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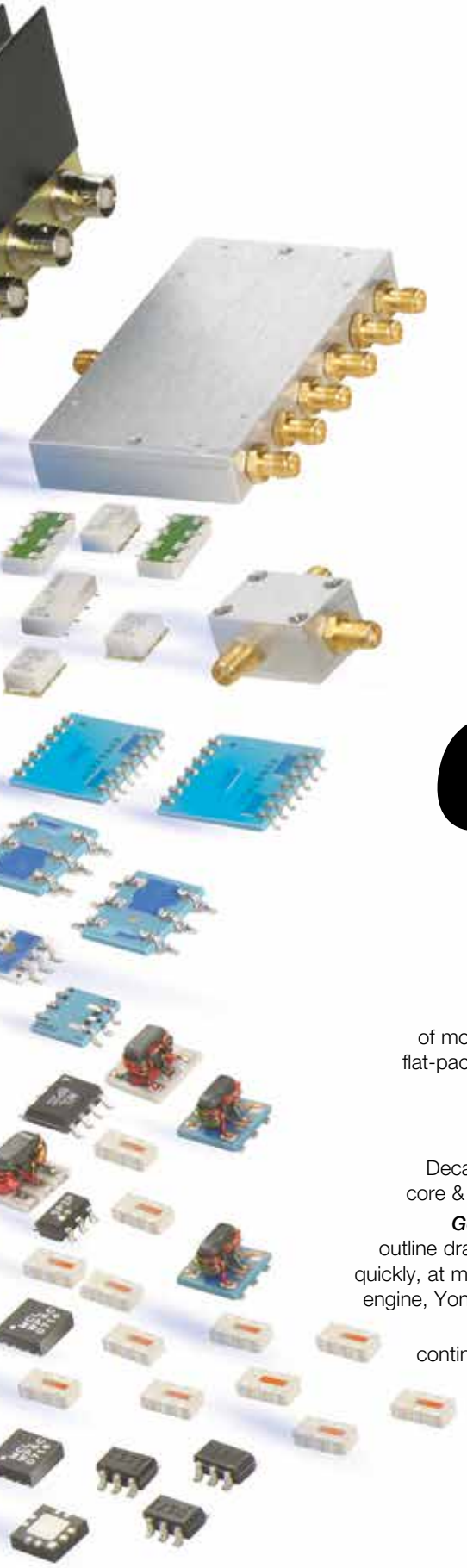

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Hurdles Cleared for DOD Budget and NGJ

Scott L. Spencer
Publisher

As we prepared to go to press with the February 2014 issue of *High Frequency Electronics,* news came that Raytheon had been re-awarded a nearly $280 million contract to lead the Engineering and Manufacturing Development of the Navy's Next- Generation Jammer (NGJ). The system is set to replace outdated AN/ALQ-99 systems used on the EA-18G airborne electronic attack aircraft. The contract was originally awarded to Raytheon last July after a run-off with teams led by Northrop Grumman and BAE Systems. BAE, however, lodged a protest with the General Accounting Office, which was partially upheld. In question was whether the Navy had "failed to reasonably evaluate technical risk" in accordance with the evaluation guidelines. The protest resulted in the Navy revisiting the selection process and carrying out a new cost and technical analysis of all three original bids. In the end they reached the same conclusion: Raytheon offered the best answer to meet the Navy's future airborne EW needs. For Raytheon it opens a clear path to a lucrative $3 to $10 billion market in production awards, upgrades, and logistics.

NGJ Improves Attack and Jamming Capabilities for EA-18G

Not everyone agrees with the Navy's decision—especially those that led teams who worked so hard yet whose efforts came up short. However, most everyone can agree that the venerable AN/ALQ-99 Tactical Jamming System with its vacuum-tube technology is nearing the end of its useful life and needs to be replaced. This program is so old that I even worked on it when I was employed at Raytheon's Electromagnetic Systems Division in Goleta, California way back in the mid-1970s.

Back then the "99" was state-of-the-art, with the first fully integrated computer controlled support jamming system. It was mostly deployed on the EA-6B Prowler, but at least one variant was produced with a conformal array for the supersonic EF-111 Raven. The on-board system included a receiver, processor, and aircrew interfaces. The jammer pods could be reconfigured based on the mission and they were self-powered by a ram air turbines and carried the transmit modules and the exciter. TWTs provided sufficiently high levels of effective radiated power (ERP) to jam a large numbers of threats simultaneously. Soon the rapid evolution of complex integrated air defense, communication, data link and non-traditional RF threats began to stretch the limits of the system's capability.

Over the years the "99" has seen lots of upgrades and improvements. The Receiver Processor Group (RPG) was added in the 1990s, providing precision direction finding, passive ranging, identification, and threat warning in very dense environments and in the presence of onboard jamming. Later upgrades included improvements to the exciter, additional Band 9/10 transmitter capabilities and a host of signal processing algorithm updates. Nonetheless, the aging system had critical limitations in light of increasingly complex threats.

According to Raytheon their NGJ will provide "innovative airborne attack and jamming capabilities with greater precision, power, reactive speed and directivity to ensure superior mission performance for the EA-18G Growler airborne electronic attack aircraft." The new system will employ a combination of high-powered, agile beam jamming techniques and cutting-edge solid-state technology. Variants of the system could find opportunities for deployment on additional manned and unmanned platforms.

Budget Compromise Eases Sequestration—Temporarily

All this comes as the compromise budget passed by Congress and signed by President Barack Obama in late December begins to kick in and the Pentagon has roughly $30 billion over the next two years that they would not have had under sequestration. This is all good news because for the first time in three years they also have some near-term budget confidence.

In summary, defense spending is capped at about $498 billion in 2014, $29 billion less than requested but $21 billion above the sequester cap. In 2015, spending is capped at $521 billion, more than $9 billion above the previous $512 billion cap. Not the greatest scenario, but far better than some had predicted.

Adding perspective to all this was Gen. Martin Dempsey, chairman of the Joint Chiefs of Staff, when he recently said, "Of course, the remainder of sequestration still lurks on the horizon beyond these two years. And so, some of the force structure changes-force structure reductions that we had planned based on sequestration will march on." He added, "We know what the bottom looks like; the money that's coming back, we're buying it back. We'll buy it up to the level we can buy it, and there will still be a delta. The work is done."

HFE

Conferences

March 19 – 20, 2014
Microwave & RF
Paris
www.microwave-rf.com

March 23 – 27, 2014
IEEE International Wireless Symposium (IWS 2014)
Xi'an, China
http://iws-ieee.org/

May 8 – 9, 2014
IEEE MTT-S International Wireless Power Transfer (WPTC 2014)
Jeju, Korea
http://www.wptc2014.org/

June 1 – 6, 2014
IEEE International Microwave Symposium (IMS2014)
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LabVIEW user groups.
https://decibel.ni.com/content/community/zone/labviewusergroups

Call for Papers

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IEEE International Conference on Ultra-WideBand (ICUWB)
Paris
Abstract submission deadline: March 11, 2014
Final submission deadline: June 6, 2014
Notification of acceptance date: May 12, 2014
http://www.icuwb2014.org/

September 14 – 19, 2014
International Conference on Infrared, Millimeter, and Terahertz waves (IRMMW-THz)
Tucson, Ariz.
Abstract submission deadline: March 21, 2014
Final submission deadline: May 25, 2014
Notification of acceptance date: April 20, 2014
http://www.irmmw-thz.org/

October 19 – 22, 2014
2014 IEEE Compound Semiconductor Integrated Circuit Symposium (CSISC)
La Jolla, Calif.
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Continuing Counter-Terror Operations Sustain DoD Budget for SOCOM

U.S. Department of Defense (DoD) Special Operations Command (SOCOM) spending is anticipated to remain stable over the next few years, despite existing budget pressures. Investments in commercial off-the-shelf (COTS) products as well as networking and collaboration tools will rise as they lower overall costs and enhance efficiency.

New analysis from Frost & Sullivan finds spending on military products and services stood at $10.09 million in 2012 and estimates this to reach $10.60 million in 2018.

"With the U.S. DoD SOCOM involved in direct operations, training or relationship building in over 100 countries, the need for operations and maintenance services as well as military system upgrades is on the rise," noted Frost & Sullivan Aerospace & Defense Senior Industry Analyst Brad Curran. "U.S. policy to forge low-footprint, low-cost military relationships to achieve counter-terror objectives provides the foundation for budget and acquisition plans."

The U.S. DoD SOCOM is also expected to spend on new platforms, especially training and ground mobility vehicles up to 2018. In terms of technology, expenditure will focus on incremental size, weight and power (SwaP) product improvements. Command, control, communications, computers, intelligence, surveillance, reconnaissance systems, training and simulation, as well as rotary wing applications will witness maximum growth.

—Frost & Sullivan
frost.com

US 4G LTE Competition Intensifies on Path to 190M Connections in 2014

T-Mobile's acquisition and swap of spectrum with Verizon Wireless will further the carriers' respective aims of greater LTE coverage and capacity in 2014, intensifying network-based competition and stimulating market growth, according to Strategy Analytics. Recent forecasts from Strategies Analytics predict LTE will account for 50 percent of wireless connections in the US by end 2014 and 79 percent by end 2018.

The US will lead the world in 4G LTE in 2014, accounting for more than one in three of the forecast 528 million LTE connections by year-end. Together with Japan and South Korea, the competitive intensity in these developed 4G markets will help them dominate the LTE landscape this year, though all eyes will be on China as it takes its first steps with TD-LTE services.

"The spectrum trade is a great deal for both T-Mobile and Verizon Wireless," comments Phil Kendall, Director Wireless Operator Strategies. "The 700MHz spectrum, covering 50 percent of the US population, will be crucial for T-Mobile as it looks to catch up with its larger rivals on 4G LTE coverage. And Verizon Wireless's priorities are all about capacity: with two-thirds of traffic on its LTE network, additional AWS and PCS spectrum will form an important part of its network build-out plans."

—Strategy Analytics
strategyanalytics.com

ISR Video Analytics Demand Increasing

The demand for intelligence, surveillance and reconnaissance (ISR) video analytics solutions that assist in the processing, exploitation and dissemination (PED) of full motion video (FMV) has increased significantly in the U.S. The need to provide actionable, real-time intelligence to U.S. troops on the ground, based on the FMV gathered through sensors and platforms that have grown from a few dozen systems a decade ago to thousands today, is main driver for the market.

According to new research from Frost & Sullivan, the defense budget for this market will reduce to $837.5 million in 2018 from $1,207.2 million in 2012, as the combat operations in Afghanistan cease over the next few years and forces are withdrawn. No less, necessary intelligence to fend off increasing terror attacks sustains the market and presents future commercial market opportunity.

"The vast amount of video analytics equipment used in Iraq and Afghanistan to warn troops of impending threats and allow them to locate targets will soon return to the U.S.," said Frost & Sullivan Aerospace & Defense Senior Industry Analyst John Hernandez. "Converting these tools into useful assets that can protect the homeland will open up lucrative opportunities in the commercial sector."

In fact, the importance of video surveillance, electro-optical/infrared technologies, and the exploitation of social media within the country is growing considering recent terrorist attacks such as the Boston Marathon bombings.

ISR video analytics is expected to restructure the long-established intelligence cycle in the U.S. Growth in the number of unmanned vehicle systems that can stay airborne for longer periods and collect more data has set in motion changes in the PED of ISR collections. This, in turn, is altering intelligence training, data and data storage standards.

However, insufficient bandwidth is a key market restraint. The fast transfer of FMV output along with other sensor content is affected by inadequate bandwidth, causing end users to spend more time on processing data instead of focusing on additional collection, dissemination, and planning.

—Frost & Sullivan
frost.com

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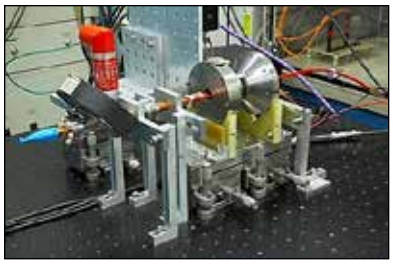

DARPA Image

Researchers under DARPA's **Terahertz Electronics (THz) program** have designed and demonstrated a **0.85 Terahertz power amplifier** using a micromachined vacuum tube—a world's first. The achievement comes from DARPA-funded researchers at **Northrop Grumman Electronic Systems**, who built the **1 centimeter-wide traveling wave vacuum tube**. The vacuum tube power amplifier is only one achievement of the broader THz program, which seeks to develop a variety of breakthrough component and integration technologies necessary to one day build complex THz circuits for communications and sensing.

The final three of eighteen primary **mirrors** built by **Ball Aerospace & Technologies Corp**. for the **James Webb Space Telescope** (JWST) have arrived at Goddard Space Flight Center, Greenbelt, Md. for integration prior to a scheduled launch in 2018. Once in orbit, the 18 hexagonal mirror segments will work together as **one 21.3-foot (6.5-meter) primary mirror**, the largest mirror ever flown in space and the first to deploy in space. Ball Aerospace also developed the secondary mirror, tertiary mirror, and fine-steering mirror. Ball is the principal optical subcontractor for the Webb Telescope, led by prime contractor **Northrop Grumman Corp. Aerospace Systems.**

Advantech Wireless Inc., a privately-held Canadian corporation and manufacturer of Satellite, RF Equipment and Microwave Systems, announced that it has successfully completed the delivery of several orders totaling $1M for its **25W GaN C-band and X-band BUCs**. The 25W GaN C-band and X-band BUCs are constructed in a compact cooling enclosure specially designed for outdoor operation. The units are weatherproof and are perfectly suited for harsh environments such as man-pack terminal deployments.

Raytheon Company, Tucson, Ariz., is being awarded a $52,084,929 modification to previously awarded contract (N00024-12-C-5405) for Design Agent Engineering and Technical Support Services for Phalanx, SeaRAM, and Land-based Phalanx Weapon Systems required for maintenance, reliability, and improvements. **PHALANX Close-In Weapon System (CIWS)** is a fast-reaction terminal defense against low- and high-flying, high-speed maneuvering anti-ship missile threats that have penetrated all other defenses.

Agilent Technologies Inc. announced the name of the electronic measurement company it expects to spin off in early November 2014 as **Keysight Technologies**. The name Keysight conveys the ability to see what others cannot, offering the critical or key insights to understand and unlock the changing technology landscape. The new company's tagline, "unlocking measurement insights for 75 years," commemorates the 1939 birth of the original **Hewlett-Packard Company**, from which Keysight originated. "Keysight reflects our rich heritage—a direct line from both Hewlett-Packard's standards of integrity and innovation and Agilent's premier measurement business," said **Ron Nersesian**, president and CEO of Keysight.

Northrop Grumman Technical Services, Sierra Vista, Ariz. was awarded a $36,294,099 modification (P00017) to contract W58RGZ-13-C-0010 for contractor logistics services and engineering support for the **Hunter Unmanned Aircraft System**. Fiscal 2014 operations and maintenance (Army) funds in the amount of $10,400,000 were obligated at the time of the award. Estimated completion date is Jan. 14, 2015. Work will be performed in Afghanistan and Sierra Vista, Ariz. Army Contracting Command, Redstone Arsenal, Ala. is the contracting activity.

Agentase LLC, Pittsburgh, Pa., has been awarded an $11,206,720 cost contract by **DARPA**. The work will support the DARPA's **In Vivo Nanoplatforms program (IVN)**. IVN seeks to develop new classes of adaptable nanoparticles for persistent, distributed, unob-

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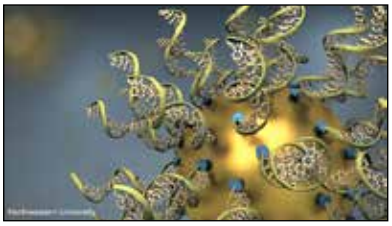

Artist's concept of an In Vivo Nanoplatform. DARPA image

trusive physiologic and environmental sensing as well as the treatment of physiologic abnormalities, illness and infectious disease. Work will be performed in Pittsburgh, Pa., (44.59 percent); Cambridge, Mass., (8.04 percent); Davis, Calif., (40.92 percent) and College Station, Texas, (6.45 percent). The estimated completion date is April 14, 2015.

AVX
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AVX Corp., a leading manufacturer of passive components and interconnect solutions, has become a member of the **National Science Foundation's Industry/University Cooperative Research Center** (NSF I/UCRC) for **Electromagnetic Compatibility (EMC**) at the Clemson University International Center for Automotive Research (CU-ICAR). The center sponsors research that helps member companies design products that are free from electromagnetic interference problems by keeping them appraised of the latest advances in the field, providing their engineers with access to the latest EMC design tools and technologies, and encouraging the employment of state-of-the-art designs. Current NSF I/UCRC for EMC membership includes three universities and approximately 20 companies from various sectors of the electronics industry, several of which have successfully utilized resultant research to address fundamental issues related to electromagnetic compatibility and signal integrity in current and future products over the course of the center's 18-year history.

DARPA Image

An unmanned target ship demonstrates the effects of the second successful flight test of a **Long Range Anti-Ship Missile (LRASM) prototype**, conducted November 12 off the coast of Southern California. The test reinforced the results of LRASM's first successful free-flight transition test (FFTT) on August 27, which verified the prototype's flight characteristics and assessed subsystem and sensor performance. Both tests achieved all of their objectives after the prototypes used their respective onboard sensors to detect, engage and hit the moving 260-foot target ships with inert warheads. DARPA and the **Office of Naval Research (ONR)** are collaborating on the LRASM program, which is developing new approaches and advanced capabilities for surface warfare to support a variety of Department of Defense missions.

PMI

Planar Monolithic Industries announced that its technical paper, "The Design of Ultra Narrow-band Amplifiers using Small Signal Varactor Up-converters for ESM, ECM, ECCM, and ELINT Applications," was accepted for presentation at the **Third International Conference on Electronic Warfare**, Bangalore, February 17 – 20. The paper was authored by **Dr. Alfred I. Grayzel, Dr. Ashok (Ash) K. Gorwara,** and **Paul Kuhn**, Planar Monolithics Industries, Inc., Frederick, Maryland.

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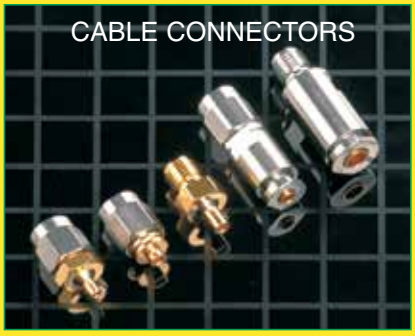

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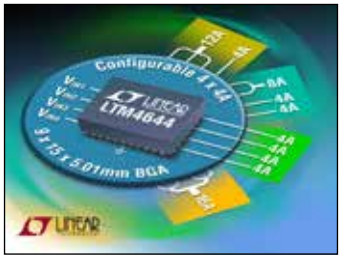
Renaissance Electronics
rec-usa.com



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Analog Devices introduced two 14-bit A/D converters that provide the lowest power in the smallest package size in their class. In industrial ultra-sound and instrumentation, healthcare imaging, military countermeasure and communications receiver applications, the 16-channel, 65-MSPS AD9249 and the 8-channel, 125-MSPS AD9681 A/D converters meet designer needs for high-performance, multi-channel data acquisition.

Analog Devices
analog.com

EMI Shields

TE Connectivity announced its new lightweight composite EMI shields (LCES) for military, aerospace, RF, radar and satcom applications. The composite EMI shields are up to 40 percent lighter compared to standard aluminum, help provide increased EMI suppression and are more cost-effective relative to machined or cast aluminum shields.

TE Connectivity
te.com

DAS Antennas

Pulse Electronics introduced three new low passive inter-modulation (PIM) distributed antenna system (DAS) in-building, ceiling mount omni antennas. With an industry-

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Phased Array Radar system performance has long been limited by the phase change over temperature of coaxial cables.

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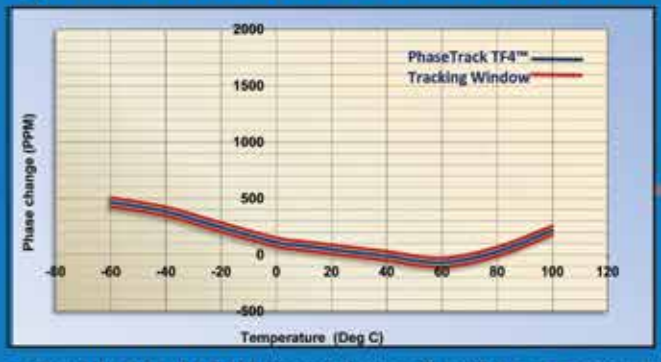
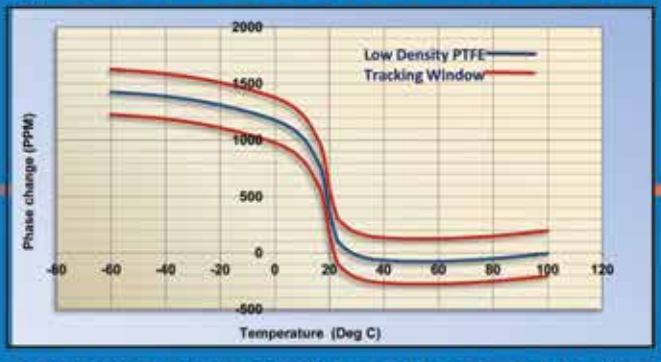
Typical PhaseTrack TF4™ Performance



Typical Low Density PTFE Performance



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leading PIM spec of -155 dBc at 2 x 20 watts, Pulse Electronics' line of PIMinators meets the most demanding requirements of cellular operators and integrators of low PIM components for 2G, 3G, and LTE/4G bands around the world.

Pulse Electronics
pulseelectronics.com

Attenuators

AtlanTecRF launched its first-ever comprehensive range of Digitally Controlled PIN Attenuators. The ADA series covers frequencies from 500 MHz to 40 GHz in 17 models. Bandwidths offered include those particularly suited to satellite and terrestrial communications as well as octave and multi-octave for the defense and test and measurement markets.

AtlanTecRF
atlantecrf.com

Signal Analyzer

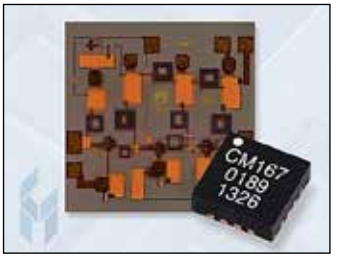
The new R&S FSW-B500 hardware option is now available for all analyzers of the R&S FSW family and can therefore be used for measurements in a frequency range up to 67 GHz. This enables completely new applications for the signal and spectrum analyzer in research and development. The analyzer is especially well-suited for sophisticated measurement tasks in radar or satellite applications.

Rohde & Schwarz
rohde-schwarz.com

Amplifier

Model SBG-5737034060-1212-S1 is an E band general purpose amplifier with an operation bandwidth from 57.0 GHz to 70.0 GHz. It exhibits a typical of 6.0 dB noise figure and 40 dB small signal gain. Output power is +10 dBm typical and it draws 200 mA current from a single positive DC supplier in the voltage range of +6 to +12 Volts. It is equipped with standard WR-12 waveguide and UG387/U flange as its RF connectors.

SAGE Millimeter
sagemillimeter.com



LNAs

The CMD167 is a highly efficient, ultra-low-noise GaAs MMIC amplifier that operates from 10 to 17 GHz. It is the packaged version of the amplifier which operates from 8 to 16 GHz. At 14 GHz, both the CMD167 and the CMD167P3 deliver greater than 15 dB of gain, with an output 1 dB compression point of +11 dBm and a noise figure of 1.8 dB.

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er has a minimum phase range of 360 degrees with 12-bit, 0.25 degree resolution and operates over the bandwidth of 2 to 4 GHz. Maximum RF input for linear operation is +6 dBm but the device can handle up to +20 dBm. Typical insertion loss through the TEP4000-5 is only 5 dB.

RFMW
rfmw.com

Filter

Mini-Circuits' ZX75HP-139+ is a high pass filter in a rugged connectorized package covering 225 to 2200 MHz. This filter will find its application in TV Broadcast, point-to-point military radio and cordless telephones. It has repeatable performance across production lots and consistent performance across temperature.

Mini-Circuits
minicircuits.com

Test Set

Model STG-10-S1 is a W band noise figure and gain test set that includes a high performance solid-state W band noise source (STZ-10-I1) and a full waveguide band down converter (STC-20-10-S1). It extends the noise and gain measurement capacity from 12.5 to 18.33 GHz to the frequency range of 75 to 110 GHz. The full waveguide band down converter requires a +10 dBm LO signal in the frequency range of 12.5 to 18.33 GHz.

SAGE Millimeter
sagemillimeter.com

High Power Amp

Mini-Circuits' model ZHL-20W-13SW+ high power amplifier features: High power, 20 Watt; Protected against overheat - shuts off automatically at about +100°C case temperature; Protected against over voltage - shuts off automatically at about +29V(excluding fan); Excellent gain flatness, ±1.2 dB typ.; RF built-in switch with TTL/CMOS control; Class A amplifier; Protected by US patent 7,348,854.

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50 MHz to 26.5 GHz

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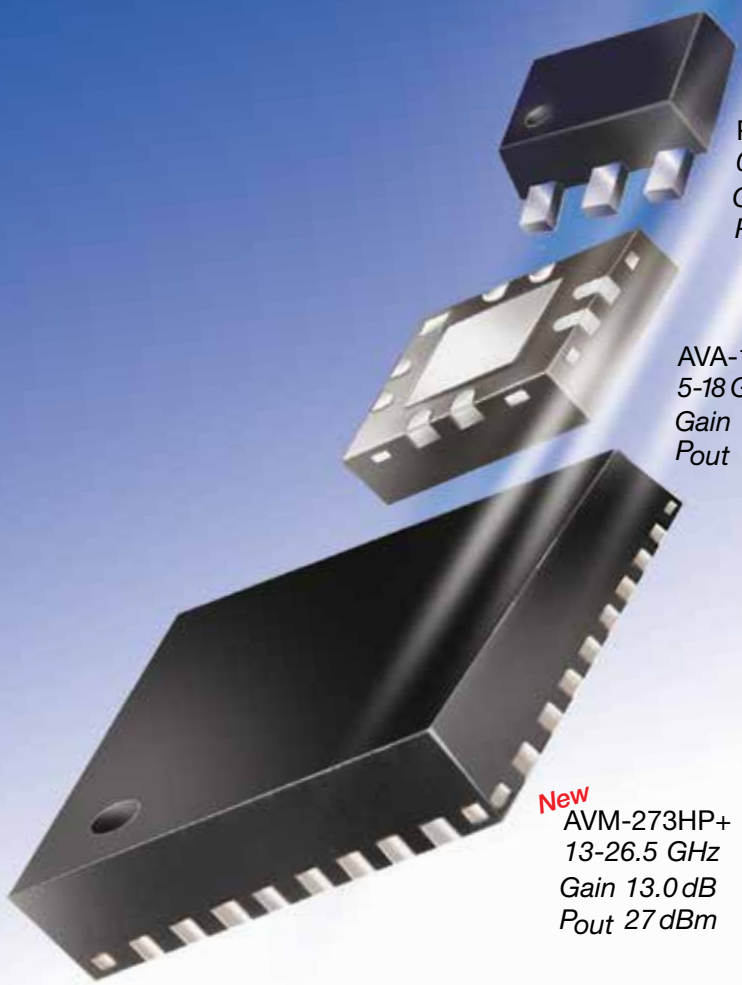

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P_{out} 22 dBm

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P_{out} 27 dBm

Mini-Circuits' New AVM-273HP+ wideband, 13 dB gain, unconditionally stable microwave amplifier supports applications from 13 to 26.5 GHz with 0.5W power handling! Gain flatness of ±1.0 dB and 58 dB isolation make this tiny unit an outstanding buffer amplifier in P2P radios, military EW and radar, DBS, VSAT, and more! Its integrated application circuit provides reverse voltage protection, voltage sequencing, and current stabilization, all in one tiny package!

The AVA-183A+ delivers excellent gain flatness (±1.0 dB) from 5 to 18 GHz with 38 dB isolation, and 19 dBm power handling. It is unconditionally stable and an ideal LO driver amplifier. Internal DC blocks, bias tee, and microwave coupling capacitor simplify external circuits, minimizing your design time.

The PHA-1+ + uses E-PHEMT technology to offer ultra-high dynamic range, low noise, and excellent IP3 performance, making it ideal for LTE and TD-SCDMA. Good input and output return loss across almost 7 octaves extend its use to CATV, wireless LANs, and base station infrastructure.

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Recognize, Capture, and Profit From Intellectual Property

By David Rardin

Create wealth by recognizing, capturing, and then protecting ideas—through patents, trademarks, trade secrets, and copyrights.

Use your brain! Over a third of U.S. GDP wealth is produced by ideas: intellectual property (IP). You do not have to invent a new quantum-entanglement transmitter to profit from your ideas. Have you said "a-HA!" recently? Consider a patent. Crowded fields such as connectors and cables continue to have innovations patented. Some government contracts even require inventors to file patent applications. There are over 64,000 radar-related patents alone. Create wealth by recognizing, capturing, and then protecting ideas - through patents, trademarks, trade secrets, and copyrights [1]. This article presents tools to use to save your thoughts.

I. Introduction

This is not legal advice, and it does not establish an attorney-client relationship. Okay, now that we have that out of the way, what follows will hopefully clarify the role of intellectual property in establishing wealth. As the abstract said, non-obviousness (a-HA!), not technical sophistication, is the determining factor for intellectual property protection. Intellectual property protection then creates business opportunities. Business opportunities, well executed, produce wealth.

For example, one of the first coaxial cable connector patents, 2,615,953 from 1952, is certainly recognizable.

In hindsight, while detailed, this invention is no flux capacitor, but a better way to electrically mate cables. Patents are measured by their business value, not necessarily by their "gee-wiz" quotient. The similarities to today's coaxial couplings indicate that inventor Amory H. Waite, Jr. got it right. We still use the basic design 60 years later. When industries adopt an invention, prosperity follows.

This patent references a tubing coupler from 1931, pat. 1,862,833. One principle this illustrates is that inventions build on what is known. While they need to add extra-ordinary results, they do not need to represent new fields of technology.

This patent is also an example of government interest in patents. Its first line states that the Government may manufacture and use the invention without royalties. Federal Acquisition Regulation (FAR) Subpart 27.3 and elsewhere can even require that if a patentable invention is made under a government contract, a patent applica-

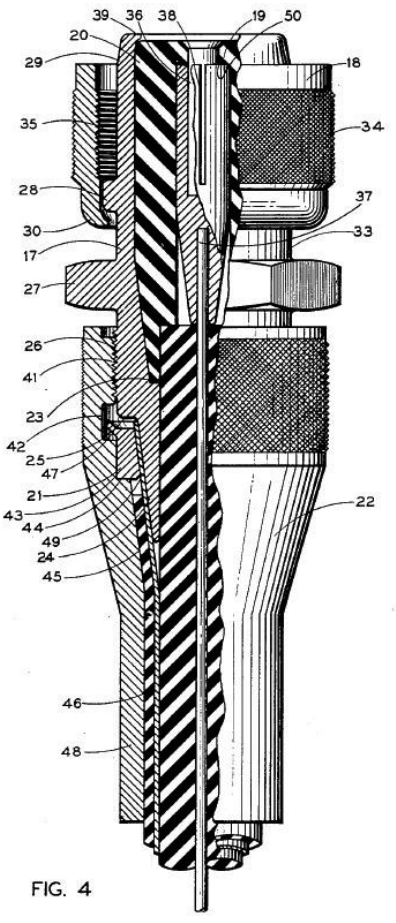

Figure 1 • Coaxial connector from Figure 4 of U.S. Patent no. 2,615,953.

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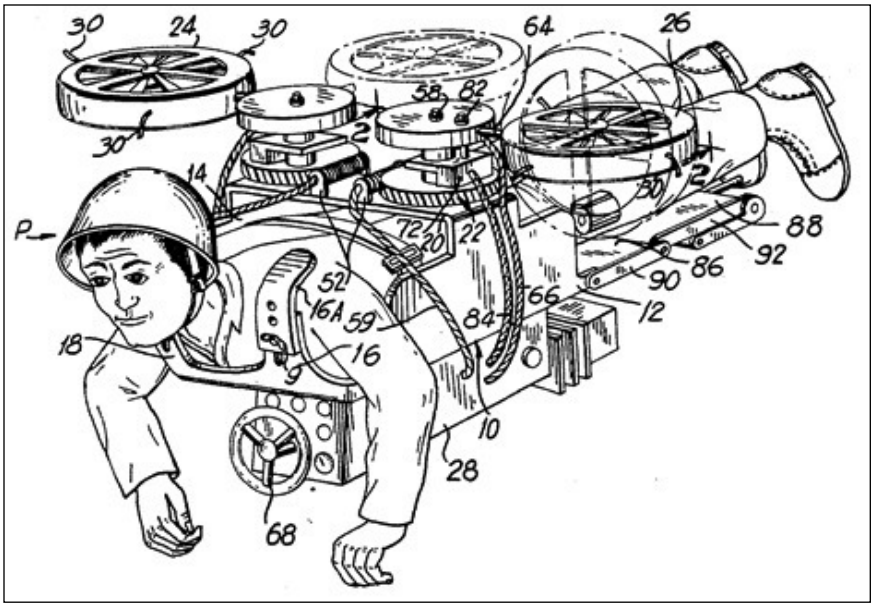

Figure 2 • One-man flying apparatus from Figure 1 of U.S. Patent no. 3,556,438.

tion must be filed. Check your contract for "Subject Inventions" language!

II. Patents: What Are They?

The "muscle" behind patents is that they give you the right to stop others from copying your ideas. I suspect that misconceptions prevail that patents are like registrations. You record them with the patent office, and get a weapon that lets you go after those who didn't bother to get a patent. The government is not just granting you an ID to show you own the idea. It is more like a birth certificate that says this is a new creation that came from your mind. It never existed anywhere before you gave birth to it. Continuing in analogies, patents are like dissertations: you must prove that the ideas are original and yours. Furthermore, as long as there is some utility, there is no judgment regarding the feasibility of the idea. For example, consider Patent 3,556,438 for a one-man flying apparatus.

It may be novel and non-obvious, but who would risk strapping on fans, motors and brackets to fly? While patents may protect your idea, to be worth the investment others must be willing to pay for the product.

The Patent/Trade Secret Conundrum

While patents protect the invention directly, trade secrets protect ideas only as long as they are kept secret. Think of patents as protecting ownership of the horse in the corral, and trade secrets as the corral around the horse. For trade secrets, if the horse (invention) becomes public by escaping the (trade secret) corral, all is lost. The value of trade secrets comes from secrecy. All is lost when secrecy is lost. Nondisclosure agreements can give some hope of restitution, but the invention is lost to the public. Patents, by their nature, are predisclosures of inventions that give the inventor 20 years of exclusivity in return for revealing the invention's secrets to the public. After the 20 years, all benefit from free use of the invention.

III. To Patents and Beyond!

Or, what do all those superscripts mean?

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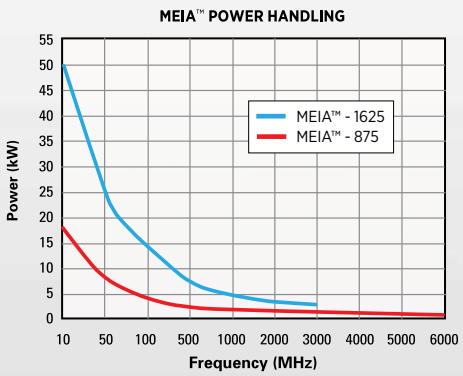

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© the circle C designates a copyright that protects "original works of authorship fixed in a tangible medium of expression." This is for original books and art, for example. More information than you can imagine can be found at copyright.gov [2]. Their FAQs are the best.

® the circle R designates a trademark registered with the U.S. Patent and ***Trademark*** Office (USPTO). This protects your product names and logos.

™ designates a mark currently without a registration at the USPTO. Sort of a precursor to ®.

Actually, the Circle R also IS a Texas ranch. The Circle C is a New York ranch and a neighborhood in Texas. As an irrelevant aside, although Disney had a trademark allowance for "To Infinity and Beyond," they allowed it to go abandoned. However, "Math Infinity - To Infinity and Beyond®" with logo is a licensed trademark of Unifier Learning Academy Corporation Taiwan.

Some particulars and cautions on trademarks. A common disappointment with new businesses is the loss of a favorite name after getting a cease and desist (C&D) letter. Creative founders brainstorm a terrific company or product name without a search. The patent office has a quick search page called Trademark Electronic Search System (TESS) [3] that they could have used. However, now it is their baby's name and becomes intimately associated with the enterprise. The problem is, they are number two. Unknown to the founders, the name was in-use, and worse, registered by another. Someone had already succeeded in registering the name with the USPTO. They discovered the successful new founders using the same name. Their lawyers send a cease and desist letter to the founders. Sometimes, these are "nastygrams" demanding immediate ending of use of the name and removal from all products, publications and the web. All may not be lost, especially if the pre-exisitng registered mark is for different goods and services. The problem is, even if this is true, proof will cost much for the legal defense. Take-away: do not be inseparably married to you mark before you check with TESS.

IV. Is That A Troll Or My Co-Inventor?

A word about patent trolls. In the popular press patent trolls are getting a bad rap. Non-practicing entities, call them what you want, they are legitimate owners of patents. As an owner of a patent, an inventor can sell that ownership. Thus the property part of intellectual property. For various reasons, inventors/patent owners sell their rights in their patents to others, including their co-inventors. This does not diminish the rights attached to the patent. For many inventors, their business plan is to create something new for the world, patent it, sell it to another to extract the value, and move on to another

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invention. From an economic perspective, this specialization can extract the maximum value from ideas and produce the maximum number of new ideas. Of course, there are bad actors in every group. Specific tactics can be questionable, but the underlying premise of patent ownership and its rights is independent of a patent's link to the original inventor. The risk in over-censoring "trolls" is reduced compensation for inventors when they try to sell their patented inventions. Not all 'trolls' are bad; address the behavior, not the label.

V. Do You Know Where Your Business Plan Is?

All the consultants tell you to "start with a business plan," "failing to plan is planning to fail," and "the only bad plan is no plan." Regarding IP, justification is the issue. Regardless of plans, can you dedicate five plus years on-and-off and likely (much) over $10,000, for the right to stop others from copying your idea? This is the question to be answered. While this applies primarily to patents, trademarks also require thought, time, and investment. Considering copying—how important will it be to stop others from copying your idea? As mentioned, this is the muscle behind patents. If it is easy to work around the invention, or the invention has a very limited competitive lifespan, patenting may not make business sense. The considerations are many and can be complex beyond the scope of this article. The point is to have considered them before skipping down the patent path.

VI. Summary

As you watch the Olympics this month, look for ©, ®, TM, and patent-pending markings. You can bet real money is involved with that intellectual property! You, too, can get deserved rewards by applying the legal protection available for your ideas. Hopefully now you have at least a little better understanding of your options.

About the Author:

David Rardin is a patent lawyer with Maine Cernota & Rardin (MCR-IP). Previously, he was a Staff Scientist at SAIC, and a physicist stationed at Wright-Patterson AFB before that. Email: drardin@mcr-ip.com.

References

[1] http://www.uspto.gov/inventors/index.jsp?utm_source=dlvr.it&utm_medium=twitter
[2] http://www.copyright.gov/
[3] http://tess2.uspto.gov/

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EXCELLENCE BY DESIGN

Partialized Continuous-Variable Pin Diode Attenuator

By Giovanni Bianchi and Marco Garbati

The proposed structure improves precision and linearity, although at the expense of the maximum attenuation range.

A novel broadband continuous-variable attenuator is presented. Compared with the standard solution, the proposed structure improves precision and linearity, although at the expense of the maximum attenuation range. Moreover, the presented circuit is designed considering the RF chain that includes the attenuator itself. Precisely, such a chain typically consists of cascaded amplifiers and passive components: the first (latter) present lower gain (higher loss) as the frequency increases. That produces the typical and well-known (and typically not desired) high frequency roll-off in the response of the RF chain.

For that consideration, the proposed circuit is intentionally designed to present the minimum insertion-loss at the highest frequency. An experimental prototype based on very conventional SMD components and one microstrip PCB has been realized and successfully tested, showing the effectiveness of the idea from 10 MHz up to 6 GHz.

Circuit Description

Figure 1A shows the schematic of a Π -type resistive attenuator. That schematic is the starting point for our design. A variable attenuator can be realized by somehow implementing the schematic of figure 1A at RF if the implemented resistors are variable under a control excitation (i.e. a control voltage or a control current). The resistances of the three resistors are

$$R_1(A_{dB}) = R_3(A_{dB}) = R_0 \frac{1+10^{-\frac{A_{dB}}{20}}}{1-10^{-\frac{A_{dB}}{20}}} \quad (1)$$

$$R_2(A_{dB}) = R_0 \frac{1-10^{-\frac{A_{dB}}{10}}}{2\cdot 10^{-\frac{A_{dB}}{20}}} \quad (2)$$

where R_0 is the normalization resistance, and A_{dB} is the required attenuation in dB units. In the following considerations we will assume $R_0 = 50\Omega$, unless differently specified.

Figure 1B shows a possible implementation of a continuous variable attenuator based on the Π configuration of figure 1A. Each resistor of figure 1A is replaced by one PIN diode with its associated bias elements. Ideally, the bias elements (green in figures 1B to 1D) should be "transparent" at RF: the capacitors (series RL bipoles) should work as short-circuit (open-circuit).

Each PIN diode presents an RF resistance which is strongly dependent (monotonically decreasing) from the DC control current and slightly on the applied RF voltage. The latter relatively small dependency gives the typical good linearity of PIN diode based attenuators. Unfortunately, at low RF frequencies (comparable with the reciprocal of the PIN diode carrier lifetime) such good effect disappears. Low RF range performance is then a sensitive test for linearity-oriented designs, such as ours.

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Model (with heat sink/fan*)	Frequency (MHz)	Gain (dB)	Pout @ Comp. 1 dB (W)	Pout @ Comp. 3 dB (W)	$ Price (Qty. 1-9) with heat sink	$ Price (Qty. 1-9) without* heat sink
LZY-22+	0.1-200	43	16	32	1495	1470
ZHL-5W-1	5-500	44	8	11	995	970
• ZHL-100W-GAN+	20-500	42	79	100	2395	2320
• ZHL-50W-52	50-500	50	40	63	1395	1320
• ZHL-100W-52	50-500	50	63	79	1995	1920
LZY-1+	20-512	43	37	50	1995	1895
• ZHL-20W-13+	20-1000	50	13	20	1395	1320
• ZHL-20W-13SW+	20-1000	50	13	20	1445	1370
LZY-2+	500-1000	46	32	38	1995	1895
NEW ZHL-100W-13+	800-1000	50	79	100	2195	2095
ZHL-5W-2G+	800-2000	45	5	6	995	945
ZHL-10W-2G	800-2000	43	10	13	1295	1220
ZHL-30W-252+	700-2500	50	25	40	2995	2920
ZHL-30W-262+	2300-2550	50	20	32	1995	1920
ZHL-16W-43+	1800-4000	45	13	16	1595	1545
ZVE-3W-83+	2000-8000	36	2	3	1295	1220
ZVE-3W-183+	5900-18000	35	2	3	1295	1220

Listed performance data typical, see minicircuits.com for more details.

** To order **without** heat sink, add **X** suffix to model number (example: LZY-22X+).*

• Protected under U.S. Patent 7,348,854

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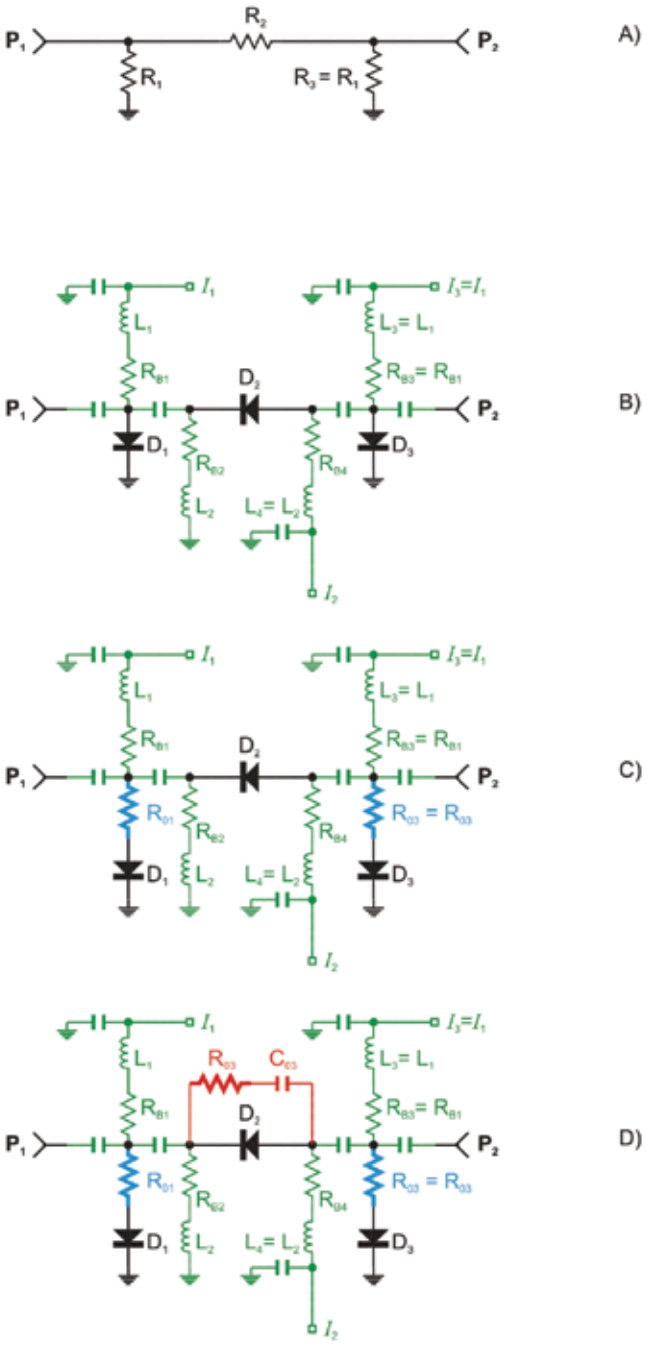

Figure 1 • Π attenuators: A) Ideal, B) with PIN diodes, C) optimized, D) partialized. RF elements (black) bias elements (green), optimizing RF elements (blue), partializing RF element (red).

Let us analyze the main limitations associated with the solution of figure 1B, and show the improvements given by the circuits of figure 1C and 1D.

From (1), (2) it follows the minimum and maximum resistance for attenuation range $[\,A_{dB}^{MIN}\;;\;A_{dB}^{MAX}\,]$ in the case of a variable attenuator. Quite typically, such a circuit presents zero minimum attenuation, at least in the ideal case. For that condition, equations (1) and (2) give the obvious values

$$\lim_{A_{dB}\to 0} R_1(A_{dB})=\infty \quad ; \quad R_2(0)=0 \tag{3}$$

For very high attenuations it is

$$\lim_{A_{dB}\to\infty} R_1(A_{dB})=R_0 \quad ; \quad \lim_{A_{dB}\to\infty} R_2(A_{dB})=\infty \tag{4}$$

Therefore, the series resistance R_2 ranges from zero to infinity, while the shunt resistance R_1=R_3 ranges from open-circuit to R_0. If the specified/required maximum attenuation A_{dB}^{MAX} has a finite value, the upper (lower) limit of R_1=R_3 (R_2) further reduces to a finite value (something smaller than R_0).

On the other side, PIN diodes exhibit RF resistance monotonically decreasing with the control current, and such resistance assumes all the values from very small (few Ohm typically) to very high (close to open-circuit) ones. Therefore, the circuit in figure 1B does not exploit the complete range of resistance variation in the shunt diodes D_1 and D_3. This makes the control currents I_1 and I_3 to be bounded between two finite and nonzero values, instead of between zero and a maximum value. Consequently, the driver becomes more critical and the RF linearity of the attenuator is also compromised. The latter effect can be explained by considering that a diode working with a limited (and narrow) control current range is more prone to self-bias effects due to RF power.

Problem Alleviated

Figure 1C shows a solution that alleviates the above addressed problem: the shunt elements are now not just PIN diodes. They have rather additional series resistors (the blue elements R_{01} and R_{03}) their resistance being R_{01} = R_{03} = R_0. In this way, the diode resistance has to be only a part of the required RF one. In formula

$$R_1^{(D1)}(A_{dB})=R_1^{(D3)}(A_{dB})=R_1(A_{dB})-R_0=R_0\frac{2\cdot 10^{-\frac{A_{dB}}{20}}}{1-10^{-\frac{A_{dB}}{20}}} \tag{5}$$

From (5) it follows that the shunt diode RF resistance of the circuit in figure 1C is bonded within the limits

$$0\le R_0\frac{2\cdot 10^{-\frac{A_{dB}^{MAX}}{20}}}{1-10^{-\frac{A_{dB}^{MAX}}{20}}}\le R_1^{(D1)}(A_{dB})\le R_0\frac{2\cdot 10^{-\frac{A_{dB}^{MIN}}{20}}}{1-10^{-\frac{A_{dB}^{MIN}}{20}}}\le\infty$$

Again, if the required minimum attenuation is zero, then the RF maximum resistance of the shunt diodes approaches the open-circuit: the zero-bias region becomes part of the used operating range of the PIN diode. The solution of figure 1C uses a wider driving current range

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for the shunt diodes than the one in figure 1B. Consequently, the driver design becomes less critical, the self-bias effects are mitigated.

The circuit of figure 1C presents higher precision on the RF attenuation and higher linearity (i.e. better P1dB and IP3) than the one of figure 1B. A further improvement of both attenuation precision and linearity can be achieved if the required maximum attenuation is smaller than the one achievable with the available diodes. To make the explanation clearer, we can use some typical numbers. If the required attenuation is bonded between zero and five dB (i.e $A_{dB}^{MIN}=0 \quad ; \quad A_{dB}^{MAX}=5$), from equations (1) and (2) it follows that $\infty \le R_1 = R_3 \le 178.5\Omega$ and $0 \le R_2 \le 30.4\Omega$. The diodes do not use the full available RF resistance range with the already explained consequences on linearity and precision.

Figure 1D shows a modified version of the circuit in figure 1C, which further improves precision and linearity. The blue added resistors in series with the shunt diodes have now a larger resistance than R_0:

$$R_{01} = R_{03} = R_1\left(A_{dB}^{MAX}\right) = R_0 \frac{1+10^{-\frac{A_{dB}^{MAX}}{20}}}{1-10^{-\frac{A_{dB}^{MAX}}{20}}} \cong R_0 \cdot 3.57 \cong 178.5\,\Omega$$

Moreover, the series diode D_2 is a shunted with the resistor R_{02} (the red one in figure 1D) having resistance

$$R_{02} = R_2\left(A_{dB}^{MIN}\right) = R_0 \frac{1-10^{-\frac{A_{dB}^{MIN}}{10}}}{2\cdot 10^{-\frac{A_{dB}^{MIN}}{20}}} \cong R_0 \cdot 0.61 \cong 30.4\,\Omega$$

With the described arrangement, the global RF resistances of the attenuator range between the required finite values although the PIN diode DC currents vary within the full range: from zero to the maximum value specified by the diode manufacturer. The resulting circuit presents therefore low sensitivity to the control current values with the consequent high precision of the RF attenuation and high linearity. An additional good effect of the added fixed resistors R_{01} to R_{03} is that they limit the amount of RF energy that invests the PIN diodes: this further reduces the nonlinear RF impedance variation due to the RF energy itself with a consequent improvement on the linearity.

Experimental Results

Figure 2 shows a photograph of the realized attenuator prototype. The PCB is 22 mm long, including some 50 Ω microstrip lines. One small but important difference is present between the schematic of figure 1D and the photo of figure 2: the bias inductors are not designed to present high (ideally infinite) impedance at RF. Rather; they are short-circuit stubs, λ/4 long at the highest working frequency (i.e. 6 GHz). The combination of those stubs with the respective series bias resistor produce a minimum attenuation (ideally zero) at the highest working frequency, and an increasing attenuation as the frequency becomes lower. Such behavior is intended to compensate the typical high frequency roll-off that is typical for the broadband RF chains (at increasing frequencies, the gain of the amplifiers becomes lower and the attenuation of the passive component becomes higher, as known) that include the proposed variable attenuator.

Figure 3 shows the measured linear RF performances of the prototype. The working frequency range goes from 10 MHz to 6 GHz. The minimum

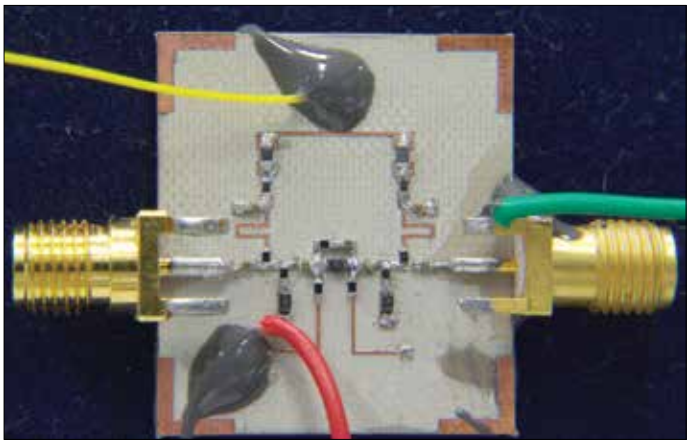

Figure 2 • Photo of the prototype.

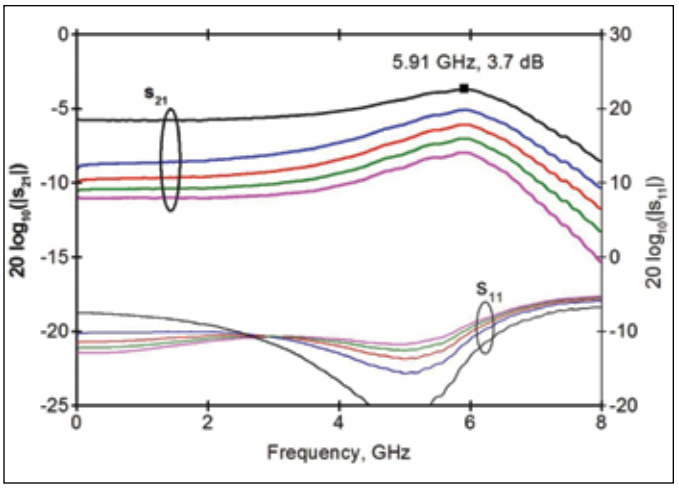

Figure 3 • Measured linear response of the attenuator prototype.

attenuation is less than 4 dB at the highest frequency. The relative maximum relative attenuation is about 5 dB. The minimum return-loss is slightly worse than 10 dB (worst case over frequency and attenuation)

About the linearity: the measured IIP3 is better than 20, 30, 40 dBm at 10 MHz, 100 MHz, 1 GHz, respectively (worst case over the attenuation). Compared with a measured circuit based on the configuration in figure 1B (and using the same bias elements and PIN diodes), the proposed circuit presents an improvement of about 6 dB on IIP3 at 10 and 100 MHz and slightly less at 1 GHz.

About the Authors:

Giovanni Bianchi (R&D Engineer) received the Laurea degree in Electronic Engineering from the University of Rome "La Sapienza," Rome, Italy, in 1987. In 1988, he joined the Microwave Department of Elettronica S.p.A. where he was involved in and later responsible for microwave components (including GaAs MMICs) and subassembly design. He joined Motorola PCS in 2000, where he worked on GSM and WCDMA mobile phone design, and in 2004 joined SDS S.r.L. as responsible for microwave designs. Since January 2008 he has worked as an R&D Engineer in the hardware/RF division at Advantest Europe GmbH (formerly Verigy), and is an expert in high frequency theory and techniques. In his 26 years of design experience, he has covered both passive and active microwave components, including filters, amplifiers, oscillators, and synthesizers. He is the author of four books as well as 16 papers.

Marco Garbati (Ph.D. Student) received the Laurea degree in Electronic Engineering from the University of Perugia, Italy, in 2013. His dissertation deals with variable attenuator designs and covers the object of the presented paper. He is presently working to achieve his Ph.D. degree. His interests cover analog and digital electronic design, especially those involving high frequency.

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1. G. Hiller, "Designing with PIN diodes", MA-COM Application Note AG-312.

2. R. H. Caverly, "Distortion modeling of PIN diode switches and attenuators", IEEE MTT-S Symposium Digest, pp. 957–960, 2004.

3. Roberto Sorrentino, Giovanni Bianchi, *Microwave and RF Engineering,* John Wiley, August 2010, section 10.3

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Radio Frequency Systems
rfsworld.com


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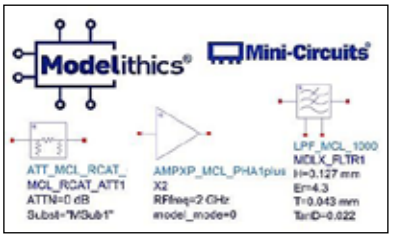

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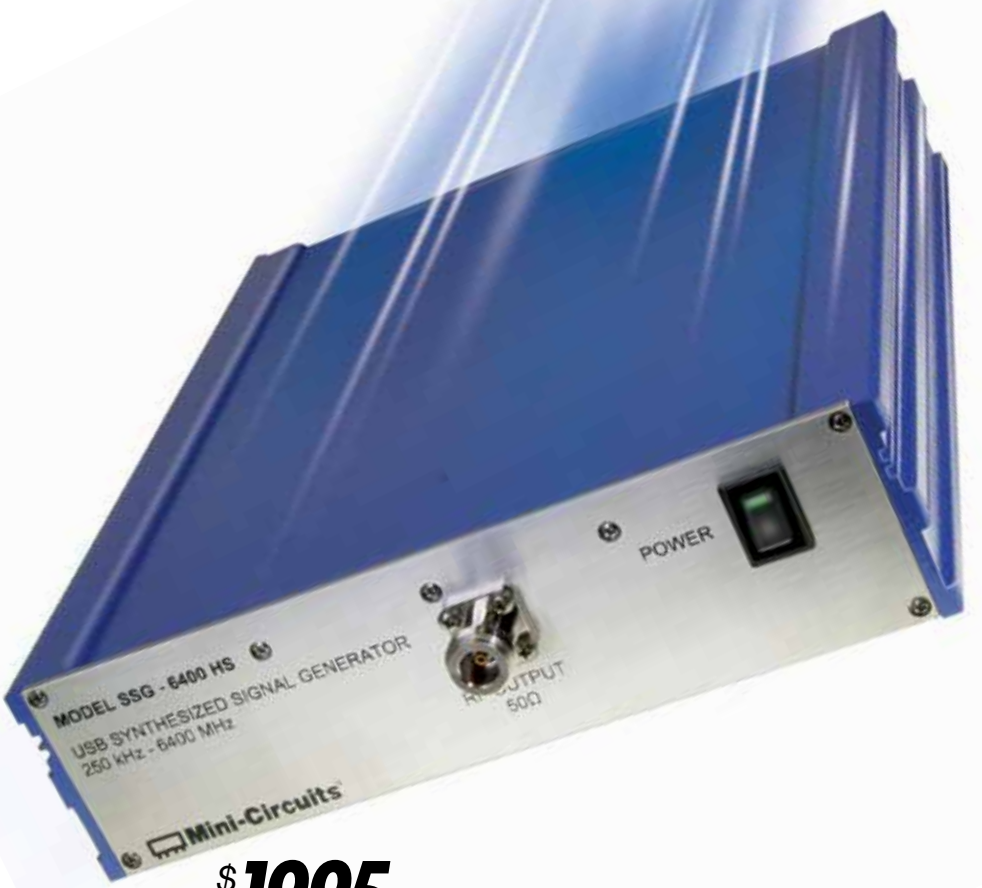

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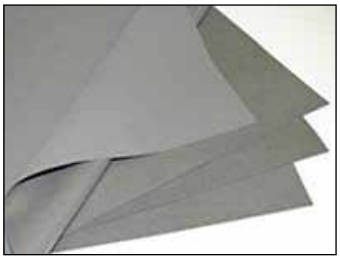

EMI White Paper

RFMW, Ltd. announced the availability of a white paper discussing the proper selection of microwave absorbing and EMI shielding products. This Technical Bulletin from MAST Technologies defines the characteristic properties of various elastomers used in the manufacture of microwave absorbing products.

RFMW
rfmw.com

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Planar Monolithics Industries
pmi-rf.com

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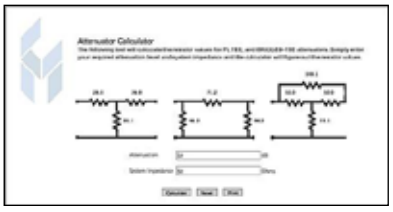
SAGE Millimeter
sagemillimeter.com



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The new calculator determines the resistor values for PI, TEE, and BRIDGED-TEE fixed attenuators. Users simply enter their required attenuation level and system impedance, and the calculator displays the required resistor values.

Custom MMIC
custommmic.com

Power Divider

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imcsd.com

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SAGE Millimeter
sagemillimeter.com

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Norden Millimeter
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- Passive Components
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- Blindmate Connectors
- Product Highlights: Connectors & Cables

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- Millimeter Waves
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July 6 - 12, 2014

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- Power Amplifiers
- Cable Assemblies and Connectors
- EMC
- Product Highlights: Defense Electronics

Events:
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- Military Systems
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Events:
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- Control Components
- EuMW 2014 Preview
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- Product Highlights: Connectors & Cables

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November 4 - 7, 2014

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- Power Amplifiers
- RFICs and MMICs
- Product Highlights: Defense Electronics

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richardsonrfpd.com

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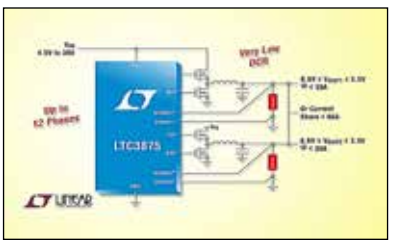
RFMW
rfmw.com



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vishay.com

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Murata Power Solutions
murata-ps.com

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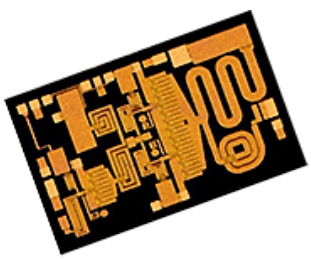
agilent.com

PIM Analyzer

AWT Global launched a new PIM analyzer for TETRA and UHF frequencies: The S1L TETRA MK2 Series. The analyzers are designed for measuring TETRA and UHF networks in the 400 MHz frequency range. They come with a wide variety of test modes for different tasks including field measurement mode, analyzer, multi PIM display, Rx sweep, PIM vs. time and single carrier mode for insertion loss (IL) and coverage measurements.

AWT Global
awt-global.com



Power Amp

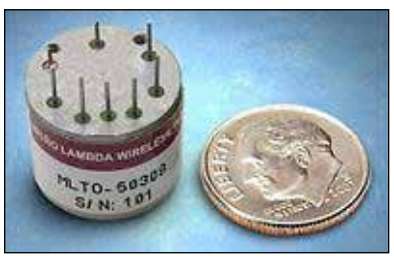
TriQuint's TGA2583 is an S-band amplifier fabricated on TriQuint's production 0.25um GaN on SiC process (TQGaN25). Covering 2.7-3.7 GHz, the TGA2583 provides 10W of saturated output power and 33dB of small-signal gain while achieving 54% power-added efficiency. Higher power can be achieved at the expense of PAE by increasing the drain voltage.

TriQuint Semiconductor
triquint.com

Inductors

Featuring a homogeneous pressed iron powder core construction, LMIP Series inductors exhibit low loss and reduced inductance drop due to applied current, enabling higher saturation current ratings in smaller, lower profile packages. They are ideal for applications including: portable electronics, power inverters, power supplies, reverse battery protection, and DC/DC, AC/DC, and point of load (POL) converters.

AVX Corp.
avx.com



Mini YTOs

MICRO LAMBDA's MLTM-Series Miniature YIG-Tuned Oscillators cover the frequency range of 2 - 8 GHz. They are available in customer selected tuning ranges and are fitted with a low power main coil, and FM coil for phase locking. All units operate from a +8 Volt and –5 Volt supply and operate over the 0º to + 65ºC temperature range. Units do not require a heater.

Micro Lambda Wireless
microlambdawireless.com

Attenuator

Mini-Circuits' RCAT-series attenuators are fixed value absorptive attenuators. The highly precision and repeatable monolithic attenuator chip is processed using the most advanced semiconductor processing techniques.

Mini-Circuits
minicircuits.com

Bandpass Filter

Mini-Circuits' CBP-A1060C+ is a ceramic-coaxial-resonator based bandpass filter in a miniature shielded package fabricated using SMT technology. This filter offers outstanding close in rejection, low insertion loss and high power handling for use in aviation, mobile radio, broadband and fixed wireless.

Mini-Circuits
minicircuits.com

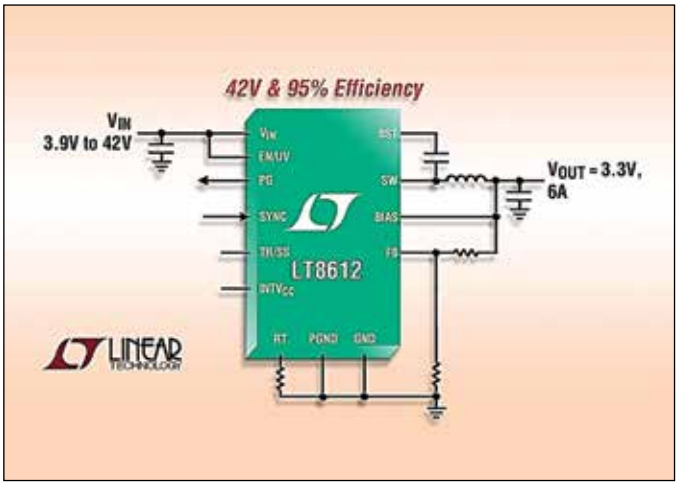
Product Showcase

Product Highlights

EMS, EMI Measurements

The new standardized R&S CEMS100 test platform is the first flexible and reliable off-the-shelf solution for EMS measurements in line with IEC/EN 61000-4-3. The state-of-the-art platform includes all the components needed for EMS and EMI measurements. It covers all common frequency ranges and field strengths required for precompliance tests and certification.

Rohde & Schwarz
rohde-schwarz.com



Regulator

Linear Technology announced the LT8612, a 6A, 42V input capable synchronous step-down switching regulator. Synchronous rectification delivers efficiency as high as 95% while Burst Mode® operation keeps quiescent current under 3µA in no-load standby conditions. It features a 3.4V to 42V input voltage range.

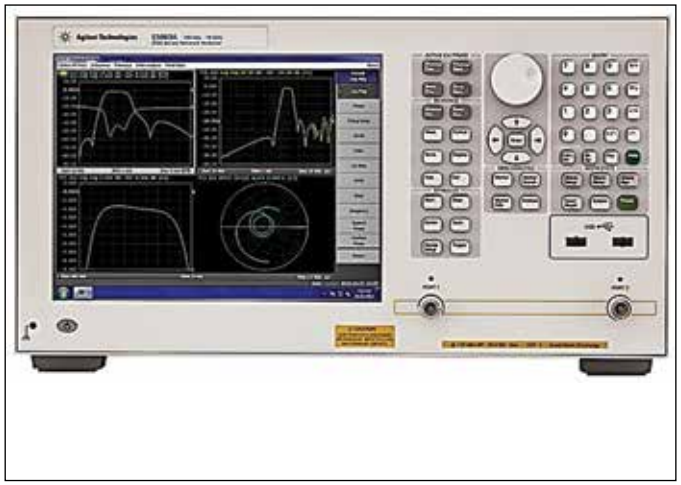
Linear Technology
linear.com

Attenuators

Narda Microwave-East's expanded attenuator line features nine new variable attenuator models, including miniature, broadband and high power units. These units feature low minimum insertion loss, small size, and an adjustable attenuation range of up to 30 db. Additionally, they can be deployed in operational temperatures up to 105ºC. They are ideal for aerospace, defense and test applications.

Narda Microwave-East
nardamicrowave.com/east

Product Highlights



Network Analyzer

Agilent Technologies announced the E5063A ENA Series network analyzer, a low-cost ENA solution for manufacturing test. The instrument offers optimized performance and functionality for testing simple RF passive components, such as handset/BTS antennas, RF cables and filters. It can also be used in R&D for evaluation of RF passive devices and dielectric materials.

Agilent Technologies
agilent.com

Inductor App

Coilcraft has announced its RF and Power Inductor Product Finder App for Apple and Android smart phones. This free application enables users to quickly select the best inductor for their design and order free evaluation samples, all from their mobile phone. The new App offers parametric product search capability and includes Coilcraft's full suite of RF and Power inductor selection tools.

Coilcraft
coilcraft.com

Power Sensor w/ Long Reach Connector

LadyBug Technologies' new extended N connector is ideal for many laboratory, manufacturing and field applications. The high quality Type N-male connector (option XNM) is available on most LadyBug power sensors including its True RMS, Peak & Pulse and Pulse-Profiling sensors. LadyBug sensors provide high accuracy NIST-traceable RF Power measurements to below -60 dBm. A virtual power meter application is included with each sensor.

LadyBug Technologies
ladybug-tech.com

Product Highlights

Synthesizers

The MLSP-Series of YIG-Based wideband synthesizers are ideal as the main local oscillators in receiving systems, frequency converters and test and measurement equipment. They provide 1 kHz frequency resolution over the 18 to 33 GHz frequency range, in bands. Power levels of +13 dBm are provided and full band tuning speed is 6 mSec. The units are 5" x 3" x 1" high and fit a 2 slot PXI chassis.

Micro Lambda Wireless
microlambdawireless.com

Coupler

KRYTAR announced a new directional coupler operating in the frequency range of 12.4 to 18.0 GHz offering nominal coupling of 30 dB in an extremely compact package. The coupler provides simple solutions for many applications including electronic warfare, commercial wireless, SATCOM, radar, signal monitoring and measurement, antenna beam forming, and EMC testing environments.

Krytar
krytar.com

Surge Tester

Times Microwave Systems introduced the Times-Protect® LP-SPT™ RF surge protection tester. The LP-SPT™ provides the capability to test any lightning protection device or component to ensure its proper functioning and capability to protect critical and expensive RF equipment. Weighing only 16 ounces and powered by two 9 volt batteries, the ruggedized hand-held unit is completely portable making it ideal for field use.

Times Microwave Systems
timesmicrowave.com

Product Highlights

BERT

The new M8000 Series BER test solution is highly integrated and scalable for physical-layer characterization, validation and compliance testing for receivers used in multigigabit digital designs. With support for a wide range of data rates and standards, the new series provides accurate and reliable results that accelerate insight into the performance margins of high-speed digital devices for computer, consumer, server, mobile computing and data-center products.

Agilent Technologies
agilent.com

LNA

Mini-Circuits' CMA-252LN+ is an E-PHEMT-based Ultra-Low Noise MMIC Amplifier with a unique combination of low noise and high IP3, making it ideal for sensitive high dynamic range receiver applications. This design operates on a single 3 to 4V supply. The MMIC amplifier is bonded to a multilayer integrated LTCC substrate and then hermetically sealed under a controlled nitrogen atmosphere with gold-plated covers and eutectic AuSn solder.

Mini-Circuits
minicircuits.com

Switches

Two new DC-18 GHz SPDT non-reflective switches cover the same bandwidth and are housed in the same 3 x 3 mm RoHS-compliant SMT package. The CMD195C3 has an insertion loss of 2.25 dB at the low end of its bandwidth, which then reduces monotonically to 1.5 dB at higher frequencies. The CMD196C3 has a low insertion loss of 1.5 dB that increases slightly as the frequency approaches the upper end of the operating bandwidth.

Custom MMIC
custommmic.com

Product Highlights

Coaxial Relay

RelComm Technologies' high power 1P2T failsafe coaxial relay with side-launched connectors incorporates type N connectors and is enhanced throughout with low loss, high temperature dielectrics. The side-launch connector configuration adds versatility for system layout, particularly when cabling into through-panel applications. Performance is rated to 3 GHz VSWR 1.20:1 maximum, Insertion Loss 0.20 dB maximum and Isolation better than -60 dB.

Relcomm Technologies
relcommtech.com

VCO

Crystek's CVCO55CC-3850-3850 VCO operates at 3850 MHz with a control voltage range of 0.5V~4.5V. This VCO features a typical phase noise of -110 dBc/Hz @ 10KHz offset and has excellent linearity. Output power is typically +7 dBm. Engineered and manufactured in the USA, the model CVCO55CC-3850-3850 is packaged in the industry-standard 0.5-in. x 0.5-in. SMD package.

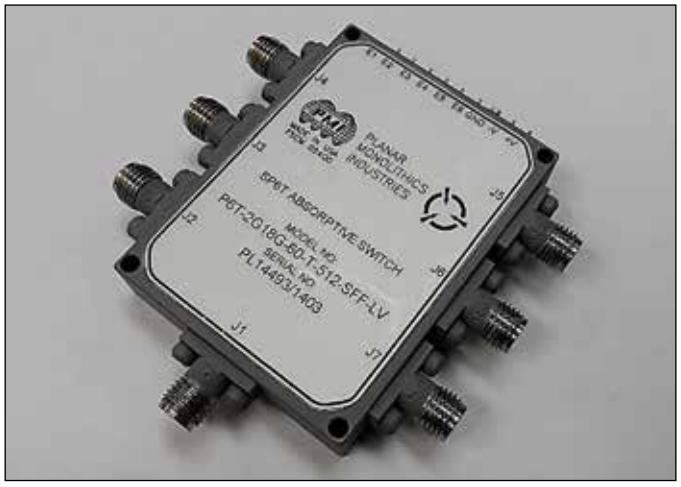
Crystek
crystek.com

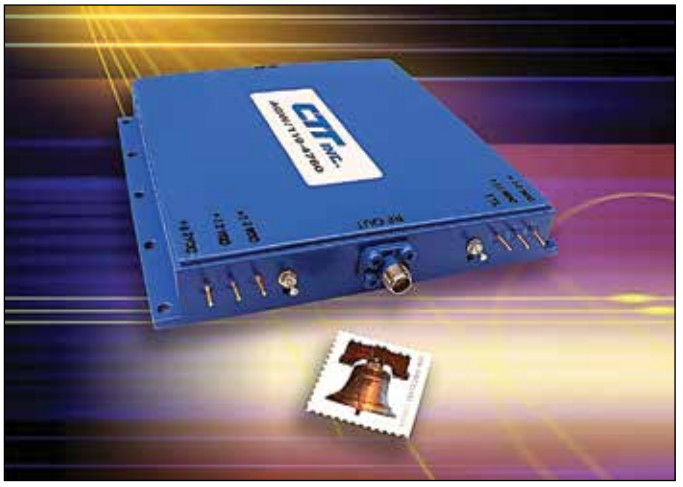
Resistors

Vishay Intertechnology introduced a series of thick film chip resistors for high-power, surface-mount RF applications. Offered in the compact 1206 case size, the Vishay Dale RCP series devices feature a power rating of 1 W at +70°C with a standard board mount and up to 11 W with active temperature control. They are optimized for high-power aerospace, military, industrial, and telecom systems.

Vishay Intertechnology
vishay.com

Product Highlights





Switch

PMI Model No. P6T-2G18G-60-T-512-SFF-LV is a single pole, six throw, absorptive, low video transient, solid state switch operating over the frequency range of 2.0 to 18.0 GHz. This model has a maximum insertion loss of 4.0 dB and a minimum isolation specification of 60 dB with video transients of 2mV typically.

Planar Monolithics Industries
pmi-rf.com

SSPAs

CTT announced a family of compact, GaN-based solid-state power amplifiers (SSPAs) operating in the 7.0 to 11.0 GHz frequency range for a wide variety of commercial, industrial and military microwave applications. CTT's latest compact SSPA designs offer as much as 100 Watts of output power in a compact package. This new line is engineered specifically to meet the stringent requirements imposed by many multi-function system designs.

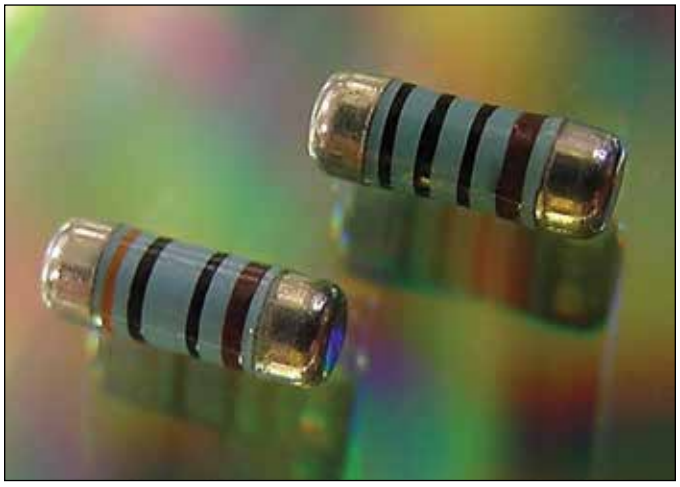
CTT
cttinc.com

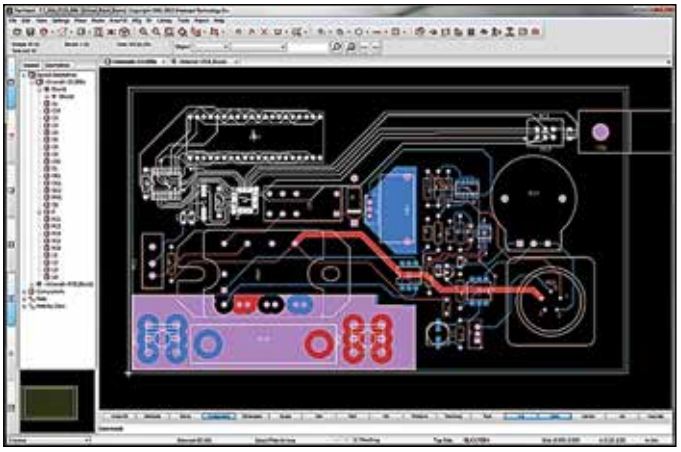
Optocouplers

Standex-Meder Electronics announced the ATEX optocoupler for intrinsically safe circuits. The optocoupler series is tested and certified for extreme/harsh environments such as potentially explosive atmospheres so they will not become an ignition point when subjected to short circuits or adjacent component failures. Markets the optocouplers will benefit include test and measurement, and others.

Standex-Meder Electronics
meder.com

Product Highlights





Resistors

Stackpole expanded the resistance range of its MLF/MLFM Series of metal film melf resistors. The ¼ watt and ½ watt sizes are now available in resistance values down to 10 ohms for TCR's of 25 ppm and tighter. The ½ watt size is now available in resistance values down to 0.2 ohms for TCR's of 50 ppm and 100 ppm. The series is a popular choice for applications such as instrumentation, communications equipment, network analyzers, and more.

Stackpole Electronics
seielect.com

Design Software

Intercept Technology released a version of its Mozaix schematic design software that no longer requires top level sheets and block symbols to build hierarchy in a schematic. This functionality is especially useful for hybrid and Multi-Chip Module (MCM) designs, where circuits are divided based on their location in or around layout cavities. Another application: use the virtual block object for smaller reuse circuits that are shared among related designs.

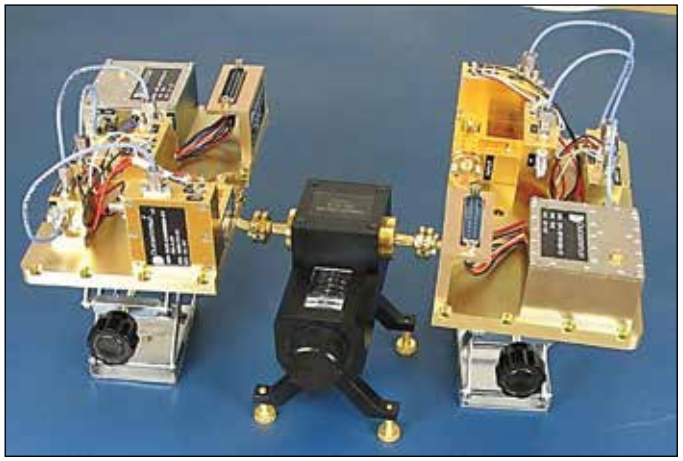
Intercept Technology
intercept.com

PCB Analyzer

Agilent Technologies introduced the E5063A PCB Analyzer for printed circuit board impedance test in manufacturing. The solution offers technology breakthroughs in accuracy and repeatability and reproducibility (R&R). The analyzer also provides a dedicated user interface with broader language support, and more robustness against electrostatic discharge for PCB manufacturing environments.

Agilent Technologies
agilent.com

Product Highlights



RF Subsystem

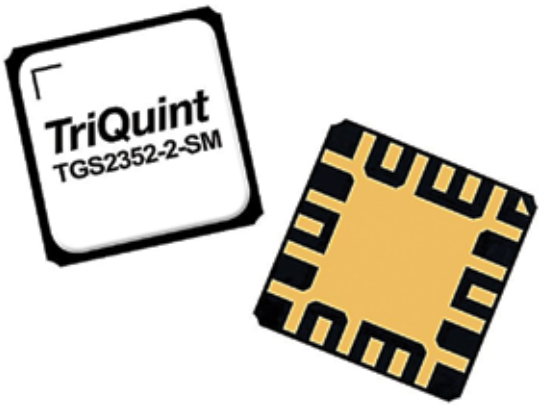
DLT has announced the release of E-band Radio link RF subsystem. This subsystem operates over the E-band frequency spectrum from 71- 86 GHz. One of its applications can be found in the E-band multi-gigabit wireless communication system, which offers local area networks and "Virtual Fiber" local loop for wireless transmission of data, voice and video at 1-10 Gbps speed.

Ducommun LaBarge
ducommun.com

Base Station Tester

Aeroflex Limited launched an extended version of its TM500 industry-standard base station tester capable of emulating several thousand LTE user equipments (UE), fading channel models, and LTE-A carrier aggregation functionality in a one-box benchtop unit. The TM500 Test Mobile delivers more leading edge LTE-A development capability with a higher UE density than any other solution on the market.

Aeroflex Limited
Aeroflex.com

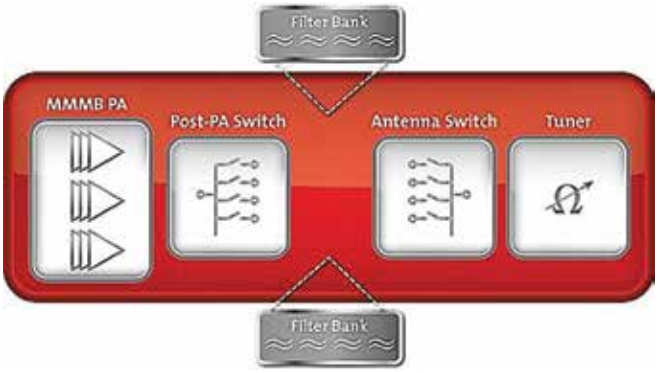


Switches

RFMW, Ltd. announced design and sales support for a pair of high power GaN SPDT switches from TriQuint. The TGS2352-2-SM covers frequencies from 500 MHz to 12 GHz and handles input power up to 20W while the TGS2353-2-SM extends frequency coverage to 18 GHz and handles up to 10 watts of input power. Both the TGS2352-2-SM and TGS2353-2-SM offer switching speeds <35nS and control voltages of 0V/-40V.

RFMW
rfmw.com

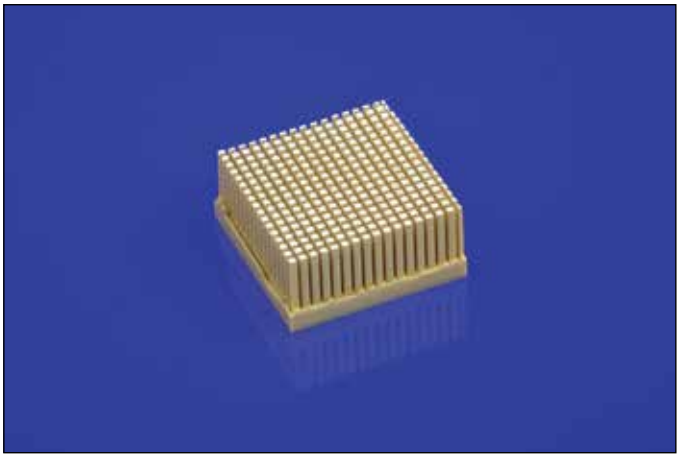
Product Highlights



RF Front End

Peregrine Semiconductor announced UltraCMOS Global 1, the first reconfigurable RF front end (RFFE). For the first time, 4G LTE platform providers and OEMs will be able to save time and money by creating a single-SKU design for global markets. Global 1's entire system – multimode, multiband (MMMB) power amplifier (PA); post-PA switch; antenna switch; and antenna tuner – is based on Peregrine's UltraCMOS 10 technology platform.

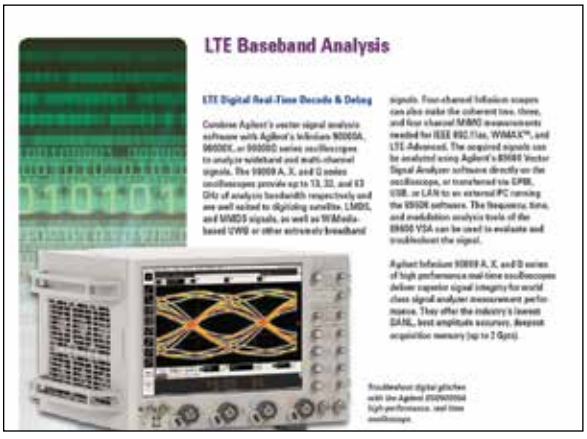
Peregrine Semiconductor
psemi.com



Composite Components

Morgan Advanced Materials launched of a range of piezoelectric composite components, ideal for applications where high performance is critical, including doppler flow, and military and commercial sonar. Components manufactured with Piezo composite materials offer improved acoustic performance over traditional transducer materials, feature higher transmit and receive efficiency, and can be produced in custom sizes, shapes, and materials.

Morgan Advanced Materials
morganadvancedmaterials.com



LTE Guide

The "LTE and LTE-Advanced Solutions" guide offers insights into today's LTE or Long Term Evolution standard for cellular communications. Providing the delivery of the next generation of mobile broadband, LTE and now LTE-Advanced continues to provide many challenges to the engineers developing and delivering products that work to the standards.

Agilent Technologies
agilent.com

Product Highlights: Connectors and Cable

Cable Assemblies

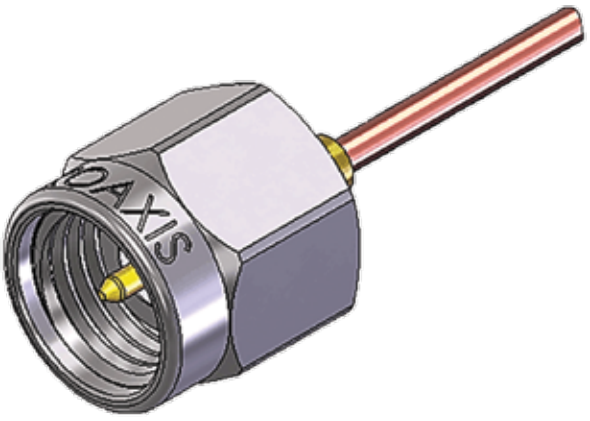
Molex announced its Ruggedized Backplane Cable Assemblies, ideal for defense and aerospace contractors looking to deliver high-speed data transfer between commercial backplanes or servers, to commercial-off-the-shelf (COTS) connectors or full military-qualified interfaces. Customized backplane cables have gone through extensive engineering testing to ensure they meet their respective application-specified data rates and performance requirements.

Molex
molex.com

Coaxial Connectors

SGMC Microwave is offering a new line of gold plated 1.0 mm to 2.4 mm Between-Series Precision Coaxial Connectors. 1.0 mm Male to 2.4 mm Female and 1.0 mm Female to 2.4 mm Male between-series adapters offer low VSWR, excellent performance up to 50 GHz, and rugged construction for repeatability & reliability. The 2.4 mm connector series is mechanically compatible and intermate-able with the 1.85 mm connector series.

SGMC Microwave
sgmcmicrowave.com



Connectors

Koaxis, Inc. offers immediate availability of SMA Plug (male) Connectors for .047" dia Coaxial Cable Assemblies. This connector adds to Koaxis' line of SMA connectors for semi-rigid, hand-formable, and flexible cables. With outstanding performance for frequencies up to 26.5 GHz, these assemblies provide small size for tight spaces. Flexible cable assemblies provide an exceptional flexibility and superior phase-stability.

Koaxis
koaxis.com

Product Highlights: Connectors and Cable

Cable Assemblies

Coaxicom manufactures a broad line of standard and custom flexible, semi-rigid, and Ultra-Flex cable assemblies. Low loss, high performance cables, as well as ruggedized assemblies suitable for production environments are also available. Standard and custom flexible cable assemblies can be supplied using virtually all of the common RG Type Cables.

Coaxicom
coaxicom.com

Test Cables

Pasternack's low loss test cables utilize a 0.195 inch diameter coax with an expanded dielectric which results in 83% Velocity of Propagation (VoP) performance up to 18 GHz. The double shielded flexible coax provides excellent shielding effectiveness greater than 95 dB and VSWR of less than 1.35:1. A heavy duty boot and FEP jacket improve strain relief and allow for a minimum bend radius of 1 inch which adds durability.

Pasternack
pasternack.com

Adapters

VidaRF introduced the low PIM series of the popular 7/16 and Type N adapters within series and between series applications. Contact pin silver plated on Be-CU, body silver/Tri metal on Brass. Delivery ship from stock. As with all RF components that VidaRF offers, we are happy to build to your specifications and provide best delivery and price.

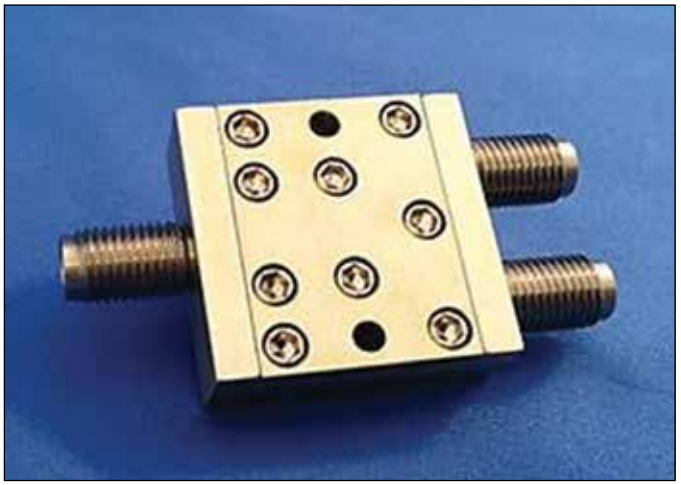
VidaRF
vidarf.com

Product Highlights: Connectors and Cable

Cable Assemblies

TRUcore™ series cable assemblies offer a new level of RF & microwave performance combined with superior mechanical and environmental durability. They are available for 18, 26.5, 40 and 50 GHz broadband electrical performance, and provide designers with a highly durable construction that will not degrade under real life torque, vibration, crush or kinking forces that may be found in critical RF applications.

TRU Corp.
trucorporation.com



Power Dividers

XMA Corp.'s 40 and 50 GHz Power Dividers have a lightweight, compact design and they operate between temperatures of -54°C to +125°C while offering great VSWR through the frequency range of 10 GHz to 50 GHz. These can be used for many test, production, commercial, and military applications.

XMA Corp.
xmacorp.com

Bundled Cable

LMR® Bundled Cable is a spiral configuration of multiple LMR®-400 or smaller LMR® cables under a common polyethylene outer jacket. It acts as the perfect feeder cable for applications requiring multiple runs, such as on towers or building top sites. A unique, patented grounding fixture grounds the outer shields of each cable and a rugged end cap seals the bundle to prevent moisture ingress.

Times Microwave Systems
timesmicrowave.com

Product Highlights: Connectors and Cable

Adapters

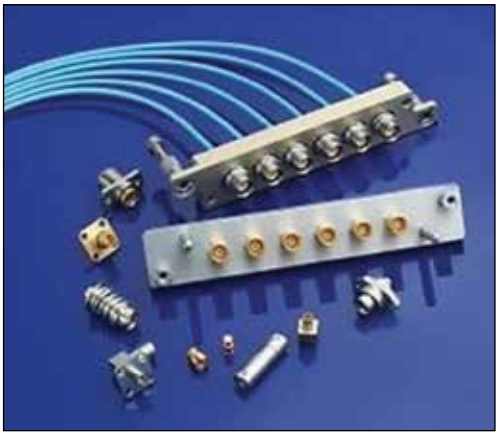
P1dB, Inc. introduced a full line of low-PIM adapters within their P1LP-ADP line. Available for 7/16 and Type N within-series applications and 7/16 between-series (Type N and SMA) applications, the new high-performance line of adapters complements P1dB's high quality low-PIM cable assemblies.

P1dB
p1db.com

Adaptors

Response Microwave announced a series of quick connect male adaptors that expedites general DUT testing. The new units are available in SMA18, SMA27, N, 7/16, TNC and TNCA interfaces and operate incrementally over the DC – 27 GHz range. Typical electrical performance offers insertion loss of 0.3 dB and VSWR of 1.2:1 max.

Response Microwave
responsemicrowave.com



Connectors, Cable

SV Microwave designs and manufactures RF connectors, cable assemblies and passive components. With over 40 years of proven performance, SV Microwave manufactures a very broad range of RF and microwave products. Our product range includes standard off-the-shelf catalog items, but primarily custom designed products for special customer requirements.

SV Microwave
svmicrowave.com

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HTTP://IMS2014.MTT.ORG

IEEE MTT-S

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CONFERENCE DATES: ***1- 6 JUNE 2014!***

How Data, Devices and Personalization are Fueling Demand for Innovation

Vida Ilderem - *Vice President, Intel Labs;*
Director, Integrated Computing Research, INTEL CORPORATION

Vida Ilderem is Vice President of Intel Labs and Director of the Integrated Computing Research [ICR] for Intel Corporation. ICR explores the next revolution in computing with focus on new emerging platforms. The research vectors include breakthrough technology innovations for seamless connection, highly integrated small form factors, and enablement of Internet of Things. Prior to joining Intel in 2009, Vida served as vice president of Systems and Technology Research at Motorola's Applied Research and Technology Center. Vida holds a PhD in Electrical Engineering from Massachusetts Institute of Technology, and has 27 issued patents.

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Turn USB Power Sensors into

Smart RF POWER METERS

from -35 up to +20 dBm 9 kHz to 8 GHz

• True RMS model now available! *• Lightning-fast measurement, as quick as 10 ms* • Compatible with most test software† • Up to 55 dB dynamic range • Measurement averaging*

Don't break your bank with expensive conventional power meters. Mini-Circuits USB Power Sensors turn almost any Linux® or Windows® based computer into a low-cost testing platform for all kinds of RF components. Reference calibration is built in, and your USB port supplies required power. Our GUI offers a full range of watt or dB measurements, including averaging, frequency sweeps, and multi-sensor support.

Our power sensors can be carried in your pocket, or mounted remotely for manual or automated system monitoring (internet connectivity required). Data can be viewed on-screen or exported to Excel® spreadsheets for reporting and analytic tools. Mini-Circuits Power Sensors cost half as much as you might expect, so why do without? Place an order today, and we can have it in your hands as early as tomorrow.

All Power Sensor models include:

- *Power Sensor Unit*
- *Power Data Analysis Software*
- *SMA Adaptor (50Ω only)*
- *USB Cable*

Model	Frequency	Price $ ea. (Qty 1-4)
PWR-4GHS	9 kHz-4 GHz	795.00
PWR-2.5GHS-75	100 kHz-2.5 GHz	795.00
PWR-6GHS	1MHz-6 GHz	695.00
PWR-8GHS	1MHz-8 GHz	869.00
PWR-8FS	1MHz-8 GHz	969.00
NEW! PWR-4RMS	50 MHz-4 GHz	1169.00

RoHS compliant

** Measurement speed as fast as 10 ms with PWR 8 FS. All other models as fast as 30 ms.*

† See datasheets for an extensive list of compatible software.

Mini-Circuits®

www.minicircuits.com P.O. Box 35166, Brooklyn, NY 11235-0003 (718) 934-4500 sales@minicircuits.com

NOW

USB & ETHERNET
RF SWITCH MATRIX

Efficiency for your test setup. Economy for your budget.

DC to 18 GHz from $385 ea.

We're adding more models and more functionality to our line of RF switch matrices. All models now feature switch cycle counting with automatic calibration interval alerts based on actual usage, an industry first! This function improves test reliability and saves you money. Our new RC-series models feature both USB and Ethernet control, so you can run your test setup from anywhere in the world! Rugged aluminum cases on all models house our patented mechanical switches with extra-long life of 10 years/100 million cycles of guaranteed performance!*

Our easy-to-install, easy-to-use GUI will have you up and running in minutes for step-by-step control, full automation, or remote operation. They're fully compatible with most third-party lab software,† adding capabilities and efficiency to existing setups with ease! Visit minicircuits.com today for technical specifications, performance data, quantity pricing, and real time availability – or call us to discuss your custom programming needs – and think how much time and money you can save!

USB Control Switch Matrices

Model	# Switches (SPDT)	IL (dB)	VSWR (:1)	Isolation (dB)	RF P_{MAX} (W)	Price $ (Qty. 1-9)
NEW USB-1SP4T-A18	1 (SP4T)	0.25	1.2	85	2	795.00
USB-1SPDT-A18	1	0.25	1.2	85	10	385.00
USB-2SPDT-A18	2	0.25	1.2	85	10	685.00
USB-3SPDT-A18	3	0.25	1.2	85	10	980.00
USB-4SPDT-A18	4	0.25	1.2	85	10	1180.00
USB-8SPDT-A18	8	0.25	1.2	85	10	2495.00

NEW USB and Ethernet Control Switch Matrices

Model	# Switches (SPDT)	IL (dB)	VSWR (:1)	Isolation (dB)	RF P_{MAX} (W)	Price $ (Qty. 1-9)
RC-1SP4T-A18	1 (SP4T)	0.25	1.2	85	2	895.00
RC-1SPDT-A18	1	0.25	1.2	85	10	485.00
RC-2SPDT-A18	2	0.25	1.2	85	10	785.00
RC-3SPDT-A18	3	0.25	1.2	85	10	1080.00
RC-4SPDT-A18	4	0.25	1.2	85	10	1280.00
RC-8SPDT-A18	8	0.25	1.2	85	10	2595.00

*The mechanical switches within each model are offered with an optional 10 year extended warranty. Agreement required. See data sheets on our website for terms and conditions. Switches protected by US patents 5,272,458; 6,650,210; 6,414,577; 7,633,361; 7,843,289; and additional patents pending.

†See data sheet for a full list of compatible software.

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