“Value Instruments”
Look to Make a Big Difference

Tom Perkins: How to Make RF/Microwave Appealing to the Next Generation

Sherry Hess: How to Develop More Female Engineers

Featured Products

Product Highlights
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ADAPTERS • CABLE CONNECTORS • RECEPTACLES • CUSTOM DESIGNS

Including These Connector Series

<table>
<thead>
<tr>
<th>1.85mm</th>
<th>DC-65 GHz</th>
<th>2.92mm</th>
<th>DC-40 GHz</th>
<th>7mm</th>
<th>DC-18 GHZ</th>
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<tbody>
<tr>
<td>2.4mm</td>
<td>DC-50 GHz</td>
<td>3.5mm</td>
<td>DC-34 GHz</td>
<td>SSMA</td>
<td>DC-40 GHz</td>
</tr>
</tbody>
</table>

ISO 9001:2008

C.W. SWIFT & Associates, Inc.
15216 Burbank Blvd., Van Nuys, CA 91411
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Empower RF
empowerrf.com

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RelComm Technologies, Inc. has added to its RF Relay store product line the RRMT-12S6AB-P. This is a low cost high performance 1P12T relay configured with 'SMA' type connectors providing exceptional RF performance to 18 GHz.

The relay measures 2.25” square and is less than 2” tall. It is fitted with standard DA15P header for ease of installation. This relay is fail-safe configuration with 28 volts DC operation and is RoHS compliant.

RelComm Technologies
rfrelaystore.com

High-Power SPDT Switches

Skyworks’ newest family of high power SPDT switches, the SKY12241-492LF, SKY12242-492LF and SKY12245-492LF, deliver leading performance and efficiency in an extremely compact package, enabling high data rates with low power consumption for next generation wireless devices. Specifically designed for TDD 2G/3G/4G micro and macro-cell base stations, the SKY1224x suite offers excellent low transmit/receive insertion loss as well as high transmit to receive isolation, facilitating optimal system performance. A single 5 V DC supply also simplifies design and implementation.

Skyworks
skyworksinc.com

Pulse Power Meter: Ideal for Defense, Commercial Apps

LadyBug Technologies’ thermally stabilized LB680A RF Pulse Power Sensor is ideal for Defense and Commercial applications. The USB sensor makes measurements up to 20 GHz (18.6 GHz with Type-N connector). Order with the connector you need and place the sensor directly on your DUT for the absolute best match and accuracy. The LB680A now includes Option 004, wide bandwidth video. With its 35ns typical video rise time, the sensor is capable of making statistical and pulse profiling measurements on radar, communication signals and more.

The included full featured software is capable of making a wide range of measurements such as Crest Factor, Droop, Peak & Pulse Power along with Average Power and statistical information like CDF, PDF and CCDF. Drivers for ATE users along with example code in various platforms are all provided.

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22: Feature Article

R&S “Value Instruments” May Make a Big Difference
By Tom Perkins

RF and microwave laboratories face common challenges in these times. They include shrinking timelines for acquisition of accurate test results and leaner financial budgets. Formidable present-day laboratory challenges include integrating radios with embedded designs which add a new twist. New EMI challenges abound. Specific protocol events need to be triggered upon, and result tables exported for further analysis or documentation.

Low speed serial bus data can be captured with oscilloscopes, and with analysis software, can be decoded and validated. Also, obtaining high fidelity bench power is a necessity. Power rail tolerances are getting tighter and more difficult to measure. There are many power rails in designs for devices such as CMOS amplifiers, Application Specific Integrated Circuits (ASICs) and DRAMS with voltages such as -5, +1.2, +3.3, +5 and sometimes higher for devices such as GaN amplifiers. Sleep and wake modes are critical for proper control of circuitry.
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Visit our website at www.timesmicrowave.com for a list of authorized distributors
Several encounters during 2018 have caused me to ponder what may be a concern for our industry. The dilemma posed by company managers, professional society volunteers and to some extent academics, is reduced interest in RF/Microwave engineering and related technology.

One manager seeking more help in growing his business asked how we can make microwave engineering “sexy.” No doubt this field has always been considered somewhat difficult and challenging, possibly perceived by some to lack adequate intellectual or financial reward. Some avoid the defense component, not wishing to be bothered with government regulations and security. The result? Shortages in qualified personnel, associated with shrinking budgets for design software, test equipment and even laboratory space.

As an EE, I observed a related conundrum for many years in that mechanical engineers too often shy away from microwave technology in favor of things that mesh with or have moving parts, implying more excitement. Personally, I have always visualized motion within microwave circuits, assemblies, modules, cables, and antennas. But this is in my mind, or with simulated wave motion. These are electromagnetic waves traveling near the speed of light, interacting with all sorts of materials and misbehaving if not properly controlled and channeled. These are difficult concepts to convey to a mechanical engineer, if not schooled in the subject matter. This is something that perhaps needs to be expressed in layman’s terms to the young. Not long ago I used a garbage can and portable FM radio to demonstrate a Faraday cage at a STEM event. I wound up asking one of the middle school students, “How do you know that the radio stopped working simply because it is dark in there?” The idea is to get them thinking and using their imagination.

The not easily formulated passion for microwaves is often incubated in future EEs long before coming of college age. In my own experience at age 13 it was curiosity and developing interest in RF as an amateur (ham) radio enthusiast. We generally don’t see the same inclination in young people today perhaps due to competition with the internet, gaming, computer technology, and electronic gadgetry in general. Also, the ability to “breadboard” or build kits in general is more complicated and not easily accomplished by a hobbyist these days. One constant tends to be “home brewing” antennas.
Furthermore, regarding amateur radio, an IEEE colleague, Howard Michel, WB2ITX, has recently taken the role as ARRL Chief Executive Officer. In recent articles he speaks of how he became a ham and how ARRL is a membership association, business, and public charity. I reiterate here his mention of purpose in the Articles of Association for ARRL. We can somewhat mirror this statement to our profession (abbreviated and paraphrased).

The promotion of interest in Amateur Radio communication and experimentation. Establishment of networks in emergencies. Furtherance of public welfare. Advancement of the art. Fostering of communication by electronic means throughout the world. Fostering of education in the field of electronic communications. Promotion and conduct of R&D. The dissemination of technical, educational, and scientific information and printing and publishing material on related subject matter.

Dr. Michel states, “We need to go back to our roots, and keep the purpose for which we were formed always at the front of what we do.” Howard seems a modest man. He has yet to mention that he served many roles in IEEE including President (2015).

My initial attraction to microwaves in college courses was fascination with parallel plate waveguide, using a slotted line, transverse modes, and the fundamental simplicity of some circuits. The solution to stimulating interest is not easy. There are now many competing and sometimes complementary technologies in electronics. Microwaves101.com identifies fewer than 60 colleges and universities worldwide that currently teach microwaves. Notwithstanding, many options for study and specialization are positives that are being exercised today in schools of higher learning. One is access to modern test equipment and design software. Special discounts, value instruments, and discounted user licenses have enabled classrooms and labs to feature sufficient quantities of tools for students to have “hands-on” experience that was generally, at best, only had by observation 50 years ago. Making these assets readily available is also wise advertising on the part of the producers of these tools.

There is a proliferation of IoT and vast applications of microwave/millimeter-wave technology not imagined three decades ago. We need to promote our field in new and exciting ways to the folks who will carry forth our great profession.
Meetings and Events

IEEE Radio Wireless Symposium 2019
January 20 – 23, 2019
Orlando
https://www.radiowirelessweek.org/

IMS 2019
June 3 - 7, 2019
Boston
https://ims-ieee.org/

IEEE Wireless Power Transfer Conference
June 18 - 21, 2019
London
https://www.mtt.org/conference-calendar

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LabVIEW Core 2
Online
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Object-Oriented Design and Programming in LabVIEW
Online
http://sine.ni.com/tacs/app/fp/p/ap/ov/pg/1/
Free, online LabVIEW training for students and teachers.
http://sine.ni.com/nievents/app/results/p/country/us/type/webcasts/

2019 IEEE WIE Leadership Summits

IEEE Women in Engineering International Leadership Summits (WIE ILS) provide regional opportunities to foster networking, mentorship, and collaboration. IEEE WIE will continue the WIE ILS program in 2019 as part of the portfolio of global initiatives that focus on Empowerment, Entrepreneurship, Leadership, and Emerging/Future Technology. https://wie.ieee.org/leadership-summits2019/

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“Look to the leader in YIG-Technology”
5G Capacity Will Drive Down Prices, Not Drive up Profits

The 5G wave is real and justified by the supply-side benefits it delivers. However, the impact on revenues and margins in converged network competition is less certain and there is potential for disruption. The Strategy Analytics Service Provider Strategies (SPS) report, “Can 5G Slow Operator Profit Erosion?” emphasizes the challenge for 5G in lifting operator performance in a competitive telecoms and media environment where household expenditure and commercial willingness to pay or invest in ICT are flat.

The report finds the benefits from 5G in terms of capacity and network efficiencies are compelling. The question on the table is whether 5G’s new service attributes will enable new service value propositions that create significant new revenues. Given Strategy Analytics’ analysis of the industry structure in which operators exist, we believe the answer is no.

Harvey Cohen, President and report author comments, “At the core, the issue is whether the technological advantages offered in the transition of networks will overcome or aggravate the industry structure and competitive forces that are inherent in the regulated telecoms industry. Regardless of the technological power of the offering, if the service portfolio is offered without value proposition differentiation, the results will be predictably below average due to the increasing commoditization of the market.”

David Kerr, Vice President notes, “There is no question that the volume of traffic has skyrocketed during the last ten years. However, as operators transformed their networks to video-capable 4G and pushed their fixed broadband towards gigabit speeds, competition drove prices down faster than even the impressive growth in GBs was able to accommodate.”

Phil Kendall, Director Service Provider Group, adds, “Technology alone will not improve operator financials. Regulatory intent to pass on cost improvements in networks to consumers appears to control the ability for networks to achieve a return on sales of much greater than 6% on a sustained basis. Value creation for operators will come through behavioral segmentation to identify actionable market segments and their needs, improved brand positioning to create differentiated emotional themes that relate to buyer needs and pain points, and a focus on innovative value propositions that are derived from segment-specific requirements and willingness-to-pay.”

—Strategy Analytics
strategyanalytics.com

Commercial UAS Market has $15B Potential

The growing market for commercial UAS (unmanned aerial systems) platforms and associated services will be led by demand from the agriculture, commercial security and first responder sectors: The Strategy Analytics Advanced Defense Systems (ADS) service report, “Commercial UAS Market Outlook 2017-2027,” forecasts the commercial UAS market will grow to over $15.1 billion by 2027.

The growth in demand for UAS platforms providing commercial services encompasses agriculture, delivery services, media, first responder, media/entertainment and other industries, with agriculture, commercial security and first responder sectors potentially accounting for close to 49% of demand for commercial UAS platforms by 2027. Globally, the market for commercial UAS platforms and associated services will be driven by the European, Asia-Pacific and North America regions and could together account for over 83% of global demand by 2027.

“To achieve mass adoption of commercial UAS platforms across government and enterprises and achieve this $15 billion potential will be almost singularly contingent upon the establishment of favorable regulatory frameworks,” noted Asif Anwar, Director of the ADS service. “Existing regulations that currently underpin the use of UAS platforms will need to evolve and expand, especially as drone usage enables applications that require sharing of civilian airspace as well as the ground infrastructure currently used exclusively by manned aircraft.”

The associated demand for mission sensor payloads is predicted to witness faster growth than the UAS market itself as platforms are increasingly equipped with the ability to swap multiple sensors on a plug and play basis.

As capabilities expand, so will the extent to which UAS platforms move towards operation in civilian airspace. Integration of commercial UAS operations into civilian airspace will need to address several technical challenges which will include the man machine interface (MMI), Communications and Control Minimum Operating Performance Standards (C2 MOPS) and Sense-and-avoid (SAA) or detect-and-avoid (DAA) systems.

This will dictate additional demand for dedicated sensors and associated technologies including satellite data-links to allow beyond line of sight flight, sense and avoid systems underpinned by radar, LiDAR and EO-IR technologies and machine learning/artificial intelligence based processing.

This report also looks at the regulatory environment that will be crucial in enabling the market for commercial UAS platforms and discusses the technologies that will be required to enable integration and operation of these platforms in civilian airspace.

—Strategy Analytics
strategyanalytics.com
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Our 0402DC and 0805HP Series provide the industry’s highest Q factors in their respective sizes for super low loss in high frequency circuits. Select values from 2.6 to 820 nH, including 0.1 nH increments from 2.8 to 10 nH in the 0402DC Series.

Find out why our customers are so bullish on our wirewound ceramic chip inductors. Order your free samples today at www.coilcraft.com.
New Materials Architectures Sought to Cool Hypersonic Vehicles

Hypersonic vehicles fly through the atmosphere at incredibly high speeds, creating intense friction with the surrounding air as they travel at Mach 5 or above – five times faster than sound travels. Developing structures that can withstand furnace-like temperatures at such high speeds is a technical challenge, especially for leading edges that bear the brunt of the heat.

To address this thermal challenge, DARPA recently announced its Materials Architectures and Characterization for Hypersonics (MACH) program. The MACH program seeks to develop and demonstrate new design and material solutions for sharp, shape-stable, cooled leading edges for hypersonic vehicles.

“For decades people have studied cooling the hot leading edges of hypersonic vehicles but haven’t been able to demonstrate practical concepts in flight,” said Bill Carter, program manager in DARPA’s Defense Sciences Office. “The key is developing scalable materials architectures that enable mass transport to spread and reject heat. In recent years we’ve seen advances in thermal engineering and manufacturing that could enable the design and fabrication of very complex architectures not possible in the past. If successful, we could see a breakthrough in mitigating aerothermal effects at the leading edge that would enhance hypersonic performance.”

The MACH program will comprise two technical areas. The first area aims to develop and mature fully integrated passive thermal management system to cool leading edges based on scalable net-shape manufacturing and advanced thermal design. The second technical area will focus on next-generation hypersonic materials research, applying modern high-fidelity computation capabilities to develop new passive and active thermal management concepts, coatings and materials for future cooled hypersonic leading edge applications. Both technical areas will be described in a Broad Agency Announcement solicitation expected soon.

—DARPA
darpa.mil

Bringing Advanced Microelectronics to Revolutionary Defense Applications

Today’s critical Department of Defense (DOD) systems and platforms rely on advanced electronics to address national security objectives. To help tackle obstacles facing a half-century of electronics advancement, DARPA launched the Electronics Resurgence Initiative (ERI) – a five-year, upwards of $1.5 billion investment in the future of domestic electronic systems. Last November DARPA expanded ERI with the announcement of ERI Phase II, which seeks to further enmesh the technology needs and capabilities of the defense enterprise with the commercial and manufacturing realities of the electronics industry.

One key focus of ERI Phase II is on developing connections between the various ERI programs and their potential defense applications. In December DARPA hosted a Proposers Day to convene leaders within the defense industry base (DIB) to discuss opportunities to further develop and demonstrate ERI’s technological advances for DOD needs. During the event, DARPA program managers shared their ideas for potential ERI defense applications, which include but are not limited to autonomy and artificial intelligence, large-scale emulation, cybersecurity, space applications, cognitive electronic warfare, and intelligence, surveillance, and reconnaissance (ISR). To foster further dialogue and collaboration, attendees had the chance to provide input on how best to support the transition of...
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In the News

electronics innovations into national defense hardware.

The Proposers Day also supported the development of a potential broad agency announcement (BAA) focused on defense transitions. Tentatively titled “Electronics Resurgence Initiative: Defense Applications (ERI:DA),” the BAA solicits innovative proposals to develop, demonstrate, and apply emerging ERI electronic technologies to deliver significant impact on DOD capabilities.

“The success of ERI relies on cooperation with the commercial sector to address shared problems. However, as a DARPA effort, ERI must also demonstrate that its research findings bolster our nation’s defenses and help create strategic surprise,” said Dr. William Chappell, director of DARPA’s Microsystems Technology Office (MTO).

“Through the ERI:DA Proposers Day and potential BAA, DARPA seeks to procure the expertise and transition support of industry and the defense community to help accelerate the delivery of ERI-derived innovations for national security needs.”

—DARPA
darpa.mil

Small cells are low-power, easy-to-implement radio access points that operate in both licensed and unlicensed spectrums with a typical range of 10 to several hundred meters. Mobile operators are utilizing a scalable grid of small cells to facilitate powerful, high-speed connectivity.

“Skyworks’ leading small cell architectures are enabling high density platforms, creating faster, more robust communication and, in turn, expanding carrier capacity,” said David Stasey, vice president and general manager of diversified analog solutions for Skyworks. “We are bringing next generation networks closer to subscribers while at the same time partnering with smartphone manufacturers via our innovative Sky5™ suite. Our comprehensive approach across both infrastructure and user equipment uniquely positions us to empower end-to-end 5G connectivity.”

According to Research and Markets, the total value of the small cell market is expected to grow from $13 billion in 2017 to more than $58 billion by 2024.

—Skyworks Solutions
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PolyPhaser’s field-tested product platform, is backed by a ten-year warranty and can be found in mission-critical communication applications in more than 160 countries.
MIL-Grade Cable Assemblies

Fairview Microwave launched a new series of military-grade MIL-DTL-17 RF cable assemblies that are ideal for military electronics, electronic countermeasures (ECM), avionics, unmanned systems, IFF systems, GPS and SATCOM.

Fairview’s new military-grade cable assemblies feature operating frequencies of up to 12.4 GHz and VSWR as low as 1.3:1 per connector. This new product line is made up of six different cable types in 124 basic configurations for a total of more than 1,200 part numbers that are all available for same-day shipment with test reports. They are constructed of MIL-C-17 qualified cable, MIL-PRF-39012 qualified connectors, J-STD soldering and AS23053 heat shrink. These commercial off-the-shelf (COTS) cable assemblies are 100% tested and come complete with test data, test report and material lot traceability. They are ideal for the aerospace, defense, transportation and telecommunications industries, or any area where there is a high cost-of-failure.

Fairview Microwave
fairviewmicrowave.com

Pocket-Size Signal Generator

Saelig announced availability of Triarchy Technologies’ VSG6G1C RF Vector Signal Generator—a cost-effective pocketable USB-connected RF signal source with capabilities that provide standalone and PC-controlled functions comparable to full-size analog RF signal generators. Offering frequencies from 1MHz to 6.1GHz with frequency sweep, frequency hopping using I&Q modulation, and arbitrary signal generation, this compact signal source can generate most of the modulated signals that RF engineers might need. The VSG6G1C’s many test functions can be customized to meet the needs of proprietary and other nonstandard wireless protocols. This compact design is ideal for field test situations since it can be conveniently added to a field service kit, and configured to operate standalone without any connected PC - just a 5V USB source or battery pack. The VSG6G1C can also operate in ATE systems as a signal source module, simulating many different RF systems for test purposes.

Saelig
saelig.com

Broadband Low Magnetic Field Coaxial Isolator

The VCI-80180-X from VidaRF is an RF broadband low magnetic field coaxial isolator that operates from 8-18GHz. It provides Isolation of 16 dB with an insertion loss of 0.70dB, VSWR of 1.40:1. The device can handle average power of 5 W (forward) and 1 W (reverse). It is available in a module with SMA connectors. The isolators are stackable for space savings.

VidaRF
vidarf.com

Mixer: Handheld Spectrum Analyzers

OML’s mixer series, MxxHxDC, is specifically designed for handheld spectrum analyzers as a portable solution for millimeter wave spectrum analysis measurement. Utilizing the handheld spectrum analyzer tracking generator as an LO source and the built-in DC supply; this harmonic mixer provides you the ease of portable field measurement in a one box solution. Available in waveguide bands WR-12 (60-90 GHz), WR-15 (50-75 GHz) WR-10 (75-110 GHz). OML’s innovative millimeter wave frequency extension products can help you with your testing in the emerging application areas such as WiGig, 5G, collision avoidance radar systems, E-Band backhaul and defense.

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The upconverter has independent input IF and output RF attenuation for over 60 dB of gain control. These attenuators are controlled by parallel attenuation bits on a rear power/control multi-pin connector. Both converters offer best in class spur free dynamic range. The units use a single
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Featured Products

Feed Horn Antenna
Model SAF-6039031340-141-S1-122-DP is a dual polarized, WR-12 scalar feed horn antenna assembly that covers several popular 5G bands in the frequency range of 60 to 90 GHz. It features an integrated ortho-mode transducer (OMT) that provides high port isolation and cross-polarization cancellation and a broad band scalar horn that provides low sidelobe levels. The OMT enables the antenna to separate a circular or elliptical polarized waveform into two linear, orthogonal waveforms or vice versa. The dual polarized horn also supports either vertical or horizontal polarized waveguide forms with more than 25 dB cross polarization rejections.

Power Amp
RFMW announced design/sales support for a GaN on SiC power amplifier. The Qorvo QPA1019 offers 10 Watts of saturated output power from 4.5 to 7 GHz for C-Band Radar systems and satellite communications. Power added efficiency is up to 40% while power gain is >19 dB. Biased from a 22 V supply, the QPA1019 draws 290 mA. With an integrated power detector, this PA is offered in a 5 x 5 mm, plastic over-mold QFN with a copper paddle for high reliability.

Power Sensor with Security Features
LadyBug Technologies features its LB5900 Series Power Sensors Security Options for commercial and military applications. Models with frequency coverage up to 40 GHz are available. Security options include Option SEC -- secure erase -- and Option MIL – memory write prohibited. For the highest level of security, Option MIL prevents any user information from being stored in the sensor but still allows a very high level of usability, including programmatic control. Items such as presets, inter-
Loss is critical in millimeter wave applications, and IW manufactures the range of lowest attenuation/phase stable coax to maintain your signal’s integrity. From K-band to E-band, our family of coax was developed using IW’s proprietary EPTFE lamination process to ensure the lowest cable loss across the mmWave spectrum:

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Operating Freq. (GHz)</th>
<th>Atten. (max) dB/ft. dB/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1801</td>
<td>30</td>
<td>0.49 / 1.62</td>
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<tr>
<td>1701</td>
<td>38</td>
<td>0.57 / 1.88</td>
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<tr>
<td>1571</td>
<td>40</td>
<td>0.64 / 2.09</td>
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<tr>
<td>1501</td>
<td>40</td>
<td>0.75 / 2.46</td>
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<td>1401</td>
<td>50</td>
<td>1.02 / 3.34</td>
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<td>1251</td>
<td>70</td>
<td>2.14 / 7.02</td>
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<tr>
<td>0471</td>
<td>110</td>
<td>4.95 / 16.23</td>
</tr>
</tbody>
</table>

With a broad selection of interconnects including 3.5mm, 2.92mm, 2.4mm, 1.85mm, SMP and SMPM interfaces, plus jacketing and armoring options, IW Microwave delivers reliable custom cable assembly solutions to suit a diverse range of applications from satellite communications systems to 5G test.

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nal user cal tables, simple and frequency dependent offsets, will be lost when the power is removed. Each time the sensor is powered, it will appear as it did when it was first delivered. Option SAN provides a secure erase of all data stored by the user in the sensor. This includes all offsets, presets, user cal tables, FDO tables, and other data not placed in the sensor by the factory. Initial factory calibration is not erased.

**LadyBug Technologies**
ladybug-tech.com

**Bandpass Filter in WR-15 Waveguide**
Spacek Labs model Fc2-625-9 is a broadband band pass filter in WR-15 waveguide. This series of filters operate from 18 to 110 GHz in the standard or custom waveguide bands and have bandwidths from 30 to 100% of the waveguide band. These waveguide filters are a combination of our exceptional performance low pass filter technology along with our high pass filter in series, with both filters designed to meet your exacting pass-band requirements. Model Fc2-625-9 has a passband from 48 to 72 GHz. The lower and upper 20 dB reject points are 45 and 74 GHz respectively. The filter has a rejection of >30 dB out to 110 GHz. Insertion loss is 1 dB typ and 2 dB max.

**Spacek Labs**
spaceklabs.com

**Hi-Q/Low ESR Capacitors**
Specifically produced for high power/high frequency requirements, these products are available in surface mount or leaded configurations that are 100% RoHS compliant and are also available in a non-magnetic termination. With over 30 years in the RF/Microwave industry, Passive Plus manufactures high quality, high power passive components using state-of-the-art manufacturing techniques. Specializing in Magnetic & Non-Magnetic HI-Q Capacitors product lines, PPI supplies reliable quality components to the Military, Medical, Semiconductor, Broadcast and Telecommunications Industries.

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RF Relay Store

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P: (410) 749-4488 - F: (410) 860-2327 - www.relcmmtech.com - sales@relcmmtech.com
RF and microwave laboratories face common challenges in these times. They include shrinking timelines for acquisition of accurate test results and leaner financial budgets. Formidable present-day laboratory challenges include integrating radios with embedded designs which add a new twist. New EMI challenges abound. Specific protocol events need to be triggered upon, and result tables exported for further analysis or documentation.

Low speed serial bus data can be captured with oscilloscopes, and with analysis software, can be decoded and validated. Also, obtaining high fidelity bench power is a necessity. Power rail tolerances are getting tighter and more difficult to measure. There are many power rails in designs for devices such as CMOS amplifiers, Application Specific Integrated Circuits (ASICs) and DRAMS with voltages such as -5, +1.2, +3.3, +5 and sometimes higher for devices such as GaN amplifiers. Sleep and wake modes are critical for proper control of circuitry.

Recently Rohde & Schwarz, generally known for high quality but expensive test instruments, showcased a new generation of Value Instruments for *High Frequency Electronics*. The take-away was that a great amount of capability is packed into smartly designed instrument cases weighing approximately 10 pounds which will revolutionize electronics hands-on in education institutions, research and development facilities, small business production laboratories and even hobbyist benches. These types of instrument products, not all unique to R&S, are creating a new paradigm in lab measurements. The units demonstrated are so compact...
and lightweight that if handed to someone wearing a blindfold, they might think it is a shoebox, or upon feeling the controls, that it is only a mock-up instrument. Certainly not your father’s or grandfather’s rack or rolling wheeled cart mounted equipment.

In this case the supplier introduced “a portfolio of entry-level to mid-range value instruments, promoting five key technologies.” Included are more than 100 products and 300 accessories including oscilloscopes, spectrum analyzers, precision power supplies, and signal generators. (See Figure 1).

Designed with the high quality and precision that users have come to expect of Rohde & Schwarz, the new value instruments are manufactured at the same European plants as the company’s higher-end products. With more than eight decades of experience and renowned German engineering, the company’s value instruments provide the performance needed for measurement tasks in everyday laboratory operations at universities and research and development facilities.

“At Rohde & Schwarz, we pride ourselves on our high-quality, German engineering that customers have come to expect for the last 85 years,” said Bob Bluhm, R&S vice president of value instruments. “With the introduction of our value instruments line, we’ve challenged our high-end RF engineers to deliver that same level of quality, capability and performance to this market place. They did not let us down. Just ask an engineer who owns one; these products provide outstanding features at a much lower price.”

Value Instrument Oscilloscopes

Oscilloscopes were originally called oscillographs. Digital displays and added capabilities may eventually be a catalyst for name change again. Modern value-class oscilloscopes go far beyond the features of a traditional oscilloscope; these instruments include a logic analyzer, protocol analyzer, waveform and pattern generator and voltmeter in the same instrument. For example, featuring the power of 10, these value instrument oscilloscopes include a class exclusive 10-bit analog-to-digital converter (A/D converter), 10s of Msamples of memory and a 10.1-inch touchscreen offering the highest resolution in its class: 1280x800 pixel. The technology’s 10-bit A/D converter provides sharper waveforms and more signal details, compared to conventional 8-bit A/D converters, yielding up to four-fold improvement.

Users desire features such as lower cost with more performance, large touchscreen displays, and more vertical resolution. The RTB2000 oscilloscope (see Figures
2 and 3) features a 10.1-inch capacitive touchscreen that allows users to quickly navigate pop-up menus and adjust scaling by zooming in or moving a waveform. A memory depth of 10 Msample is available on every channel if all channels are active, or users can benefit from 20 Msample when channels are interleaved. Ten times more memory than comparable oscilloscopes is offered, allowing users to capture longer signal sequences for more analysis results. The oscilloscope features a frequency range of 70 to 300 MHz. Utilizing state-of-the-art A/D converters and low-noise frontends, the oscilloscope can precisely measure very small vertical resolution. Combining the product’s smart operating concepts with the power of 10 makes it the ideal tool for troubleshooting embedded designs during development, or for use in settings such as university laboratories, production and service departments.

Stepping up, the RTM3000 oscilloscope offers a greater frequency range of 100 MHz to 1 GHz. The oscilloscope features a custom 10-bit A/D converter to deliver four-fold improvement over conventional 8-bit A/D converters, providing users with sharper waveforms and more signal details. As with the RTB2000, the RTM3000 features a 10.1-inch capacitive touchscreen in compact form. This is the largest capacitive display with the highest resolution (1290 x 800 pixel) in its class.

Higher End Value Oscilloscopes

Designed with class-leading signal integrity and responsive ultra-deep memory, the RTA4000 oscilloscope brings the power of 10 to a new level. The oscilloscope features a custom 10-bit A/D converter to deliver four-fold improvement over conventional 8-bit A/D converters, providing users with sharper waveforms and more signal details. As with the RTB2000, the RTM3000 features a 10.1-inch capacitive touchscreen in compact form. This is the largest capacitive display with the highest resolution (1290 x 800 pixel) in its class.
Up to 300W
COUPLERS
20 to 6000MHz
10:1 Bandwidths  0.02 dB Insertion Loss

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tion previously unseen in a value class instrument. Starting at about $6,000 USD, it also features a frequency range of 200 MHz to 1 GHz, sensitivity down to 500 µV/division and class-leading time-based accuracy of ±0.5 ppm to ensure accurate measurements over long time periods. It is ideal for applications ranging from EMI debugging to power integrity and power analysis, the RTA4000 adapts to project updates as needed to best grow with user needs.

**Value Instrument Spectrum Analyzer**

_HFE_ personnel were next introduced to the FBC1500 Spectrum Analyzer (See Figure 4). This unit had a vertical antenna attached to an input port and of course noticeable signals appeared to be local cellular activity, as expected. Local 4G LTE activity can be seen below 800 MHz as well as perhaps traditional cellular signals closer to 900 MHz.

Speaking of value, some entry-level spectrum analyzers costing less than $3,000 are the only ones on the market with the value and capabilities of a three-in-one instrument – a spectrum analyzer, vector network analyzer and a signal generator. Featuring a frequency range of 5 kHz to 1 GHz, the FPC1500 (see Figure 5) can be upgraded to 2 GHz or 3 GHz high end frequency limit. It has a low noise floor, -165 dBm (typical with a preamplifier). In addition to being able to measure RF signals up to 1-watt (+30 dBm), it is also an RF signal generator and features a tracking generator and an independent continuous wave (CW) signal generator.

**Figure 3 • Value Instruments in College Laboratory.**

**Figure 4 • Live Demonstration of Value Spectrum Analyzer with Whip Antenna Receiving Over the Air Signals.**
It also includes a one-port vector network analyzer with a Smith Chart display, a signal generator, internal voltage standing wave ratio (VSWR) bridge, independent signal source and resolution bandwidth settings down to 1 Hz. It includes a 10.1-inch Wide XGA/WXGA (1366 x 768 pixel) display, is Wi-Fi-enabled and includes a remote-control capability. It is compatible with iOS, Android and PCs and features a low noise floor and high maximum input power. Data can be stored to these devices and then saved, stored, and if desired, sent to a printer.

**Power Supplies**

As the only power supply on the market featuring four channels, while obviously not the solution for everybody, the R&S®HMP4040 power supply (Figure 6) offers a maximum voltage of 128 V and maximum current of 40 A, up to 10 A output current per channel. Up to 160 watts of channel power can be had, and unlike other power supplies available on the market, the product offers identical voltage range on all channels. It comes standard with a dual USB/LAN interface and locates all basic functions on the front panel to allow for direct access.

Offering high efficiency and low residual ripple, the product includes a wide variety of protection features to prevent damage to the instrument and the device under test (DUT), such as overtemperature, overload and short-circuit protection. Sleep and wake modes are critical and can be managed from a coordinated Wi-Fi interface. We noted that due to the ability to make voltage additive, applications like electroplating and powering GaN high power amplifiers are quite feasible.
Another interesting product is the signal generator, such as the model SMC100A shown in Figure 7. Here, the manufacturer claims that the “graphical interface allows you to set up the signal the way you think about it.” It mimics the functional blocks of a transmitter. Functional highlights are: output frequencies of 9 kHz to 1.1 GHz or 3.2 GHz, output power up to 50 milliwatts, low phase noise typically -111 dBc, AM/FM/phase/pulse modulation, optional reference oscillator, optimized level...
accuracy, USB and LAN, and optional GPIB. This is a very useful tool particularly for classroom training purposes and circuit design work.

**Customer/User Education and Support**

Rohde recognizes that these instruments can be of much more value to the user with competent customer support and their goal is to promote features with minimal asterisks or exceptions to specifications. They maintain close links with leading research centers and University departments in the mobile communications, RF and microwave fields. They offer discounted equipment packages to schools to assist in quantity buys for equipping teaching laboratories. This could help make our field more visible and appealing to students as mentioned in our January 2019 Editorial. They also provide multiple formats for easy access technical support,

**Other Suppliers and Conclusion**

It is perceived that there is a large, untapped market for value instruments like the ones previously described. There are other specific instruments useful in RF labs such as those made by competing companies or in some cases, complimenting ones such as low-cost network analyzers and power meters that certainly deserve mention.

Since the equipment described in this article is principally *not* “vendor neutral” (a play on words!) we mention other companies like Anritsu, Copper Mountain, Fluke Corporation, Keysight, LadyBug Technologies, Mini-Circuits, National Instruments and Tektronix. Some of these companies provide cost effective instruments that rely on computers such as ordinary laptops for fulfillment of functionality. That saves capital expenses. Worthy of note, Tektronix reports to have sold more than 1 million oscilloscopes based on their TDS2 platform, the latest being the TBS 2000 series (Figure 8).

It should be noted that not all these companies are on the same “playing field,” but certainly deserve consideration when weighing test equipment needs such as their application, ease of use, durability and cost. This value instrument trend will no doubt grow and flourish going forward.

*HFE*’s thanks to Rich Markley, Distribution Product Manager for Rohde & Schwarz USA and Erica Harbison of Blu Print Public Relations for their December briefing.

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**COMPONENTS**

- 10-110 GHz
- Broadband Detectors
- Waveguide & Planar Mixers
- Low-Noise & Power Amplifiers
- Active & Passive Multipliers
- Low, High & Band-Pass Filters

**SUBSYSTEMS**

- 10-110 GHz
- Receivers
- Transmitters
- Transceivers
- Block Converters
- Up & Down Converters
- Mixer-Front-Ends
- Phase-Lock Sources
- Radiometric Front-Ends

**SYSTEMS**

- 10-110 GHz
- Multi-Channel Receivers
- Ka & W-Band
- Cloud Radar
- Frequency Extenders
- Frequency Synthesizers
- Switching Arrays
- Custom Integrated Assemblies

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- Custom Integrated Assemblies

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LNA Line: 2 - 60 GHz

Norden Millimeter continues to expand its LNA product line covering bands 2 - 60 GHz. Norden has released a 17 - 22 GHz LNA providing a noise figure of 1.3 dB. Pictured is an 18 - 40 GHz LNA for 5G applications. Norden also provides custom designs.

Norden Millimeter has extensive experience in product development and manufacturing of millimeter wave amplifier products to specific customer specifications with quality and customer satisfaction the ultimate objective. MMIC technology is used extensively throughout our product base. Extensive qualification is used to insure MIC integrity during our manufacturing process and for our customer’s final application.

Norden Millimeter
nordengroup.com

Cross Guide Couplers

Fairview Microwave’s comprehensive line of cross guide couplers is made up of 160 parts in three sub-categories: cross guide couplers (4 waveguide ports), cross guide couplers with terminations (3 waveguide ports) and cross guide couplers with terminations and waveguide to coax adapters (2 waveguide ports with either an SMA, Type-N or 2.92 mm coaxial connector). These couplers are constructed with bronze waveguide bodies and are offered with EIA (CPR)-style flanges or UG-style flanges per military standard. They cover eight waveguide bands in the 5.85 GHz to 33 GHz frequency range and are available with coupling factors from 20 to 50 dB.

Fairview Microwave
fairviewmicrowave.com
Technical Brief: YIG-tuned Bandpass and Band-reject Microwave Filters

Using small conductive “loops” a YIG filter is coupled to and from a YIG spheres’ resonant magnetic field. The closer the loop, the wider the bandwidth. Bandwidth can also be expanded by increasing the number of YIG resonators and carefully “tuning” the RF coupling loops. In this brief, RF engineers will learn the three basic methods in which this coupling is applied: signal transfer; signal reflection; and oscillation feedback, and how this differentiates a bandpass from a band-reject filter. Readers will also learn the limits (i.e. limiting) on the total amount of RF energy that a YIG resonator/sphere can couple/transfer (e.g. 0 dBm to +10 dBm).

Micro Lambda Wireless
microlambdawireless.com

Coaxial RF Probes

Pasternack’s extended line of coaxial RF probes now includes 4 models that deliver 10 dB maximum return loss over the broad frequency range of DC-40 GHz. These probes are offered in GS and GSG configurations with a pitch of 800 or 1500 microns and a 2.92mm interface. They are gold-plated and have compliant pogo pin contacts that allow for a wide range of probing angles. These RF coaxial probes can be used by hand, with or without a probe positioner, and can be cable mounted or mounted with Pasternack’s multi-axis probe positioner. They are ideal for signal integrity measurement, chip evaluation, coplanar waveguide, Gigabit SERDES, substrate characterization and test fixture applications.

Pasternack
pasternack.com

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Tomorrow?

Pasternack
pasternack.com
Spectrum Analyzer Extension Modules
OML can extend the frequency range of your existing spectrum analyzer to millimeter wave frequencies with our single diode unbalanced harmonic mixers. Harmonic mixers are available for the waveguide bands between 18 and 325 GHz. These frequency extension modules are compatible with most spectrum analyzers that offer optional external mixer access. By substituting the harmonic mixer for the existing microwave input, you can expand your spectrum analyzer frequency coverage for millimeter wave measurements.

OML
omlinc.com

2.92mm Precision In-Series Adapters
2.92mm Precision In-Series Adapters: SGMC Microwave’s 2.92mm series are precision grade connectors designed for use with microwave applications requiring excellent performance up to 40 GHz. SGMC offers an extensive line of 2.92mm precision adapters, receptacles, and cable connectors for various semi-rigid and flexible coaxial cables. Special designs are also available upon request.

SGMC Microwave
sgmcmicrowave.com

Get info at www.HFeLink.com
Diplexer

Response Microwave features a diplexer for use in specific telecom antenna applications. The new RMDU.0-25004310f offers Tx band of DC-1GHz and Rx band of 1.5-2.5GHz, with typical electrical performance of 0.5dB max insertion loss, 14db min return loss and 35dB minimum rejection over the band. Power handling is 50W CW and PIM is -150dBc. The unit is operational over the -10° to +85° C range and mechanical package is 2.4 x 7.30 x 1.3inches, plus 4.3/10 female connectors. Alternate bands and connectors are available on request.

Response Microwave
responsemicrowave.com

E-Band Mixer

Spacek Labs model M80 5X2B is an E band mixer covering the two radio bands of 71 to 76 GHz and 81 to 86 GHz. The mixer includes an integrated LO doubler, so that the customer need only supply a 39 GHz source with +16 dBm of power. Spacek Labs can also supply a phase locked source with the assembly. The conversion loss over the band is 6 dB typ and 9 dB max, with an IF frequency range of 2 to 8 GHz. The input P1dB is 6 dBm typ, and the bias is +12 VDC at 10 mA. The RF ports is WR 12 waveguide, LO input port is 2.92mm coax connector and the IF port connector is SMA (f).

Spacek Labs
spaceklabs.com
Wideband Transceiver

Norden Millimeter model NUDC2-18/1.3-2.3 is a Wideband Microwave Transceiver in a low-SWaP 3U module.

The NUDC2-18/1.3-2.3 is a dual conversion transceiver providing 2-18 GHz operation in a versatile OpenVPX platform. The NUDC2-18/1.3-2.3 includes internal LOs which provide an instantaneous IF bandwidth of 1 GHz and exceptional Noise Figure: Down Converter NF= 6dB max, Up Converter NF=15dB max.

Norden Millimeter
nordengroup.com

Comb Generators and More

Herotek has been a quality supplier of RF and Microwave components since 1982. Herotek is a broad-based, high technology company supplying parts for the Military, Industrial and Commercial markets with designs from DC to 75 GHz. It offers standard products as well as thousands of custom designs, and is happy to match existing products. Herotek offers Detectors, Comb Generators, Limiters, Switches, GaAsFet Amplifiers (Broadband, Low Noise, and Power) and integrated subsystems of many types, including up and down converters, multipliers, harmonic mixers, and transceivers.

Herotek
herotek.com
Discrete Power GaN HEMTs and More

AMCOM RF Transistors include Discrete Power GaN HEMTs, GaAs FET (good linearity at back-off) and GaAs pHEMT (good power density and efficiency).

AMCOM has all the expertise, manpower, space, and equipment for manufacturing state-of-the-art products. Some of our capabilities are: active device design, MMIC design, and power amplifier module design. In addition, we are experts in device/MMIC packaging, module assembly and RF/DC testing. For active devices, we either procure parts such as silicon LDMOS, or GaN HEMT, or we use a semiconductor foundry to fabricate our own proprietary device/MMIC.

AMCOM was established in December 1996 by a group of microwave designers experienced in both microwave circuit design and microwave device fabrication technology. It is located in Gaithersburg, Maryland, USA, about 20 miles northwest of Washington, DC.

The company has earned a reputation as a leading edge microwave design organization that includes power FETs, MMIC power amplifiers, as well as high-power amplifier modules with RF and DC connectors that are ready to be used in microwave systems. One of our specialty products is high-power, broadband, high-efficiency power amplifiers.

AMCOM offers a variety of discrete GaN transistors with different power levels and operating frequencies. Our GaN transistors are offered in both bare die and packaged forms. We have designed many EVBs (evaluation boards) at different frequencies to provide customers with the best support.

<table>
<thead>
<tr>
<th>Model</th>
<th>Freq</th>
<th>$V_{DS}$</th>
<th>$I_{DS}$</th>
<th>EVB #1</th>
<th>EVB #2</th>
<th>EVB #3</th>
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<tbody>
<tr>
<td>AM005WN-BI-R</td>
<td>DC-8 GHz</td>
<td>28V</td>
<td>0.08A</td>
<td>$f=1.5-2$ GHz, Psat=33.5 dBm, SSG=15 dB, PAE=55%</td>
<td>$f=2.9-3.4$ GHz, Psat=33.5 dBm, SSG=15 dB, PAE=50%</td>
<td>$f=5.6-6.2$ GHz, Psat=33.5 dBm, SSG=15 dB, PAE=45%</td>
</tr>
<tr>
<td>AM012WN-BI-R</td>
<td>DC-8 GHz</td>
<td>28V</td>
<td>0.18A</td>
<td>$f=1-1.3$ GHz, Psat=37.5 dBm, SSG=20 dB, PAE=56%</td>
<td>$f=2.4-3.4$ GHz, Psat=37 dBm, SSG=17 dB, PAE=51%</td>
<td>$f=4.6-5.8$ GHz, Psat=37 dBm, SSG=13.5 dB, PAE=47%</td>
</tr>
<tr>
<td>AM025WN-BI-R</td>
<td>DC-6 GHz</td>
<td>28V</td>
<td>0.35A</td>
<td>$f=0.75-3$ GHz, Psat=40 dBm, SSG=15 dB, PAE=55%</td>
<td>$f=1.8-3.8$ GHz, Psat=40 dBm, SSG=15 dB, PAE=55%</td>
<td>$f=4.6-5.3$ GHz, Psat=40 dBm, SSG=13.5 dB, PAE=50%</td>
</tr>
<tr>
<td>AM050WN-CU-R</td>
<td>DC-5 GHz</td>
<td>28V</td>
<td>0.75A</td>
<td>$f=1.7-2.1$ GHz, Psat=43 dBm, SSG=16 dB, PAE=55%</td>
<td>$f=2.3-3.5$ GHz, Psat=43 dBm, SSG=15 dB, PAE=50%</td>
<td>$f=4.4-5$ GHz, Psat=43 dBm, SSG=14 dB, PAE=45%</td>
</tr>
<tr>
<td>AM100WN-CU-R</td>
<td>DC-4 GHz</td>
<td>28V</td>
<td>1.5A</td>
<td>$f=0.5-1.5$ GHz, Psat=46 dBm, SSG=18 dB, PAE=50%</td>
<td>$f=1.8-2.4$ GHz, Psat=46 dBm, SSG=14 dB, PAE=50%</td>
<td>$f=2.4-3.6$ GHz, Psat=46 dBm, SSG=13 dB, PAE=45%</td>
</tr>
</tbody>
</table>

For S-parameters, load pull data and more information please visit: www.amcomusa.com

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**Vertical Launch Connector**

Southwest Microwave released the industry’s first board (PCB) mounted 1.0 mm (W) Vertical Launch Connector.

For microstrip or grounded coplanar waveguide (GCPW) designs, Southwest Microwave vertical launch connectors provide optimal signal integrity, are reusable and can be installed without soldering. The new 1.0 mm Vertical Launch Connector delivers low insertion loss and a VSWR of 1.35:1 max across 70 to 105 GHz and a VSWR of 1.6:1 max across the complete 110 GHz bandwidth. Data represents two 1.0 mm connectors mounted on testboard.

**Southwest Microwave**
southwestmicrowave.com

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**Direct Digital Synthesizer: 10 MHz to 1 GHz**

Avid Systems announces the AVS-1012, a coherent direct digital synthesizer capable of output frequencies from 10MHz to 1 GHz. The AVS-1012 uses a multi-modulus NCO to provide an exact frequency output and can switch to any frequency in 160 nS. The AVS-1012 produces a spectrally pure output with spurious less than -75 dBc as well as outstanding phase noise characteristics. The modular design allows customers to specify output power and operating frequency.

**Avid Systems**
avid-systems.com
Up to 50 GHz!

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*Varies by model. See individual model data sheets for details.
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**Applied RF Engineering I**
Next Session Starts Soon! - Online - Rex Frobenius

**Radio Systems: RF Transceiver Design from Antenna to Bits & Back**
Feb. 25 - Mar. 01, 2019, San Diego, CA - Dr. Waleed Khalil

**mm-Wave RFIC and MMIC Design Techniques**
February 25-27, 2019, San Diego, CA - Dr. Ali Darwish

**Transceiver and Systems Design for Digital Communications**
February 25-27, 2019, San Diego, CA - Scott Bullock

**Cognitive Radios, Networks, & Systems for Digital Communications**
Feb. 28 - Mar. 01, 2019, San Diego, CA - Scott Bullock

**GaN Power Amplifiers - Web Classroom**
April 2-4, 2019, Online, On-Demand - Dr. Ali Darwish

**Phase Noise & Jitter - Web Classroom**
April 8-10, 2019, Online, On-Demand - Dr. Waleed Khalil

**Power Amplifier ABCs - Web Classroom**
May 6-10, 2019, Online, On-Demand - Allen Podell

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Enclosure: Highest EMI/RFI Protection Available

The US National Defense Authorization Bill H.R 1540 now passed the House and the Senate. The bill requires our nation’s Defense and infrastructure to sustain an EMP attack both natural and man-made. The threats that the bill mainly focuses on are the following:

EMP weapons: These weapons on a large scale could have a catastrophic effect such as damaging the power systems, electronics and information systems that make up our nation’s infra-

Equipto’s new R6 shielded enclosure line offers the highest level of protection to your electronics both from Electromagnetic Pulse and Electromagnetic Radiation effects.

structure. On a smaller directional scale, the weapons can damage surveillance systems, industrial production lines and automotive electronics.

Solar storms: Geomagnetic storms could damage large transformers hence resulting in a black-out for almost a year. They also have a devastating effect on the electronics that are crucial for the infrastructure of our country.

Equipto’s new R6 shielded enclosure line offers the highest level of protection to your electronics both from Electromagnetic Pulse and Electromagnetic Radiation effects. The R6’s cost-effective design is compact and mobile while providing Shielding Effectiveness comparable to an anechoic chamber.

Equipto Electronics equiptoelec.com

The Ka Band is hot! New Ka Shield rack enclosures provide serious protection for EMI/RFI signal intrusions or leakage with sensitive equipment from RF to the microwave Ka Band. With shielding effectiveness of over 75 dB at 40 GHz, the enclosure provides an essential defense against EMP weapons and geomagnetic storms that can “take out” communication centers, power plants, µP-controlled infrastructure, surveillance systems and more.

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- Adjustable mounting rails; punched, threaded or square holes

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Get info at www.HFeLink.com
Multicoax Connector

Amphenol Ardent Concepts has released a form factor of its TR Multicoax connector. The connector was designed specifically for solving signal integrity issues caused by serpentine trace routing from high speed devices. TR Equal Trace delivers superior signal integrity from multiple high-speed channels in an arched footprint, making it ideal for applications where equal and short trace lengths are imperative for performance tuning. In these cases, TR Equal Trace can eliminate the need to create complicated serpentine traces, helping to ensure signals reach their destination at the same time in data and clock routing for peak performance. The tight pitch of TR Equal Trace gets the connector closer to the device to reduce signal loss.

Amphenol Ardent Concepts
ardentconcepts.com

26.5 GHz RF Downconverter

The SC5318A is a C to K broadband single-stage downconverter, converting frequencies from 6 GHz to 26.5 GHz down to 50 MHz to 3 GHz. The LO frequency range is from 6 to 26.5 GHz with an input LO range from 6 to 14 GHz. An internal frequency doubler multiplies the input LO range up to 26.5 GHz. This module also features an internal 26.5 GHz synthesized LO, RF preamplifier, and variable gain control, making it a standalone module. The SC5318A may be paired together for MIMO applications such as ground-based satellite communications, point-to-point radio, and test instrument systems.

SignalCore
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Custom Microwave Components and More

Designers in the RF-microwave industry require higher frequencies, lower spurious and phase-noise performance, smaller footprints, and more cost-effective components and assemblies.

Oscillator-Based Microwave Components

NI’s broad array of microwave components include voltage-controlled oscillators (VCOs), fixed-tuned oscillators (FTOs), phase-locked oscillators (PLOs), digitally tuned oscillators (DTOs), high-speed clocks, and frequency multipliers up to 67 GHz and beyond.

Integrated Microwave Assemblies (IMAs)

The popular QuickSyn frequency synthesizer is widely utilized in both military and commercial applications.

To respond to rapid advances in technology across multiple industries, the NI team leverages its extensive microwave-technology knowledge to design and manufacture highly complex, multi-function integrated microwave assemblies (IMAs) as solutions for engineering challenges.

QuickSyn Frequency Synthesizers

The popular QuickSyn frequency synthesizer is widely utilized in both military and commercial applications. The revolutionary phase-refining technology used in QuickSyn synthesizers enables fast-switching speeds, low phase noise, and low spurious performance.

NI Microwave Components
http://ni-microwavecomponents.com/
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Founded in 1849, Ducommun is the oldest company in California. Evolving from a hardware supply store opened by Charles Ducommun in Los Angeles during the California Gold Rush, the company assisted in the birth of the aerospace industry in Southern California by providing aircraft aluminum to early aerospace pioneers like Lindbergh, Douglas and Lockheed.

Today, Ducommun is a global provider of innovative manufacturing solutions for customers in the aerospace, defense and industrial markets. We specialize in two core areas – Electronic Systems and Structural Systems – to produce complex products and components for commercial aircraft platforms, mission-critical military and space programs, and sophisticated industrial applications.

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Women in Engineering: Thoughts from EDI CON USA

Sherry Hess, VP of Marketing, AWR Group, NI

I recently participated in a panel at EDI CON USA, where we discussed “Skills Employers Will Want in 2020.” The inspiration for this panel came from a recent study by the World Economic Forum (WEF) revealing that employers will not only look at the core skills necessary as an engineer but also communications skills – the ability to communicate your ideas with others and to get along as a team.

In this guest editorial I’m sharing a few of the discussion points that resonated well with me and would be of value to men as well as women seeking to further their careers in engineering.

As VP of marketing for a large tech company and being in the industry for over 20 years, do you and if so how do you see change happening with corporate hiring initiatives?

I like to call myself an outgoing nerd, and as such most early managers I worked for said that I’d be a natural for sales and marketing. Today, however, I don’t see that same assumption being applied to new college grads with an engineering background. With a greater focus on diversity of people and skills for filling technical roles across the spectrum of departments in a high-tech firm, I see change happening as I write this blog.

Regardless, I credit millennials in large part for changing the needs of what they want from a career/job to accelerate a necessary change in the tech industry where collaboration and empathy, as well as technical abilities, are all being valued as equally important skills to possess. You even see this in the college application process now where the pure testing score is not the only criteria for admission and ultimate success. And credit also goes to big firms like Intel, who launched a diversity challenge several years ago now to raise awareness of the need to change who we hire in tech and is also doing something about it.

On the thought thread of diversity, how do we develop strong, diverse teams?

I look for a mix of skills across team members. While we all possess multiple skills, a team should have a healthy mix of all the skills covered by the WEF (problem solving, critical thinking, creativity, people management, coordinating with others’ emotional intelligence, judgement and decision making, and service orientation) and then the manager must ensure that each team member has the opportunity to contribute. Ideas need to be heard and nurtured. For many cultures and personalities, speaking up is not necessarily a natural state and so we must ensure we make all team members feel comfortable and confident to join the conversation. Great ideas trapped inside someone’s grey matter do absolutely no good to anyone.

From your own experiences, why has engineering been a largely male-dominated field and what can we do to close the gap?

From my own experiences - both from a career trajectory as well as from raising a wonderful daughter – I have become more aware of the societal pressures in that at an early age, girls who are very capable in STEM are persuaded by outside messaging to pursue other non-STEM careers. It may also be inherent that the “E” in STEM is not tapping into the making the world a better place. I had a female engineering intern not long ago who told me she only wants to work for a green tech firm, so she can make the world a better place. Of course, we can change the messaging to which we expose these young ladies and that is happening. However, in the very near term I’ve been involved in shining a spotlight on female role models for younger girls and women to know exist, to ask questions of, and perhaps emulate. The recent movie “Hidden Figures” is an excellent example and has impact. To close the gap, we can’t have this type of messaging be a “one off” every few years. It needs to become a regular/normal narrative.

This topic and the panelists at EDI CON USA turned out to be a winning combination. The standing-room-only crowd (in excess of 40 persons – both male and female) remained for the full hour and engaged in meaningful dialogue as well. In addition to the panelist viewpoints, audience members also asked their own questions, which pushed the panel past its allotted time... a great indicator of success!
12-Way Coaxial Splitter/Combiner Channels 0.6 to 6.0 GHz

Mini-Circuits’ model ZM12PD-63-S+ is DC-passing coaxial power splitter/combiner with wide frequency range of 0.6 to 6.0 GHz. This 12-way, 0° model can handle as much as 20W RF/microwave input power as a splitter and as much as 1.5W power at each input port as a combiner. Insertion loss (above nominal 10.8-dB division loss) is typically 1.4 dB to 3 GHz and 3.0 dB to 6 GHz while isolation between ports is typically 19 dB. The typical output VSWR is 1.5:1 through 6 GHz. The amplitude balance is controlled to typically 0.4 dB to 3 GHz and 0.9 dB to 6 GHz while phase balance is maintained within 8 deg. to 3 GHz and within 10 deg. to 6 GHz. The RoHS-compliant power splitter/combiner is housed in an aluminum alloy case measuring 8.5 × 9.5 × 0.5 in. (215.90 × 241.30 × 12.70 mm) with SMA connectors. It is designed for operating temperatures from -55 to +100°C.

Surface Mount Bidirectional Coupler Handles 140W from 2 to 6 GHz

Mini-Circuits’ model BDCH-20-63A+ is a stripline-based surface mount bidirectional coupler with power-holding capability to 140W, covering applications from 2 to 6 GHz. This model provides 18 dB coupling across its full frequency range, with coupling flatness of ±0.5 dB, 29 dB directivity, and 26 dB return loss. The full-band insertion loss is typically only 0.15 dB. The coupler is supplied as an open printed laminate measuring 1.00 × 0.35 × 0.067 in. (26.40 × 8.89 × 1.70 mm) with wrap-around terminations to simplify solder connections to your PCB. It is designed for operating temperatures from -55 to +105°C.

Coaxial Bidirectional Coupler Handles 250W from 380 to 3700 MHz

Mini-Circuits’ model ZGBDC10-372HP+ is a coaxial, DC-passing bidirectional coupler capable of handling CW power levels up to 250W from 380 to 3700 MHz. This model provides 10 dB coupling across its full frequency range, with coupling flatness of ±0.2 dB from 600 to 3700 MHz. It provides low mainline loss of 0.18 dB, 20 dB typical directivity, and 24 dB return loss. Based on suspended-substrate technology, the 50Ω bidirectional coupler can pass as much as 3A current from input to output. The coupler features a rugged, sealed housing measuring 5.93 × 2.40 × 1.00 in. (150.62 × 60.96 × 25.40 mm) with Type N connectors, making it ideal for use in field applications or in the lab.

Ultra-Wideband MMIC Directional Coupler Covers 6.0 to 26.5 GHz

Mini-Circuits’ model EDC10-273+ is a surface-mount, GaAs MMIC directional coupler with a frequency range from 6.0 to 26.5 GHz. The 10 dB coupler offers typical coupling flatness of ±1.5 dB across the full frequency range. It has low mainline loss of typically 1.4 dB and maintains typical directivity of 15 dB through 18 GHz and 11 dB to 26.5 GHz. The typical input return loss is 24 dB to 10 GHz, 17 dB to 18 GHz, and 15 dB to 26.5 GHz. The typical output return loss is 22 dB to 10 GHz and 16 dB or better through 26.5 GHz. The typical coupled-port return loss is 24 dB to 10 GHz and 14 dB or better through 26.5 GHz. The miniature directional coupler is supplied in a 24-lead QFN package measuring just 4×4 mm.

Coaxial Directional Coupler Extends from 2 to 40 GHz

Mini-Circuits’ model ZCDC13-K0244+ is an extremely wideband, DC-passing directional coupler with operating frequency range of 2 to 40 GHz. This model provides 13 dB coupling with flatness of ±0.6 dB across the frequency range, and typical directivity of 16 dB through 40 GHz. It can handle signal power levels up to 20W with low mainline loss of typically 0.8 dB through 18 GHz and 1.5 dB through 40 GHz. The input, output, and coupled-port return losses are typically 14.0 dB through 18 GHz and 11.7 dB through 40 GHz. The broadband, RoHS-compliant directional coupler is well suited for many applications in 5G, fixed-satellite, mobile-communications systems, and more. It measures 2.25 × 0.7 × 0.50 in. (57.15 × 17.78 × 12.70 mm) with 2.92-mm female coaxial connectors and can handle operating temperatures from -55 to +100°C.

Coaxial 1W Termination Spans DC to 50 GHz

Mini-Circuits’ model ANNEF-50V+ is an ultra-wideband coaxial termination covering the DC to 50 GHz range. It handles RF/microwave signal power levels to 1W (+30 dBm) and exhibits typical return loss of 20 dB through 50 GHz. Designed for long operating lifetime, the durable 50Ω termination is supplied in a passivated stainless-steel case. Its handy female 2.4-mm connector eliminates the need for additional coaxial adapters at different frequency bands, since it mates with 1.85-mm, 3.5-mm, 2.92-mm, and SMA coaxial connectors. The RoHS-compliant component is 0.61 in. long with diameter of 0.31 in. It is designed for operating temperatures from -55 to +100°C.
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