This enhanced sensitivity enables longer range operation and allows for lower-power transmit signals. The device features low active and standby current (less than 1 µA), enabling battery life to be more than a year for normal mouse usage. WirelessUSB NL also has a closed-loop internal architecture that minimizes signal frequency drift for robust radio performance. This robustness minimizes retries during transmission enabling lower power consumption and allows for long payload lengths of up to 255 bytes.

www.cypress.com

RFID SMT antenna

rated for automotive use



The SDTR1103CAP RFID antenna from Premo incorporates a mechanical decoupling structure to the ferrite core and external protection against mechanical risks. Designed in the company's 1103 standard, the antenna provides up to 55 mV/Apk-pk/m sensitivity and is suitable for low frequency 20 kHz to 150 kHz receiver applications.

This series offers upper and lateral side protection with co-polyamide polyhexamethylene polymer walls, gamma radiated with high thermal stability (withstands up to 290 ºC) and a mechanical resistance up to 150 Mpa of compression. The antenna features a NiZn ferrite core with high surface resistivity (>10 Mohm/mm) that provides a very stable behaviour over -40 to 125 ºC.

The SMD antenna can be used in applications such as tire pressure monitoring, which requires excellent performance under extreme conditions, according to AEC-Q200 and additional requirements under EU regulations.

www.grupopremo.com

High linearity VGAs
target microwave radio

Hittite Microwave has released two SMT packaged GaAs MMIC variable gain amplifiers (VGAs) which are ideal for VSAT, microwave radio, military, and test and measurement equipment applications from 5 to 27 GHz.

The HMC996LP4E and the HMC997LC4 are GaAs PHEMT MMIC analog variable gain amplifiers which operate from 5 to 12 GHz and from 17 to 27 GHz respectively. Across the line, these versatile amplifiers deliver up to 20.5 dB of gain, +24 dBm, of output P1dB, and +34 dBm of output IP3 in their maximum gain state. Each of these amplifiers is controlled by a single analog control voltage between 0 and -4.5 V, and provides up to 22 dB of gain control range. The high linearity performance of the MMICs allows them to be used as either buffer amplifiers, or as power amplifier pre-drivers in microwave transmitter applications.

The HMC996LP4E consumes 120 mA from a +5 V supply, and is housed in a RoHS compliant 4 x 4 mm QFN leadless package. The HMC997LC4 consumes only 170 mA from a +5 V supply, is housed in a RoHS compliant 4 x 4 mm ceramic QFN leadless package. Both are compatible with high volume surface mount manufacturing, and both feature excellent gain flatness making them well suited for military EW, ECM and radar applications.

www.hittite.com

GPS RFIC
mitigates interference from L-band LTE signals

As GPS frequency bands come more and more under attack, Tahoe RF Semiconductor claims to offer the first integrated dual channel (L1 & L2) GPS RFIC that substantially mitigates interference from LightSquared and 4G L-band LTE signals and other high-level jamming environments.

The TRFS15011 integrates two independent receive paths with 12 bit analog-to-digital converters, providing complete conversion of GPS signals from RF to digital data. The IC also has integrated Fractional-N RF Synthesizers with a high performance VCO. The receive paths can be configured for high linearity operation by setting the ADC resolution to 12 bits, or for low power operation by setting the ADC resolution to 3 bits. The RFIC configuration is digitally controlled through a bi-directional SPI.

The company says the TRFS15011 is the most flexible and robust GPS receiver on the market. The integrated circuit has the ability to process L1 and L2 received signal data in the presence of a >60 dBc jammer and easily integrates into a complete system platform solution.

www.tahoerf.com

Precision timing chip
for 4G LTE femtocells

U-blox has announced the availability of the UBX-G6010-ST-TM, a precision timing single-chip based on GPS technology with extreme acquisition sensitivity. It is designed for high-volume applications requiring low-cost precision timing with accuracy down to 15 nanoseconds such as femtocell basestations delivering 4G LTE (Long-Term Evolution) CDMA and WiMAX services.

Available in a miniature 8 x 8 mm MicroLeadFrame (MLF) package, the chip delivers two precision time pulse outputs at up to 10 MHz frequency, plus complete GPS satellite raw data. The chip is able to operate with only one GPS satellite visible ("single-satellite tracking"). The timing accuracy of 15 nanoseconds is achieved using the built-in quantization error compensation. Additionally, an integrated time mark and counter unit can provide precise time measurement of external events.

The chip is qualified according to AEC-Q100, and is manufactured at ISO/TS 16949 certified facilities. It is guaranteed to operate from -40 °C to 85 °C.

www.u-blox.com

160-MHz signal analyzer
suitable for wide bandwidth signal analysis

Agilent Technologies has introduced two solutions for analysis and generation of wide bandwidth signals — the industry's first 160-MHz analysis bandwidth option for the high-performance PXA signal analyzer and Signal Studio software for 802.11ac signal creation.

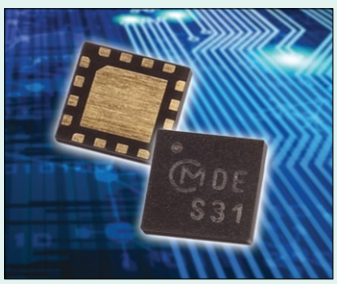
Wider bandwidth signal analysis, up to 160 MHz, is necessary to cover all of the bandwidths supported by 802.11ac. Agilent's PXA signal analyzer with 160-MHz bandwidth addresses this need, as well as any other application that requires engineers to analyze wider bandwidth signals. Its advanced performance provides valuable insight that helps speed the design, verification and troubleshooting of current and future 802.11ac devices. Moreover, when combined with the 89600 VSA software's 802.11ac modulation analysis, the PXA enables high-performance, comprehensive analysis of 802.11ac signals.

Signal Studio for WLAN software enables the creation of 802.11ac waveforms with BCC or LDPC channel coding, all MCS codes, and single- or multi-user MIMO up to four streams. Generation of up to 80-MHz bandwidth signals are supported with Agilent's ESG, MXG or PSG vector signal generators and the PXB baseband generator and channel emulator; 160-MHz bandwidth signal generation is possible with support from two Agilent vector signal generators.

www.agilent.com/find/pxa

MMID front end modules

for Wi-Fi and Bluetooth applications



Murata's Microwave Monolithic Integrated Devices (MMID) integrate the company's power amplifier, low noise amplifier and switching product into single packages for both the 2.45 GHz and 5 GHz bands (respectively numbered MDFE2PFA-022 and MDFE2PFA-023). The modules can be combined with a highly integrated, single chip radio — such as the Broadcom BCM4330 chipset — to provide a connectivity solution for the cellular phone, portable device, and person computer markets.

For the engineer, Murata's MMID series enables a complete system to be achieved with minimal components. The line is extremely flexible, with the ability to support 802.11b/g and Bluetooth and/or 802.11a. Designers can also use one or both front end modules to mix and match wireless networks with minimal design resources. This reduces the complexity of design and greatly improves time to market.

www.murata.eu

High capacity femtocell SoCs

target enterprise and metro markets

Qualcomm have expanded availability of their Femtocell Station Modem™ (FSM™) FSM9216, FSM9816 and FSM9832 enterprise chipsets. These fully integrated SoCs for femtocell development offer an extended user capacity of up to 32 active users, and complement the currently available FSM 3G femtocell chipsets that feature eight user versions targeting the residential market with hardware and software compatibility.

Also announced is a Femto-Wi-Fi hardware reference design that integrates these FSM enterprise solutions with Qualcomm Atheros 802.11n Wi-Fi® AR9350 and AR9344 access point solutions.

The 16-user enterprise FSM chipsets for UMTS and CDMA are now available. Both the Femto-Wi-Fi integration hardware platform and the CDMA version of the FSM chipset with the expanded 32-user support are scheduled for availability in the second half of 2011. These higher capacity femtocell products for enterprise and metro applications take advantage of the same industry leading UltraSON™ interference and mobility management software and algorithms that are available from Qualcomm on the existing residential FSM products. UltraSON creates robust wireless coverage while ensuring that the femtocells do not interfere with macrocells while providing hand-off capabilities between macrocells and other femtocells.

The FSM chipsets support both CDMA2000® and UMTS/HSPA+ network technologies and include a baseband modem, RF, network listen, GPS and an application processor.

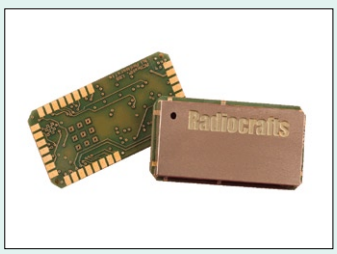
www.qualcomm.com

TinyMesh RF modules

with self-configuring mesh protocol for ISM bands

Radiocrafts AS has introduced a powerful mesh network protocol operating in all sub-1 GHz and 2.4 GHz license free ISM bands. TinyMesh networks are self forming and self healing without external interaction. Due to the mesh network redundancy, TinyMesh offers superior range and reliability, with no limitations in number of gateways or addressable nodes.

Compared to other mesh protocols, TinyMesh gives the shortest time to market due to its ease of use and self-configuring capabilities. It supports transparent data communication, as well as digital I/O control, analogue inputs and PWM outputs. Among several unique features, TinyMesh provides location information for asset tracking, automatic battery supervision and RF signal strength information. Safe and reliable data traffic is secured by Listen Before Talk, CRC integrity



check, acknowledge and retransmission mechanisms on every data packet delivery.

TinyMesh is available in Radiocrafts modules at 433, 865 and 868 MHz with optional 500 mW output power for European and Indian markets. Line-of-sight range in excess of 3 km per hop is achievable with the high power modules. TinyMesh further supports 915 MHz for North-America and 2.4 GHz with up to 100 mW output power for world-wide use. TinyMesh modules are pin-compatible with Radiocrafts' Wireless M-Bus and KNX RF modules.

www.radiocrafts.com
www.tiny-mesh.com

Antenna couplers

improve connection reliability and battery life

STMicroelectronics has unveiled two chips for controlling antenna power in mainstream 3G wireless products. The devices are more than 83% smaller than earlier components and improve energy efficiency to maximize battery life for always-on-the-go consumers and business users. Today's multi-function, multi-band cellphones and smartphones, as well as tablets and 3G USB dongles, continuously adjust their transmitter power to optimize contact with the network as environmental conditions change.

Antenna couplers monitor the power radiated by the antenna to perform this constant adjustment. Whereas most couplers measure the power radiated by the antenna in the forward direction only, these bidirectional devices also measure the reflected power, to improve control and efficiency. The CPL-WB-00D3 and DCPL-WB-00D3 are

single- and dual-path antenna couplers intended for single- and dual-antenna systems. By also integrating attenuators on coupled and isolated ports, the antenna couplers simplify circuit design while saving cost and pc-board space.

This extra integration is achieved using the company's Integrated Passive Device (IPD) technology; other types of couplers need separate attenuators. The antenna couplers are as small as 1.3 x 1.0 mm compared with earlier 1.7 x 1.4 mm devices. Other features include low insertion losses, high directivity and a wide operating frequency range.

www.st.com

World's first DECT ULE wireless sensor network devices

Dialog Semiconductor claims to offer the world's first family of IC based devices interoperable with the DECT ULE (ultra low energy) wireless standard. SmartPulse has been created for home automation, healthcare, security and energy monitoring consumer applications.

End products integrating SmartPulse wireless sensors self configure to connect with a home's DECT ULE enabled hub device or IP gateway. End users will also be able to manage SmartPulse systems remotely via a smartphone, laptop or tablet PC.

Dialog's SmartPulse suite of IC based devices consists of the SC14WSMDATA (data) and SC14WSMDECT (data and audio) wireless sensor nodes, which run for up to 10 years on a single AAA battery pack, and the SC14CVMDECT base station device that can be integrated into standalone hub products or internet gateways -— allowing the remote management of SmartPulse enabled systems over an internet connection. The DECT ULE standard is backwards compatible; enabling SmartPulse sensor nodes to communicate with existing legacy DECT enabled hubs and internet gateways from multiple manufacturers.

All SmartPulse devices transmit 232-bit packet data in the 1870-1930 MHz licensed DECT band. With a link budget of 123 dB, systems that integrate SmartPulse sensors can reliably stream data throughout even large family homes and gardens.

The wireless sensor nodes integrate the baseband, radio transceiver, antenna and power amplifier into a single system-in-package IC. In sleep mode the programmable devices use less than 3 µA. The SC14WSMDECT sensor further integrates audio functionality, enabling the creation of battery powered voice devices such as

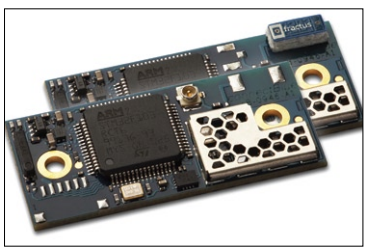
personal security and healthcare communication devices.

The SC14CVMDECT base station device supports both voice and data, connecting with up to six voice and 256 data sensor nodes, and supports the DECT ULE, DECT 6.0 and CAT-iq standards.

www.dialog-semiconductor.com

Bluetooth v4.0 low energy ready module

with Android support and Apple iOS connectivity



ConnectBlue is expanding its Bluetooth module range with the Bluetooth Serial Port Module OBS421, which is designed for Bluetooth v4.0 featuring Bluetooth low energy technology. The ready-to-embed OBS421 module is a mid-range module tailored for the especially tough demands of industrial and medical applications.

The module has a small form factor, a low build height, and initially supports Bluetooth 2.1+EDR. Since the hardware supports Bluetooth v4.0., it can be upgraded with Bluetooth low energy technology through an upcoming firmware upgrade. The module provides a mid-range (0 to 300 meters) wireless transparent serial link using an embedded Bluetooth stack with Bluetooth profiles GAP, SPP, DUN, and PAN. Key features include high throughput, low latency, high receiver sensitivity, Android support, and high speed UART.

The OBS421 also supports Apple iOS connectivity with firmware for use by Apple MFi licensees. The module also incorporates sophisticated technical features for enhanced performance including Wireless Multidrop that allows up to seven devices to communicate simultaneously.

www.connectblue.com

Secure RFID keys

feature a 13.56 MHz interface for access control

Maxim Integrated Products has introduced a line of RFID keys and cards designed for the two-billion-units-per-year automatic identification, access control, and electronic cash (e-cash) markets. This contactless RFID product family (the MAX66 000/020/040/100/120/140) leverages the expertise utilized in the company's popular 1-Wire® secure authentication ICs, which protect intellectual property in embedded systems.

With a 13.56 MHz interface, these secure keys are ideally positioned to gain market share because 13.56 MHz is becoming the worldwide standard for access control and e-payment applications.

Maxim's latest RF devices are packaged in a laminated plastic key fob or ISO thin card format and are available in either the ISO 14443B or ISO 15693 HF protocol. Each protocol family offers three products: 64-bit ROM ID only (MAX66000/MAX66100), ROM ID plus 1K-bit EEPROM (MAX66020/MAX66120), or ROM ID plus 1K-bit EEPROM and SHA-1 authentication (MAX66040/MAX66140). Custom form factors are also available.

www.maxim-ic.com/rfid

Full-band capture satellite channel stacker IC

dramatically minimizes satellite TV installation costs

Broadcom has announced its entry into the satellite Out Door Unit (ODU) market with its 40-nm BCM4550 full-band capture (FBC) satellite channel stacker, which claims to be the first fully integrated satellite ODU solution to support FBC technology. The BCM4550 with integrated full-band capture digital tuning technology dramatically minimizes satellite TV installation costs and complexity, delivering single wire architecture into the home. Enabling breakthrough design efficiency and scalable bandwidth to operators, Broadcom's ODU technology meets industry demand for more set-top boxes in the home. This provides a TV everywhere connected home experience with additional HD video streams, multi-room DVR and IP services.

The IC drives future TV by leapfroging current analog architecture by moving to digital and supporting up to 24 minimally spaced channels, which opens up the ability to stream independent HD broadcast streams and IP services from a single cable to multiple connected devices.

The BCM4550 simplifies installation and upgrades via stacked channel technology which allows single cable installation, which in-turn significantly reduces the cost and complexity for installs and upgrades. Further, full-Band Capture (FBC) digital tuning technology digitizes the entire spectrum enabling more efficient and flexible distribution of video streams and IP services.

www.broadcom.com

Outdoor packet unit for 4G/LTE backhaul

up to 1 Gbps of IP traffic on a single radio channel

Ceragon Networks has released the FibeAir® IP-10C, a compact, all-outdoor, high-capacity wireless packet backhaul unit — as the latest member of the widely deployed FibeAir IP-10 family. This integrated device delivers up to 1 Gbps of IP traffic on a single radio channel. Able to withstand harsh weather conditions, the low-power, environmentally sound backhaul unit is easily mounted on rooftops, lamp posts, traffic light poles, and in small outdoor mobile cell-sites. It is ideal for IP/MPLS backhaul in 3.5G and 4G/LTE networks, delivering affordable, efficient and comprehensive backhaul.

Key features include up to 1 Gbps of IP traffic on a single radio channel, asymmetric traffic delivery for higher download capacities, complete range of frequencies from 6 to 42 GHz, a wide range of channels that extend from 3.5 to 56 MHz, adaptive coding and modulation for increased spectrum usage, and increased backhaul capacity

Easy to install, the low power FibeAir IP-10C features a compact size and all-outdoor design for easy tower, rooftop or pole-mount installation. It also offers service support with stringent SLA (service level agreement), as well as simplified network design and maintenance for reduced CAPEX and OPEX.

www.ceragon.com

CALENDAR

European Microwave Week 2011
9th - 14th October 2011
Manchester Central
Manchester, UK
www.eumweek.com

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

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

Cartes & IDentification 2011
15th - 17th November 2011
Villepinte Exhibition Center
Paris, France
www.cartes.com

Productronica 2011
15th - 18th November 2011
New Munich Trade Fair, Munich
Germany
http://productronica.com

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

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Visit us at EuMW 2011 - Booth 103

Speed your RF and microwave circuit design.

AWR®, the innovation leader in high-frequency EDA, delivers software that quickens the pace of high-tech product development. Learn how Microwave Office™, AXIEM®, Visual System Simulator™ and Analog Office® tools improve accuracy, streamline the design process, and accelerate time-to-market. **AWR EuMW Booth 103** demonstration highlights include electrical-thermal MMIC co-simulation, yield analysis/optimization, circuit envelope simulation as well as asynchronous EM simulation. Or visit us online at **www.awrcorp.com**

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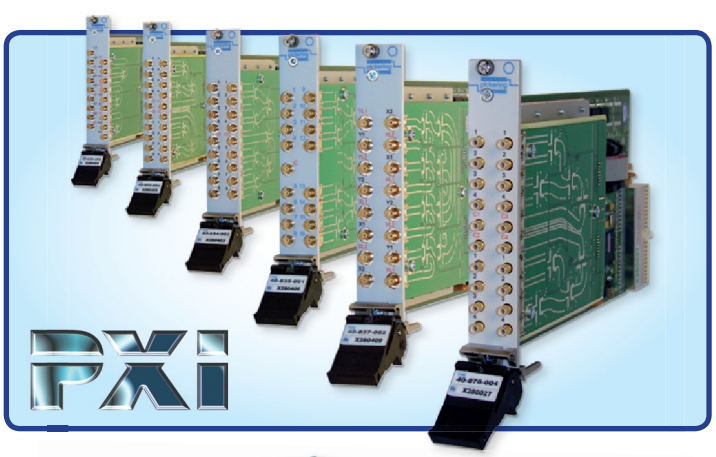
RF & Microwave Test Solutions from Pickering Interfaces

Pickering Interfaces has a wide range of RF & Microwave switch modules that can be used to increase the flexibility of Test & Measurement systems with signal bandwidths up to 65GHz. Available PXI and LXI switch module configurations include high-density multiplexers, matrices and general-purpose switches.

All versions exhibit low insertion loss and VSWR through the use of modern RF switch technology at an affordable cost. Each module has been carefully designed to ensure excellent and repeatable RF characteristics with all signal paths having nominally equal insertion loss wherever possible.

All our modules may be ordered together with mating cables to ensure speedy and successful system integration.



Detailed Pricing & Technical Data On-Line www.pickeringtest.com

40-870 Hex SPDT RF Switch SMB 50 Ohm

40-777 16 to 1 RF Multiplexer 3GHz 50 ohm SMB

40-875 Single 16:1 RF MUX SMB 50 Ohm

40-746 Dual 4 to 1 Mux 2GHz 50Ohm SMA

This is our 50 ohm range, our 75 ohm range has similar functionality, but with appropriate connectors.

PXI

RF Switching to 6 GHz				
Switch Type	**Max Freq**	**No of Switches**	**Connectors**	**Order Code**
SPDT Terminated	6GHz	2, 4, 6, 8	SMA	40-880
SPDT	3GHz	3, 6	SMB, MCX	40-870
SPDT	2.5GHz	4	BNC, SMA, SMB	40-710
SPDT	1.2GHz	9,17	SMB	40-754
SPDT	500MHz	9,17	MS-M	40-754
SP4T Terminated	6GHz	1, 2, 3, 4	SMA	40-882
SP4T Terminated	3GHz	1, 2	SMB, MCX	40-873
SP4T Terminated	2GHz	1	SMA, SMB	40-740
SP4T Term Common	3GHz	1, 2, 4	SMB, MCX	40-876
SP4T	3GHz	1, 2, 4	SMB, MCX	40-872
SP4T	2GHz	1, 2, 4	BNC, SMA, SMB	40-745, -746, -749
SP4T	1.8GHz	4, 5, 10	SMB	40-755
SP4T	500MHz	5, 10	MS-M	40-755
SP6T Terminated	6GHz	1, 2	SMA	40-881
SP8T	3GHz	1, 2	SMB, MCX	40-874
SP8T	2GHz	1, 2	SMA, SMB	40-745, -748, -778
SP16T	3GHz	1	SMA, SMB, MCX	40-875, -777
SP16T	2GHz	1	SMA, SMB	40-747
2x2 Matrix	2.5GHz	1, 2	SMB, MCX	40-877
8x2 Matrix	1.5GHz	1	SMA, SMB	40-750
8x9 Matrix	500MHz	1	SMB	40-725
12x8 Matrix	300MHz	300MHz	SMB	40-726A

Microwave Switching to 65 GHz				
Switch Type	**Max Freq**	**No of Switches**	**Connectors**	**Order Code**
SPDT	65GHz	1,2,3,4	SMA, N-type	40-881
Transfer	18GHz	1,2	SMA	40-782
SP6T	40GHz	1, 2	SMA	40-785
SP6T Remote Relays	40GHz	1, 2, 3	SMA	40-785
SP6T Terminated	40GHz	1, 2	SMA	40-785
SP6T Term Remote	40GHz	1, 2, 3	SMA	40-780
SP6T	20GHz	1, 2, 3	SMA	40-786

40-881 SP6T 6GHz Terminated MUX

40-754 17xSPDT 500MHz Relay Module

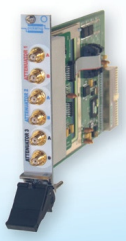
40-786 3xSP6T 20GHz MUX

40-726A 12x8 300MHz Matrix

PXI RF Attenuators

- **41-180** DC To 3GHz Programmable Attenuator
  - 0 to 63dB in 1dB steps
  - Single and Dual Versions in One PXI Slot
  - Use of Switched Resistive Attenuator Pads Ensures High Linearity and True DC Coupled Operation
- **41-182** 10MHz To 6GHz Programmable Attenuator
  - 0 to 31.75dB in 0.25dB Steps
  - Single, Dual and Triple Versions in One PXI Slot
  - Solid State Switching For Long Service Life

41-180
DC To 3GHz Programmable Attenuator



41-182
10MHz To 6GHz Programmable Attenuator

PXI Chassis

8 and 19 slot high performance PXI compliant chassis, available with remote health monitoring.

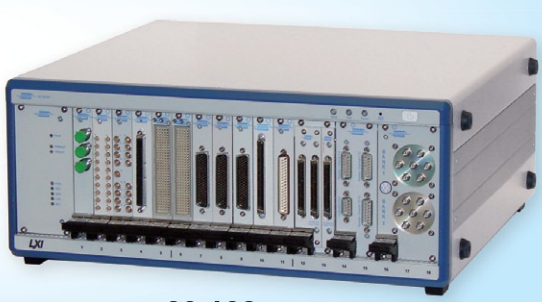
40-922
8-Slot PXI Modular Chassis

40-923
19-Slot PXI Modular Chassis

LXI Modular Chassis

For applications requiring a mix of RF and Microwave switching functions and the convenience of an Ethernet interface in the same 4U chassis, look no further than Pickering Interfaces' LXI modular platforms. These can accept any of our PXI RF/Microwave switches and attenuators.

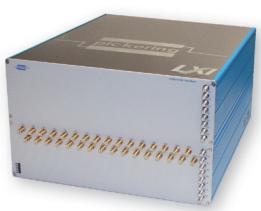
60-102
7-Slot LXI Modular Chassis



60-103
18-Slot LXI Modular Chassis

RF & Microwave Matrices

Module Configuration	Maximum Size	Minimum Size	Impedance	Maximum Frequency	Product Code
Dual Video Matrix	Dual 24x8	Single 24x8	75Ω	25MHz	60-711
Dual HF Matrix	Dual 24x8	Single 24x8	50Ω	50MHz	60-760
1GHz RF Matrix	Single 32x16	Single 16x16	75Ω	1.5GHz	60-730
	Single 32x8	Single 8x8			60-731
	Single 32x4	Single 8x4			60-732
2.4GHz RF Matrix	Single 32x16	Single 16x16	50Ω	2.4GHz	60-770
	Single 32x8	Single 8x8			60-771
	Single 32x4	Single 8x4			60-772
Microwave Matrix	Dual 4x4	Single 3x3	50Ω	10GHz	60-750
	Single 4x4	Single 3x3		20GHz	60-751



60-730/731/732
1GHz 75Ω Matrix

60-770/771/772
2.4GHz 50Ω Matrix

60-711
Dual Video Matrix

60-750/751
10/20GHz 50Ω Matrix

RF & Microwave Multiplexers

Module Configuration	Maximum Size	Minimum Size	Impedance	Connector	Product Code
Video Multiplexer	72 Channel	24 Channel	75Ω	F-Type	60-721
High Isolation Multiplexer	Dual 12 Channel	Single 12 Channel	75Ω	F-Type	60-722
Microwave Multiplexer	16 x 6 Channel	4 x 6 Channel	50Ω	SMA	60-800
	16 x 6 Channel	4 x 6 Channel	75Ω	DIN 1.6/5.6	60-820

60-800/820
50Ω/75Ω Microwave Multiplexer

60-721
High Performance Video Multiplexer

60-722
High Isolation 1GHz 75Ω Multiplexer

Software

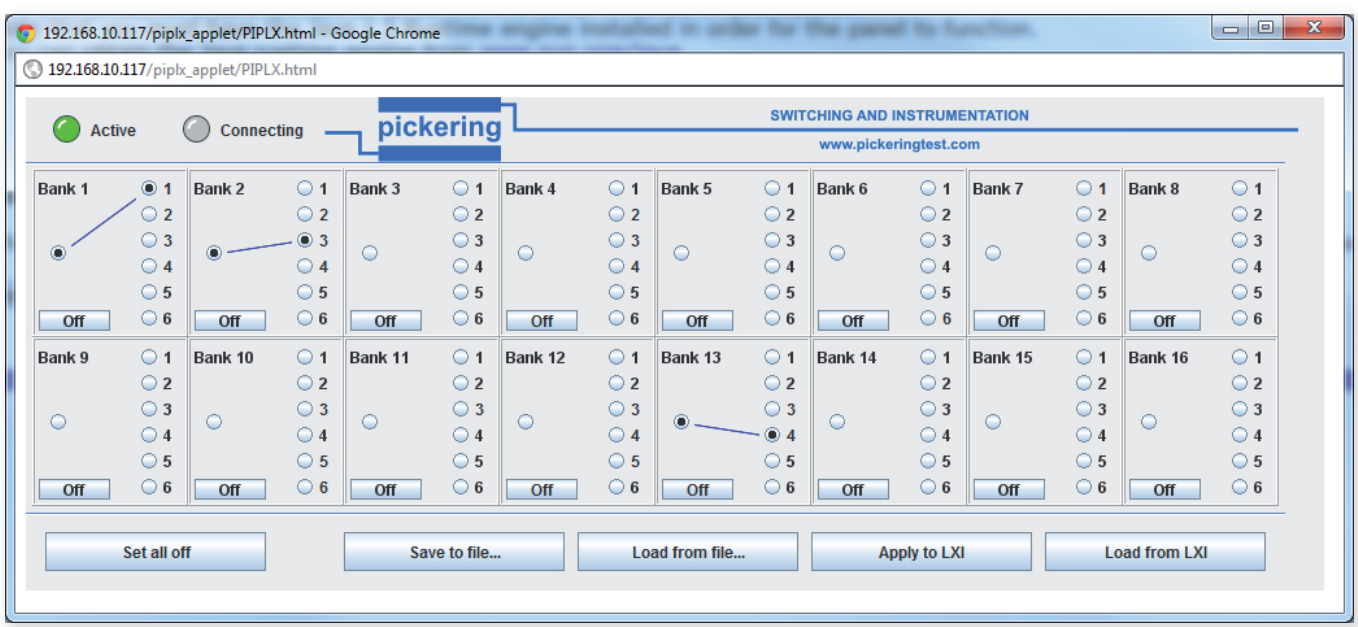
Development flexibility

With a huge of range of switching solutions based on “plug and play” and Ethernet based modules, our PXI and LXI products are an ultimate deployment platform for the automated test systems. Pickering provides the open software development interfaces allowing freedom to create different test scenarios using a wide range of development environments as follows:

- *Microsoft® Visual Studio (C/C++, C# and Visual Basic)*
- *LabVIEW™, LabWindows/CVI, SwitchExecutive and Test Stand from NI*
- *Agilent VEE*
- *Geotest ATEasy*

Using our optimized System-level Utilities

To enhance development and debugging of automated tests, Pickering provides Soft Front Panels (SFPs) and diagnostic tools with all of our products. Our SFPs help users control the module in a simpler and intuitive way. SFPs for LXI can also be accessed through the web browser to provide manual configuration, verify connectivity and explore module functionality.



Simplifying Software Solutions

Pickering provides different driver sets based on comprehensive IVI, VISA and DLL (Direct I/O) drivers which are compatible with Windows 2000/XP/Vista/7 and Linux based operating systems. Each driver supports our entire PXI switch card range hence simplifying software solutions. Most drivers are also compatible with Real-Time operating systems such as LabVIEW RT.

All drivers are provided with extensive documentation and examples to help you develop test routines with ease, and you can use the software of your choice.

Accessories

Pickering Interfaces understands that just providing switching and instrumentation modules is not enough - users need to be provided with fast and effective ways of connecting their investment to the device under test. The modules in the Pickering Interfaces PXI and LXI families are fully supported by a comprehensive range of connector and cable accessories. The accessories are detailed in the ***176 page Connection Solutions Catalog*** *available in paper or downloadable format at* **www.pickeringtest.com/pdf/Interconnection**. *The catalog is cross-referenced to all our module front-panel connectors making it easy for users to find the perfect accessories to complement their chosen products.*

Further Information

Pickering Interfaces has a variety of comprehensive information to assist you in the selection and design of your PXI based tester. To obtain your copy please visit the Catalog section of our web site or call your local Pickering Interfaces sales office.

PXImate *is a 160 page publication which looks in detail at the PXI standard and offers guidelines to help efficiently build a PXI-based test system. The latest edition features a chapter on PXI Express as well as information on the new LXI standard. Download your free electronic copy at:*
www.pickeringtest.com/pdf/pximate

Want to Know more about LXI? Get your free copy of the ***LXImate*** *by registering at*
www.pickeringtest.com/lximate

PXI Full Catalog

400 Page Full Catalog available printed or on DVD

PXI Short Form Catalog

Comprehensive Short Form Catalog Listing all of over 500 Pickering PXI Modules

LXI Product Guide

Comprehensive Short Form Catalog Listing all of Pickering's LXI Modules

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