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Including These Connector Series

<table>
<thead>
<tr>
<th>Connector Series</th>
<th>Frequency Range</th>
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<tbody>
<tr>
<td>1.85mm</td>
<td>DC-65 GHz</td>
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<tr>
<td>2.4mm</td>
<td>DC-50 GHz</td>
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<tr>
<td>2.92mm</td>
<td>DC-40 GHz</td>
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<tr>
<td>3.5mm</td>
<td>DC-34 GHz</td>
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<tr>
<td>7mm</td>
<td>DC-18 GHz</td>
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<tr>
<td>SSMA</td>
<td>DC-40 GHz</td>
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ISO 9001:2008

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HFE recently spoke with Subbaiah Pemmaiah, Applications Engineer at Copper Mountain Technologies. The topic was the millimeter-wave network analysis using Copper Mountain’s CobaltFx FET1854 50 Ohm Frequency Extension System.

This one covers 18 to 54 GHz with coaxial interfaces to the device under test (DUT). Subbaiah provided a detailed description of these compact measurement devices, appropriate for emerging 5G and defense related millimeter-wave applications.

These modular frequency extender modules can interface with the CMT Cobalt 9 GHz or 20 GHz high-performance vector network analyzers. Other frequency extender modules cover higher dedicated frequency bands: 50-75, 60-90, 75-110, 90-140, 110-170, 140-220, 170-260, and 220-330 GHz (with appropriate sized WR waveguide DUT interface). Measurements are rapid, typically 10 microseconds/data point, with a dynamic range up to 152 dB with the base VNA only and 130 dB with the extenders (at 10 Hz IF bandwidth).

Its superior and modern architecture permits highly accurate and stable millimeter-wave S-parameter measurements. Frequency extension is a standard feature in downloadable software, which can be acquired from their website and used offline at any time. Data storage is accomplished in the desktop or laptop computer.

There is no need for memory in Copper Mountain Technologies’ equipment, delivering a significant cost savings.

—Tom Perkins
Senior Technical Editor
Anritsu Company introduced Forward Error Correction (FEC) symbol capture and Bathtub test functionality for its 116-Gbit/s PAM4 Error Detector (ED) MU196040B in its Signal Quality Analyzer-R MP1900A BERTs. With the latest application software installed, the MP1900A conducts highly accurate bit error rate (BER) evaluations of 400 GbE and 800 GbE communications equipment and devices used in data centers servicing 5G networks.

Anritsu developed each software package to support the growing demand for 400 GbE/800 GbE network elements. Both solutions support quantitative measurement of PAM4 Signal Integrity, such as jitter tolerance tests, to evaluate the performance of high-speed devices and transceivers.

The FEC symbol capture function software allows the MP1900A to evaluate FEC-based network elements. The new MP1900A ED functions analyze errors to evaluate if they can be corrected by FEC. It only captures data streams when the burst errors exceed the FEC uncorrectable threshold. From the captured data, a user can determine and troubleshoot the type of data stream that caused the uncorrectable burst errors.

Anritsu also added the PAM4 Bathtub test software so engineers can use the MP1900A to evaluate and quantify jitter phase margin. This testing capability is critical, as jitter becomes more severe as the data-stream baud rate increases to achieve the higher traffic capacity associated with 400 GbE/800 GbE transmissions.

**MP1900A Overview**

The modular MP1900A BERT running embedded Windows 10 is easily expandable to meet evolving test requirements. As well as supporting 400 GbE and 800 GbE PAM4, it is a market-leading bit error rate tester (BERT) for various high-speed interfaces, including PCI Express® 5.0 and USB4™, using a full line of modules and application software. In addition to more accurate BER measurements, the MP1900A helps shorten development times for high-speed devices and transceivers.

**Anritsu Company**

anritsu.com
6: Editorial
IMS2020 is Going Virtual
By Tim Lee

The IMS2020 team of IEEE volunteers and staff could not have imagined what we are bringing to the microwave community – the first ever International Microwave Symposium and Microwave Week (IMS, RFIC and ARFTG) virtual event. Our virtual conference is slated to start 4 - 6 August 2020 with live-streamed events, immediate access to pre-recorded Technical Programs for IMS2020, RFIC2020 and ARFTG 2020 through the end of September 2020 via on-demand capabilities and the first ever virtual International Microwave Week Trade Exhibition. Our IMS2020 theme of “Connectivity Matters” was selected last summer to highlight that wireless communications enabled by our technologies would enable important use cases like Microwave Systems for 5G, Autonomy, Smart Cities, eHealthcare and Industry 4.0. IMS had accepted 734 papers and an additional 20 papers as late breaking news. We had a full program that included Keynotes, many Technical Workshops, Technical Lectures, Panels, Student competition, 5G Summit and 3MT competition. The IMS exhibition is a crucial venue to announce new products, promote brands, rekindle current relationships and build new ones. With this in mind we are developing a virtual exhibition to facilitate the benefits of a face-to-face trade show optimized for online interaction.

22: Feature Article
Tutorial: Half Band Filters
By Ain Rehman

Half band filters are useful digital filters that have symmetric impulse responses and generally about half their impulse response consists of 0 (zero) thus allowing for fewer multiplications. One of their prime uses is in decimation of multirate digital signals. The following discussion presents more details on the half band filter as well as its usage in the decimation filter. “In digital signal processing, half-band filters are widely used for their efficiency in multi-rate applications. A half-band filter is a low-pass filter that reduces the maximum bandwidth of sampled data by a factor of 2 (one octave). When multiple octaves of reduction are needed, a cascade of half-band filters is common. And when the goal is downsampling, each half-band filter needs to compute only half as many output samples as input samples.” Wikipedia.

16: Featured Products

Mercury Systems’ signal source subassemblies are critical to the performance of any frequency conversion system. Through a continued focus on innovation, advanced packaging and SWaP optimization, we have developed a line of synthesizers, signal generators, and VCOs that meet the most challenging specifications and stand up to the toughest environments. These products provide cutting edge performance to enable the most advanced RF systems. Contact us to learn how our off-the-shelf products and custom solutions can support your next design.

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IMS2020 is Going Virtual

Tim Lee
IMS2020 General Chair

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With the impact of COVID-19, Connectivity is relevant more than ever as the entire world depends on Connectivity for remote work, education, entertainment and research to attack the COVID-19 pandemic. Broadband services are essential services. Those without connectivity are left behind, or worse yet, unable to be informed for health and safety.

Starting in late February, when COVID-19 infections and deaths were growing rapidly, we started monitoring the situation. By March, all domestic and international travel was shut down, and many countries went into stay-at-home orders. We learned to live with new health guidelines for social distancing. Many conferences were being cancelled, moved or turned into virtual events. By early May, it was clear that our selected venue, the Los Angeles Convention Center (LACC), was not able to host IMS for our June dates.

Very quickly, the IMS/RFIC/ARFTG team created a recovery plan with the objectives to a) ensure a path for the authors’ work to be published in IEEE Xplore and b) to meet as many success criteria as we can for all of our stakeholders (authors, students, practitioners, exhibitors). Therefore we are now planning a virtual technical conference WITH a virtual trade exhibition. I don’t think this has been done before in IEEE, but we believe the interaction opportunities, networking between colleagues, and business information exchange constitute a core value that IMS brings to our technical community. Using a versatile platform, IMS2020 will offer:
Live Events and Virtual Exhibition: 4 - 6 August 2020
- Pre-recorded "On Demand": 4 August - 30 September 2020
- Daily live stream event times are Pacific (PDT)

The live-streamed events during 4 - 6 August 2020 will include:
- RFIC Plenary Session
- IMS Plenary & Closing Sessions
- ARFTG Keynote Session
- 5G Summit
- Three Minute Thesis (3MT)
- Panel Sessions
- HAM, WIM & YP Sessions
- Virtual Exhibition

On-Demand events will include:
- IMS, RFIC and ARFTG Technical Sessions (IF & Oral)
- Technical Lectures
- MicroApps and Industry Workshops

We have made our Registration Rate schedule extremely attractive – single pricing for all technical content (all you can eat) during the two-month duration that the Virtual IMS2020 will be hosted. Authors pay a bit more since we are processing their papers for submission into IEEE Xplore. I want to highlight that we are taking this unique opportunity to engage the entire IEEE Microwave Theory and Techniques Society (MTT-S) membership by offering them no-cost registration. Simply register with your IEEE membership number for verification.

All relevant IMS2020 Virtual Event information can be found at https://ims-ieee.org/registration-travel/registration-information. Stay informed and download our IMS mobile app on Android and IOS by searching for “IMS Microwave Week” in your app store.

We extend our heartfelt thanks to all of our authors, technical attendees and exhibiting community for your understanding and appreciate your continued support of the RF & Microwave Community.

See you online at the IMS2020 Virtual Conference and Trade Exhibition!

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Meetings and Events

**2020 IEEE/MTT-S International Microwave Symposium (IMS)**

21 - 26 July 2020  |  Los Angeles, California, USA
Field of Interest: Components, Circuits, Devices and Systems; Communication, Networking and Broadcast Technologies; Engineering Profession; Fields, Waves and Electromagnetics; Photonics and Electrooptics.

**2020 45th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz)**

13 - 18 September 2020  |  Buffalo, New York, USA
Field of Interest: Aerospace; Bioengineering; Communication, Networking and Broadcast Technologies; Components, Circuits, Devices and Systems; Engineered Materials, Dielectrics and Plasmas; Fields, Waves and Electromagnetics; Photonics and Electrooptics; Signal Processing and Analysis

**2020 50th European Microwave Conference (EuMC)**

15 - 17 September 2020  |  Utrecht, Netherlands
Field of Interest: Communication, Networking and Broadcast Technologies; Components, Circuits, Devices and Systems; Fields, Waves and Electromagnetics; Photonics and Electrooptics

**2020 17th European Radar Conference (EuRAD)**

16 - 18 September 2020  |  Utrecht, Netherlands
Field of Interest: Aerospace; Communication, Networking and Broadcast Technologies; Components, Circuits, Devices and Systems; Fields, Waves and Electromagnetics; Signal Processing and Analysis; Transportation

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**HFE’s August Issue**

Defense Electronics

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“Look to the leader in YIG-Technology”
COVID-19 Accelerates the Adoption of Civil Drone Shipments

Like many technologies, the future of robotics is being complicated by COVID-19. But more than any other technology, robotics developers have visibly demonstrated the value of more flexible automation to meet the enormous challenges being placed on businesses and governments.

While shipments in autonomous last-mile delivery and commercial cleaning robot shipments will be bolstered by the pandemic, drones for civil use-cases will see the most immediate and long-term growth. Civil drone shipments will nearly double from 2020 pre-pandemic forecasts to reach 13,400; and nearly 80,000 shipments will take place in 2025, states global tech market advisory firm, ABI Research.

In its new whitepaper, Robotics and Covid-19: Challenges and Opportunities, ABI Research reveals how COVID-19 has been the catalyst for change in the robotics industry and explores how the industry is well-placed to accelerate its deployments by enabling both corporations and governments to tackle this crisis.

“Having over a quarter of the world under lockdown would have been a mad prediction the start of 2020,” says Rian Whitton, Senior Analyst at ABI Research. “Now, with a stay at home orders being relaxed, and gatherings limited, governments are turning to drones for emergency, health, and law enforcement.”

“Drones are essentially acting as a platform for various cameras for facial recognition and crowd control. Some are equipped with infrared cameras to measure temperature. In fact, we’ve seen some infrared camera manufacturers’ orders skyrocket because businesses want to check employee’s temperature before they come to work,” says Whitton.

Many drones are deployed with loudspeakers to enforce curfews and surveil areas for security purposes, which poses a big opportunity for aerospace and drone companies to increase sales to government agencies. Delivery drones have also become more prominent during the crisis. In China, delivery drones have made more than 3,000 trips carrying 11 tons of supplies to Wuhan. In early February, the U.S. Federal Aviation Administration (FAA) began creating safety standards for specific delivery drone models, accelerating testing and eventual commercialization in the United States. ABI Research expects the small drone delivery market will reach US$10.4 billion by 2030.

Drone manufacturers received US$281 million in investment in 2019 and drone services received US$497 million. “While the industry has been wracked by the commodification of consumer drones and major incidents affecting the presumed safety of large-scale drone operations, the value of commercial services is not in doubt, and the industry will receive significant increases in orders from law enforcement agencies as a result of COVID-19,” Whitton concludes.

—ABI Research
abiresearch.com

While COVID-19 Slows Consumer 5G Deployment, 5G for Enterprise Gets a Boost

While COVID-19 has been responsible for a significant increase in data traffic as more work is moved to people’s homes, 5G has proven to have many benefits beyond being the next generation for consumer mobile broadband. Several new use cases enabled by 5G deployments have been of great help to enterprises during this global pandemic and will help spur deployments, finds global tech market advisory firm, ABI Research.

As the spread of COVID-19 continues, more than 1 billion people worldwide are in either full or partial lockdown, confined to their homes as governments are trying to moderate the spread of the virus. During this difficult time, all telco network operators report increases of 30% - 40% in all kinds of traffic, both fixed and mobile. “It seems that, so far, telco networks are coping, and the overprovisioning measures operators have been deploying their networks are paying off. User-perceived speed and user experience may have dropped, but networks are still operating at an acceptable level,” explains Dimitris Mavrakis, Research Director at ABI Research.

However, lower overall consumer confidence, potential supply chain disruptions, and potential migration of mobile broadband traffic to fixed broadband in busy urban locations will mean that the deployment of 5G for consumer use cases will slow down. ABI Research forecasts that 5G network Capital Expenditure (CAPEX) will likely suffer a 10% decline during 2020, but this will be accounted for later in 2020 and 2021, when operators will increase spending to make up for this delay. ABI Research also expects that the heavy effects of the crisis will subside in June 2020, after which the world will slowly start to go back to its natural routines.

“On the other hand, 5G in China is illustrating new use cases that provide true benefits to enterprise,” Mavrakis points out. China has already illustrated that 5G has been used as a key technology in new hospitals and, in a way, fulfilling network requirements that no other technology can. For example, China Mobile deployed 5G in Wuhan’s Huoshenshan hospital that was rapidly built to handle the outbreak.

—ABI Research
abiresearch.com
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The 0402DC also features wirewound construction for extremely high self resonance – up to 28.8 GHz – and offers DCR as low as 25 mΩ, significantly lower than other inductors this size.

Equip your lab with the ultimate impedance matching resource. Our C472-2 Designer’s Kit has 20 samples of all 112 values! Purchase one online at **www.coilcraft.com/0402DC**.
Long-range Communications without Large, Power-Hungry Antennas
Establishing long-range tactical communications for U.S. troops in remote locations currently requires giant parabolic dishes, tall pole-mounted antennas, large antenna domes, and high-power amplifiers. Besides their significant weight, power, and cost (SWAP-C), these antennas present large visual and radio frequency (RF) signatures, are vulnerable to jamming, and constitute a single point of failure.

To break this dependence on big antennas and amplifiers, DARPA recently announced the Resilient Networked Distributed Mosaic Communications (RN DMC) program. RN DMC aims to provide long-range communications through “mosaic” antennas composed of spatially distributed low SWaP-C transceiver elements or “tiles.” This approach replaces high-powered amplifiers and large directional antennas with mosaics of dispersed tile transceivers. Transmit power is distributed among the tiles, and gain is achieved through signal processing rather than by a physical antenna aperture to concentrate energy.

“This is a fundamentally different way to think about long-range tactical communications that supports DARPA’s Mosaic Warfare concept of busting monolithic systems and distributing capability for greater resilience at less expense,” said Paul Zablocky, program manager in DARPA’s Strategic Technology Office. “RN DMC seeks to develop a mobile, self-forming, self-healing mosaic antenna comprising numerous low-cost and low-power transceiver tiles that can be placed aboard ships, vehicles, unmanned and manned aircraft, and satellites, as well as individual squad members.”

The antenna mosaic concept could prove more robust against failure or attack since tiles are distributed across air, ground, and sea assets. Tiles also promise to be lower cost – targeted at $1,000 or less apiece – making individual tiles expendable without losing the mosaic antenna functionality.

“Powerful signal processing in a small, inexpensive form factor is the key enabling mosaic antenna technology,” Zablocky said. “We will leverage small form factor software-defined radios and radio frequency systems on a chip as well as previous DARPA research and development efforts that have validated the feasibility of basic distributed coherent radio transmissions.”

RN DMC includes three focus areas: system design, experimental performance validation, and operational architecture definition. The effort is divided into three planned phases, totaling 45 months.

—DARPA

First Bug Bounty Program to Hack SSITH Hardware Defenses
Electronic systems – from the processors powering smartphones to the embedded devices keeping the Internet of Things humming – have become a critical part of daily life. The security of these systems is of paramount importance to the Department of Defense (DoD), commercial industry, and beyond. To help protect these systems from common means of exploitation, DARPA launched the System Security Integration Through Hardware and Firmware (SSITH) program in 2017. Instead of relying on patches to ensure the safety of our software applications, SSITH seeks to address the underlying hardware vulnerabilities at the source. Research teams are developing hardware security architectures and tools that protect electronic systems against common classes of hardware vulnerabilities exploited through software.

To help harden the SSITH hardware security protections in development, DARPA today announced its first ever bug bounty program called, the Finding Exploits to Thwart Tampering (FETT) Bug Bounty. FETT aims to utilize hundreds of ethical researchers, analysts, and reverse engineers to deep dive into the hardware architectures in development and uncover potential vulnerabilities or flaws that could weaken their defenses. DARPA is partnering with the DoD’s Defense Digital Service (DDS) and Synack,
a trusted crowdsourced security company on this effort. In particular, FETT will utilize Synack’s existing community of vetted, ethical researchers as well as artificial intelligence (AI) and machine learning (ML) enabled technology along with their established vulnerability disclosure process to execute the crowdsourced security engagement.

Bug bounty programs are commonly used to assess and verify the security of a given technology, leveraging monetary rewards to encourage hackers to report potential weaknesses, flaws, or bugs in the technology. This form of public Red Teaming allows organizations or individual developers to address the disclosed issues, potentially before they become significant security challenges.

“The FETT Bug Bounty is a unique take on DARPA’s more traditional program evaluation efforts,” said Keith Rebello, the DARPA program manager leading SSITH and FETT. “FETT will open SSITH’s hardware security protections to a global community of ethical researchers with expertise in hardware reverse engineering to detect potential vulnerabilities, strengthen the technologies, and provide a clear path to disclosure.”

While most bug bounty programs focus on software evaluation, FETT is unique in making hardware instances available for Red Teaming. Security researchers will be given access to emulated systems running in the Amazon Web Services (AWS) EC2 F1 cloud. Each emulated system is FPGA-based and includes a RISC-V processor core, modified to include the hardware security protections developed under SSITH. The software stack on each emulated system is expected to contain known vulnerabilities, with the SSITH hardware security protections intended to prevent exploitation of these vulnerabilities. These vulnerabilities will be based on common classes of security weaknesses as identified by the MITRE Common Weakness Enumeration Specification (CWE) and NIST, including buffer errors, information leakage, resource management, numeric errors, etc. Security researchers will be tasked with devising novel exploit mechanisms to bypass the hardware security protections and sharing their findings through the established disclosure process.

“There is a lot of complexity associated with hardware architectures, which is why we wanted to provide ample time for interested researchers to understand, explore, and evaluate the SSITH protections,” noted Rebello. While most of Synack’s crowdsourced security engagements run for two weeks or continuous year round,
FETT is expected to run from July to September 2020 to allow for extensive analysis and testing of the hardware.

SSITH hardware security protections developed by researchers at SRI International and the University of Cambridge, the Massachusetts Institute of Technology (MIT), University of Michigan, and Lockheed Martin will be available for evaluation. Over the past two years, these research teams have explored a number of different design approaches and their techniques generally involve providing the hardware with more information about what the software is trying to do. With this insight, the hardware can become a more active participant in defense and guard against accidental or malicious transgressions. The research teams are working closely with Galois, a computer science research and development company, to transition the emulated systems to the cloud and support ongoing evaluation efforts.

To help demonstrate the pervasiveness of electronic systems and criticality of their security, researchers will see SSITH defenses used within a number of electronic system application frameworks. This will include a medical records database system, a password authentication system for personal computers, and several additional computer software programs that are utilizing SSITH’s protections.

“Among the vulnerable applications found in FETT is a web-based voter registration system. Successful integration of the SSITH hardware protection technologies aims to ultimately protect the underlying voter information from manipulation or disclosure, even in the presence of vulnerabilities in the system’s software. The goal with this demonstrator, as well as the other application systems, is to show how SSITH technologies could help protect critical infrastructure, and potentially prevent the erosion of trust in things like our election process or healthcare systems,” said Rebello.

Prior to the start of FETT, Synack is running a Capture-the-Flag (CTF) qualifier for any hacker, reverse engineer, or cybersecurity enthusiast interested in gaining access to the SSITH defenses. Security researchers that are not currently Synack Red Team (SRT) members will be provided an opportunity to earn a Technical Assessment ‘Fast Pass’ to join SRT (legal verification steps still required) through the CTF event. Current SRT members that meet the skills criteria will be granted access to the program throughout the life of the engagement. The CTF event is expected to run from June 15-29, 2020. Additional information is available at https://go.synack.com/darpa-ctf-registration-page.html.

—DARPA

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At the system level, this course combines theory with real-life examples to provide participants with a complete foundation in understanding overall system performance metrics such as sensitivity and bit error rate. Coverage of digital communication techniques and their effects on RF circuit parameters closes the gap between traditional RF engineering design and the needs of modern communication systems.
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RF Power Sensor: Ideal for Communication Signals

LadyBug Technologies’ LB5908A patented, thermally stable USB RF Power Sensor is for defense, EMC testing, ATE, radar applications and more. The sensor’s frequency range is ideal for communication signals. Its high accuracy, exceptional sensitivity and wide dynamic range make it ideal for a variety of other applications.

The LB5908A sensor is a composite USB device with both USBTMC and USB HID interfaces. All interfaces use standard SCPI commands. The USBTMC interface is compatible with VISA.IO. Also available is option SPI, which provides direct connection to either I2C or SPI interfaces. These interfaces deliver a calibrated power measurement to microcontrollers FPGAs etc., allowing users to build compact, portable ATE equipment.

Other sensors in the product line offer frequency coverage down to 9 kHz and up to 50 GHz. The sensors offer advanced time-gated measurements using either internal or external triggering. Users can use the trigger out port to activate external functions, or use the optional calibrated analog output, and since the sensors are fully self-contained, no computer is necessary to use the analog output once the sensor is setup.

In addition to the features already mentioned, the sensor offers security Options MIL and SAN. These allow a high level of security management for the internal settings, tables and measurement memory.

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The MAGX-100027-300C0P is high power GaN on Si HEMT device optimized for DC - 2.7 GHz frequency operation. The device supports both CW and pulsed operation with peak output power levels of 300 W (54.8 dBm) in a plastic package. The MAGX-100027-300C0P is ideally suited for a multitude of applications including military radio communications, digital cellular infrastructure, RF energy, avionics, test instrumentation and RADAR.

MACOM designs and manufactures semiconductor products for Data Center, Telecommunication and Industrial and Defense applications. Headquartered in Lowell, Massachusetts, MACOM has design centers and sales offices throughout North America, Europe and Asia. MACOM is certified to the ISO9001 international quality standard and ISO14001 environmental management standard.

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Rad-Hard SDRs

BAE Systems has delivered its first shipment of next-generation radiation-hardened software defined radios (SDR) enabled by its RAD5545 computer to Lockheed Martin Space. The radios provide spacecraft with the performance, availability, reliability and on-board signals processing capacity needed to support future space missions -- from planetary exploration to communications, national security, surveillance, and weather missions.

BAE Systems’ software defined radio is anchored by the RAD5545 single board computer (SBC), providing the most advanced radiation-hardened quad core general purpose processing solution available today to address future threats on a variety of missions. The system leverages modular and standard building blocks including a Space-VPX chassis and backplane electrical connectors, Serial RapidIO® and Spacewire interfaces, and a fully supported expansion port for a custom interface card.

BAE Systems
baesystems.com
Signal Generator Extension Modules

OML’s Signal Generator Frequency Extension Module can extend the frequency range of your existing 20 GHz microwave synthesizer to millimeter wave frequencies. Modules are available to span the waveguide bands between 50 and 500 GHz. These source modules are RoHS compliant. In addition, an option is available for manual power sweeps using a micrometer as a tuning mechanism. The standard source module has a prerequisite for +12V that is easily satisfied with many commercially available power supplies. As an alternative, a specialized option is available (SxxMS-AG) that enables the Keysight PSG to satisfy the source module’s power supply prerequisite.

OML omllinc.com

Directional Coupler

Pulsar directional coupler CCS20-50-437/1B covers the range 6-26.5 GHz, while our complete line of directional couplers cover frequency ranges up to 60 GHz. Any Pulsar model can be customized to suit your specific performance or package requirements at little to no extra cost. Pulsar is ISO-9001 certified and ITAR registered. RoHS compliance is standard, but non-compliance is available for military and other applications upon request.

Pulsar Microwave pulsarmicrowave.com

YIG Technology

YIG technology is the most effective solution to a variety of RF and microwave frequency generation and filtering challenges — especially when the absolute lowest phase noise and multi-octave tuning is required. At Micro Lambda Wireless we’ve dedicated ourselves to the art of YIG-tuned designs and perfecting the science of manipulating YIG behavior. We offer you the latest suite of standard products, customization capabilities, and the best customer support.

Established in 1990, no company has done more in the last 25 years to launch new products and revolutionize the field of YIG design. Taking what was once a technology reserved for only the most far-reaching programs, Micro Lambda has developed commercially viable and standardly packaged components to give every RF and microwave engineer the chance to consider the difference a YIG-based device or system can make.

We offer not only the deepest standard product line of YIG oscillators, synthesizers, filters, multipliers, and benchtop instruments, we’ve also thought ahead and designed complementary drivers for nearly every product in our portfolio. So you can employ them right out of the box. Every product is supported by a team of engineers that are always ready to help you with your application engineering and product integration challenges.

Micro Lambda Wireless microlambdawireless.com

Precision Connectors for Every Industry

SGMC Microwave is a registered ISO 9001:2015 manufacturer of precision coaxial connectors including cable connectors, adapters, and receptacles. Located in Melbourne, Florida,
SGMC Microwave was founded to provide the microwave and millimeter-wave industry with high-quality products that are precision grade and readily available. We are committed to quality and performance and consider our connectors “precision components.” Total customer satisfaction by meeting or exceeding expectations is our primary mission.

**SOLT Calibration Kits**

Fairview Microwave unveiled a new series of short-open-load-through (SOLT) calibration kits designed for use in lab, test and measurement, and RF and Microwave production test applications.

Fairview’s expansion of its VNA calibration kit line consists of 12 models including short circuit, open circuit and load kits (SOL), as well as short circuit, open circuit, load and thru kits (SOLT). Interface options include 2.4mm, 2.92mm, 3.5mm, 7/16 DIN, 7mm, N-Type and BNC.

Every model in this new line of VNA calibration kits includes the required short circuit, open circuit, loads and thru (model dependent) components required for VNA calibration. These RF test and measurement kits come packaged in protective wooden boxes. They are suitable for a variety of vector network analyzers from the industry’s leading providers such as Rohde & Schwarz, Agilent, Copper Mountain and Anritsu.

“The precise characterization of RF and microwave components requires a properly calibrated VNA. These new SOLT calibration kits deliver the precision components necessary to perform accurate analyzer calibrations,” said Steve Ellis, Interconnect Product Line Manager.

Fairview’s new SOLT calibration kits are specifically designed for the calibration and fine-tuning of sensitive test equipment in production environments, engineering labs and quality testing facilities. These kits are constructed to provide accurate RF equipment calibration for the life of the product and withstand years of rigorous use.

**Featured Products**

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<tr>
<th>Frequency Range (MHz)</th>
<th>Coupling (dB)</th>
<th>I.L. Loss (dB) max.</th>
<th>Coupling Flatness max.</th>
<th>Directivity (dB) min.</th>
<th>Input Power (watts) max.</th>
<th>Model Number</th>
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<tr>
<td>2.0-32.0</td>
<td>50 ± 1</td>
<td>0.06</td>
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<td>25</td>
<td>2500</td>
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</tr>
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<td>50 ± 1</td>
<td>0.10</td>
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</tr>
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<td>0.5-100</td>
<td>30 ± 1</td>
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<td>C30-102</td>
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<tr>
<td>0.5-100</td>
<td>40 ± 1</td>
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<td>1.0-100</td>
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<td>20.0-200</td>
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<tr>
<td>0.1-250</td>
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<td>20</td>
<td>1500</td>
<td>C50-31</td>
</tr>
</tbody>
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IN-OUT ports: Type N connectors standard, SMA connectors optional.
Coupled ports: SMA connectors standard. See website for details.

Get info at www.HFeLink.com
Bi-Phase Modulators

Pasternack, an Infinite Electronics brand and a leading provider of RF, microwave and millimeter wave products, has just launched a new line of bi-phase modulators that includes a comprehensive selection of nine different models covering broad octave frequency bands ranging from 0.5 to 40 GHz. Bi-phase modulators take a TTL level digital bits stream that is encoded onto the RF carrier using 2 Phase Shift Keying (2PSK) modulation, where the 2 phases are separated by 180 degrees. This performance is desirable in communications systems, microwave radio, radar, high-data-rate test & measurement, serial data transmission, base station infrastructure and other industrial and military applications.

Pasternack’s new line of 0° to 180° bi-phase modulators offer impressive features that include TTL command control, low insertion loss of 2.5 dB typ, fast switching speed of 40 nsec typ, low VSWR of 1.8:1 typ and maximum peak RF input power of 0.5 watts. All designs require dual bias voltages and the input and output RF ports are bi-directional. These bi-phase modulators operate across a wide temperature range from -40°C to +85°C. The compact and rugged packages utilize solder pins for TTL, DC bias and ground, and field replaceable SMA or 2.92mm female connectors. All designs are highly reliable, meeting MIL-STD-202 environmental test conditions for humidity, shock, vibration, altitude and temperature cycle.

Pasternack
pasternack.com

Limiters, Switches, and More

Herotek, Inc. 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

Cable Assemblies

Withwave’s High Speed & High-density Multicoax Cable Assemblies (WMX Series) provides a wide range of multiple coax connectors and flexible cable assemblies with a choice of 20,40,50,67 GHz configurations based on precision array design and superior high frequency cabling solutions.

WMX Series are excellent signal integrity solutions for bench-top testing and automated test equipment to meet increasing demands of semiconductor test equipment and optical testing industries.

These products consist of high performance flexible assemblies which can be bundled in housings (8 and 16 channels) and the interface to board is compression type which provides lower total cost of testing by avoiding costly soldering components.

Withwave
with-wave.com

Directional Coupler

Model 251-086-020 is a 50 Ohm directional coupler that covers 7 – 12.4 GHz frequency range and features a 20 dB coupling value. The frequency sensitivity is ± 0.75 dB maximum, insertion loss is 1.0 dB maximum and directivity is 12 dB minimum. Maximum VSWR is 1.50:1, RF input power is 50 Watts average / 1000 Watts peak and the RF connectors are SMA female. Directional couplers designed by BroadWave provide an accurate method for sampling a signal. We offer couplers for most applications including power measurements, signal leveling and frequency measurements from 500 MHz to 18 GHz with N or SMA connectors.

BroadWave Technologies
broadwavetechnologies.com

ISM LDMOS Module

Ampleon announced the BPF-0910H9X600 pallet, a complete 600-Watt RF Power LDMOS module for industrial, scientific and medical applications operating in the 915MHz ISM frequency band.

Based on RF power transistors using Ampleon’s 9th generation of 50V LDMOS process, this solid-state amplifier is specifically designed for companies wanting to speed up time-to-market by using a ready-made RF amplifier rather than embark on the time-consuming process of developing their own design.

Ampleon
ampleon.com
Tutorial: Half Band Filters

By Ain Rehman

Half band filters are useful digital filters that have symmetric impulse responses and generally about half their impulse response consists of 0 (zero) thus allowing for fewer multiplications. One of their prime uses is in decimation of multirate digital signals.

For a good basic introduction to FIR filters please read the FIR filter book. The link is: https://www.amazon.com/s?k=finite+impulse+response+digital+filter+design+Ain+Rehman&i=stripbooks&ref=nb_sb_noss.

The following discussion presents more details on the half band filter as well as its usage in the decimation filter.

“In digital signal processing, half-band filters are widely used for their efficiency in multi-rate applications. A half-band filter is a low-pass filter that reduces the maximum bandwidth of sampled data by a factor of 2 (one octave). When multiple octaves of reduction are needed, a cascade of half-band filters is common. And when the goal is downsampling, each half-band filter needs to compute only half as many output samples as input samples.” Wikipedia.

The frequency response of this type of filter is symmetrical about the (1/4)fs point on the frequency axis. Where fs is the sampling frequency. Because of this characteristic every other tap value of this filter is equal to zero. This implies that we do not need to do a multiplication for that tap reducing the need for multiplications! A very cost effective and useful property indeed, since multiplication takes time and silicon area. The fewer the multiplications, the lower the cost.

In addition it has some other interesting properties.

\[ wp + wst = \pi \text{ (radians/sample)} \]
\[ ws/2 = \pi \text{ (radians/sample)} \]
\[ ws/4 = \pi/2 \text{ center of symmetry (radians/sample)} \]
\[ \delta_p = \delta_s \text{ pass and stop band ripples} \]
\[ wp \text{ passband edge, wst stopband edge} \]
\[ ws \text{ is the sampling frequency.} \]

Note that the frequency axis can be specified in radians/sample, normalized frequency; normalized to the sampling rate or half sampling rate (preferred by MATLAB) etc. An excellent reference to understanding these units is the web article: “The concept of digital frequency,” by Professor Fowler, Department of Electrical Engineering, State University of New York at Binghamton. Also a good explanation is provided in the Signal Processing Group Inc., blog at: http://www.signalpro.biz/wordpress/.

The author was surprised at how little there is in terms of literature about half band filters on the web. What little exists is unclear and difficult to understand. However, here are a few references that may be useful to those seeking an understanding of the circuit as well as those wishing to design these filters.

Ref HB 1.0 MATLAB from Mathworks. Accessing information about half band filters is free on the web from Mathworks but you will have to be either a student or wealthy, to get the tool itself. Also, MATLAB has a script called firhalfband that will design and analyze a half band filter given a good set of specs.

Ref HB 3.0 A reasonably good reference to synthesis of a windowed sinc filter. The techniques are well explained for windowed sinc filters. http://www.dspguide.com/

Ref HB 4.0 The author’s book on the very fundamentals of FIR filters. Amazon publishers: https://www.amazon.com/s?k=fir+filter+design+practical+approaches+ain+rehman&ref=nb_sb_noss

Ref HB 5.0 A javascript program developed by the author and available free of charge on the usage of the windowed sinc method with Hamming and Blackman windows available upon request at spg@signalpro.biz. This CAD tool was developed based on the techniques suggested in Ref 3.0.


At this point we continue on the discussion of the design of half band filters. Please refer to Figure 9.

CAD tools: The essential tool to be used in the design of these filters (or indeed other digital filters) is MATLAB Signal Processing Toolbox. If at all possible the designer should obtain this tool. MATLAB offers free trials of its package and especially low prices for students. MATLAB can be used to design the half band filter using its firhalf-band script and also help to analyze a design that may have been designed some other way.

However, if MATLAB is not available then some of the other techniques mentioned in the following may be used. It will just take longer to optimize the filter design but it can still be done.

Example of a MATLAB half band filter design
This script has been copied straight from MATLAB's example.

Commands;

Fs = 96e3;
Fp = 22e3;
N = 100;
num = firhalfband(N,Fp/(Fs/2));
fvt = fvtool(num,'Fs',Fs,'Color','white');
fvt.MagnitudeDisplay = 'Zero-phase';
Fp is the passband edge.
N is the order of the filter. It is shown to be even.
num is the number impulse response coefficients.
fvt is the filter visualization tool. This allows the user to look at the various characteristics of the filter graphically and otherwise.

Windows sinc tool
If for some reason MATLAB is not available then another method for design can be used called the windowed sinc (Ref HB 3.0).

This script has been implemented in Javascript by the author and is available free of charge. Please download the script from the Signal Processing Group Inc. website at: www.signalpro.biz>complementary.
This script and a companion, implements the windowed sinc method for the Hamming window and the Blackman window.

The user has to make some modifications such as the cut off frequency and the order. The order, called M, can be calculated by using the following identity: M=4/BW where BW is the width of the transition region. M should be even. (Ref HB 3.0).

The script provides the impulse response of the filter. Simply run the script and the impulse response coefficients are written on the standard output. The frequency response can be found by taking the Fourier response, using the coefficients generated by the script. There are a number of freeware packages that can be used to do this. In addition MATLAB can be used to derive the frequency response. Here is an example MATLAB script that does this provided by MATLAB staff.

```matlab
b=fir2(12,f,a); % b = coefficients of a filter generated by the fir2 command. (MATLAB.)
[h,t]=impz(b); % h is the magnitude of the impulse response at time t
[H,F] = freqz(h,1,Nfft); % H and F magnitude of the frequency response at frequency F;
semilogx(F,mag2db(abs(H))); grid on; % Plot the response
xlabel('Frequency (Hz)'); ylabel('Magnitude (dB)'); % Label the plot.
```

Note: fir2 provides a filter coefficient vector for a given arbitrary frequency and matching amplitude. The frequency needs to start at 0, and end at 1. Normalized to the sampling rate.

**Semi-manual half band filter design described in Ref HB 2.0.** Here the impulse response is built manually in three steps. Once the impulse response is built it can be converted to frequency response as required. There is also additional discussion with examples.

**About the Author**

Ain Rehman is founder and chief engineer at Signal Processing Group. Contact him at spg@signalpro.biz for the javascript of the Windowed Sinc technique.
Guest Editorial

Why and How the U.S. Should Stop Financing China’s Bad Actors

By Roger W. Robinson, Jr.

Roger W. Robinson, Jr. is president and CEO of RWR Advisory Group and co-founder and chairman of the Prague Security Studies Institute. He earned a B.A. from Duke University and an M.A. from George Washington University. He served as senior director of international economic affairs on President Reagan’s National Security Council, where he was the principal architect of the secret economic and financial strategy that proved decisive to the defeat of the Soviet Union. He later served as chairman of the Congressional U.S.-China Economic and Security Review Commission. Prior to his government service, he was a vice president in the international department of the Chase Manhattan Bank.

The following is adapted from a speech delivered at Hillsdale College on September 9, 2019, during a conference on the topic, “Understanding China.”

In the early 1980s, I served on President Reagan’s National Security Council. Prior to my time at the White House, I was a vice president at Chase Manhattan Bank, in charge of its USSR and Eastern Europe division. It was my job to assess the creditworthiness of the countries in that part of the world, and I had come to realize that the Soviet Union had relatively modest hard currency income—and that what little it had came largely from the West.

In 1982, the Soviets had an empire stretching from Havana to Hanoi, but their hard currency revenue totaled only about $32 billion a year—roughly one-third the annual revenue of General Motors at the time. They were spending about $16 billion more annually than they were making, with the funding gap—the USSR’s life support—being financed by Western governments and banks.

President Reagan had long believed that the Soviet Union was economically vulnerable, because he knew it lacked the entrepreneurship, technological dynamism, and freedoms that are the prerequisites of a strong modern economy. And when he learned that we in the West were financing its brutal regime, he committed to slowing, and ultimately terminating, that flow of discretionary cash.

Our European allies had a completely different approach. Their belief in Ostpolitik, as the Germans called it, presupposed that commercial bridge-building would lead to geopolitical cooperation. If the West would offer financing and trade with the Soviets, peace and prosperity would result. Meanwhile, the Soviets were using the proceeds of Western loans, hard currency revenue streams, and technological support to build up their military, expand their empire, and engage in anti-Western activities.

The Reagan administration drew the line on a project called the Siberian Gas Pipeline, a 3,600-mile twin-strand pipeline that stretched from Siberia into the Western European gas grid. If completed, not only would it become the centerpiece of the Soviets’ hard currency earnings structure, but Western Europe would become dependent on the USSR for over 70 percent of its natural gas, weakening Western Europe’s ties to the U.S. and leaving the continent open to Kremlin extortion. Moreover, the pipeline was being financed on taxpayer-subsidized terms, since France and Germany viewed the USSR as a less developed country worthy of below-market interest rates.

The U.S. at the time had a monopoly on oil and gas technology that could drill through permafrost—which we had developed for Alaska’s North Slope—and we imposed oil and gas equipment sanctions on the USSR and European companies that were helping to build the Siberian pipeline. At one point, despite the strain it placed on relations with our NATO allies, we closed the U.S. market entirely to companies that continued to supply the pipeline project over our objections. Four of the six affected companies went under within six months, and Europeans woke up to the fact that they could do business with us or the Soviets, but not both.

As a result of these efforts we capped Soviet gas deliveries to Western Europe at 30 percent of total supplies, delayed the first strand of the pipeline by years and killed the second strand, and eventually helped dry up the bulk of Western credits to the USSR. In a secret deal, we also persuaded the Saudis to pump an additional two million barrels of oil per day and decontrolled prices at the wellhead in this country, knocking oil prices down to about $10 a barrel—significant because for every dollar decrease in the price of a barrel, the Soviets lost some 500 million
to one billion dollars. In short, the Soviet Union never recovered from these economic and financial blows. It defaulted on some $96 billion in Western hard currency debt shortly before the total collapse of the Soviet empire.

***

The story with China today has certain similarities, but with one big difference: the U.S. has been playing the role of the naïve Europeans. Since adopting the Kissinger policy of engaging with China in the 1970s, our government has operated on the assumption that economic and financial relations with China would lead Beijing to liberalize politically. And since 2001, when we backed China’s entry into the World Trade Organization, the pace at which we have given China access to our best technology and capital and trade markets has accelerated. Yet China has shown no signs of embracing individual freedoms or the rule of law.

Instead, with our support, the Chinese have launched a massive campaign to become the world’s leading superpower. We know about the “Belt and Road Initiative,” a strategic undertaking to place huge segments of the world under China’s influence or outright control. We know about “Made in China 2025,” a strategy designed to dominate key technology sectors—from artificial intelligence and quantum computing to hypersonic missiles and 5G. We know about China’s practice of forced technology transfers: requiring American companies to share their trade secrets and R&D in order to do business in China. We know about China’s predatory trade practices. We know many of these things only because President Trump has brought them to the forefront of national attention, for which he deserves credit. And the ongoing tariff war is a good thing in the sense that we’ve finally begun to take a stand.

But there is an issue more critical than trade that Americans, by and large, do not know about: China has over 700 companies in our stock and bond markets or capital markets. It has about 86 companies listed on the New York Stock Exchange, about 62 in the NASDAQ, and over 500 in the murky, poorly regulated over-the-counter market. Among these companies are some egregious bad actors. Hikvision, for example, is responsible for facial recognition technology that identifies and monitors the movement of ethnic Uyghurs. It also produces the surveillance cameras placed atop the walls of Chinese concentration camps holding as many as two million Uyghurs in Xinjiang. Both its parent company and Hikvision itself are on the U.S. Commerce Department Entity List (what many describe as the “Blacklist”).

Do any of us have the financing of concentration camps in mind when we transfer money into our retirement and investment accounts?

This sounds difficult to believe, but it is an empirical fact: the majority of American investors are unwittingly funding Chinese concentration camps, weapons systems for the People’s Liberation Army (PLA), and more. This is because the U.S. has no security-minded screening mechanism for our capital markets, which have roughly $35 trillion under management.

When it comes to screening Chinese investments in U.S. companies, we have the Committee on Foreign Investment in the United States, which was recently strengthened with the Foreign Investment Risk Review Modernization Act of 2018. Congress expanded its reach because it was properly worried about China undermining our security and stealing our technology.

Our capital markets, on the other hand, are completely unprotected. There are serial violators of U.S. sanctions in our markets today. There are proliferators to our adversaries of advanced ballistic missiles. There are manufacturers of sophisticated weapons systems for the PLA. There are companies that are militarizing the illegal islands in the South China Sea. There are companies helping maintain the North Korean nuclear threat. There are companies that have been indicted or whose employees have been arrested for espionage as well as known cyber criminals.

Do we find any of these material risk factors in the risk section of our prospectuses? No. Are we hearing
about these concerns from our financial planners or fund managers? No. Nor has there ever once been a hearing on this topic in Congress.

The trade war is hurting China—this is positive and long overdue. But the Chinese can manage it. What would hurt them immeasurably more would be any contraction in their access to our investment dollars. The Chinese are estimated to have attracted nearly two trillion dollars of American investment in equities alone. We do not even know the extent of our real exposure to China, because it has dollar-denominated bonds issued elsewhere in the world that are ending up in Americans’ bond portfolios—our investment banks buy them overseas to utilize a loophole in our regulatory structure. But I can tell you that in the next 36 months, if nothing is done, our exposure will be two to three trillion dollars more than it is today. The Chinese are moving as fast as they can into the investment portfolios of the American people because they are in desperate need of our dollars.

Beyond the need for dollars, consider the fact that roughly 150 to 180 million Americans have investments in our capital markets. What if these scores of millions of Americans wake up one morning and discover that 15, 18, or 22 percent of their retirement accounts are in Chinese securities? That’s not far-fetched—indeed, it is almost certain to happen if nothing is done. And if that happens, those scores of millions of Americans will have a vested financial interest in opposing any future sanctions or other penalties against China, irrespective of the severity of China’s offenses or the overall threat it poses to America’s national security. That’s what China is knowingly working towards—and that’s called “checkmate.”

The so-called China lobby is large and formidable today—consider how the NBA was recently cowed into silence regarding Chinese repression of the freedom movement in Hong Kong. But it is nothing compared to where things are headed if Americans become more heavily invested in China. And we remain largely blind to this development, just as we were blind—prior to Reagan’s election in 1980—to the extensive financing of the Soviet Union by the West. So here we go again—another authoritarian villain waging economic and financial warfare against us and our allies—but this time even more aggressively and capably.

Astoundingly, Americans are even investing in China’s sovereign bonds—bonds issued directly by the Chinese government, with the proceeds to be used at its sole discretion. Remember Liberty Bonds during World War II? The U.S. sold Liberty Bonds to finance our war effort. Today Americans are buying Chinese sovereign bonds to finance our own potential destruction—anti-Liberty Bonds. The California State Teachers’ Retirement System, to cite just one example, owns Chinese sovereign bonds valued at over $4 million. The Prague Security Studies Institute is finding examples like this throughout our state public employee retirement systems.

Or look at university endowments. The University of Michigan has 44 percent of its $12.2 billion in assets in private equity and venture capital; of the venture capital portion, one-third of the investments are Chinese. This is not to single out or excoriate the University of Michigan. Its investment portfolio is quite typical of what we’re finding elsewhere.

Where is the disclosure related to these Chinese investments? Where is the due diligence on the part of fund managers and index providers? There are all kinds of investment policies and standards that prohibit the financing of concentration camps, human rights abuses, the PLA, organizations engaged in espionage, and violators of U.S. sanctions—but it’s happening anyway. State legislatures need to take this up as a matter of urgent concern.

So far, we’ve talked mostly about private capital. What about our tax dollars? The Federal Thrift Savings Plan (TSP)—the retirement system for all federal employees—totals roughly $578 billion. It is the largest retirement fund in the country, with 5.7 million enrollees—including U.S. military personnel. For a long time, TSP managers were using a specific index for TSP’s $50 billion international portfolio. Morgan Stanley Capital Investment (MSCI) has a whole range of indexes, and TSP was using an index containing only companies in developed countries—largely industrialized democracies. But in November 2017, the TSP Board had the idea of changing its index to capture yields from emerging markets. A Wall Street consulting firm introduced them to the MSCI All Country World Index, which includes China. Indeed, it includes companies such as AVIC, which makes fighter aircraft for the PLA and is China’s largest producer of ballistic missiles, and China Mobile, which has been barred from U.S. government procurement for national security reasons.

The decision was made to begin moving the TSP international fund to this MSCI All Country World Index beginning next year.

So what’s to be done? The first urgent matter is to reverse the TSP Board decision before it is implemented. This should not be a partisan issue. Even leaving aside China’s brutal repression of its own people, does anyone in America, Democrat or Republican, want to fund the production of weapons designed to kill American soldiers, sailors, and marines? Does any American want to underwrite the Chinese militarization of the South China Sea? Or finance U.S. sanctions violators, benefiting Iran and North Korea? Do Americans want to finance the destruction of their own liberty and the ruin of everything they
Guest Editorial

hold dear? I think most Americans would react with outrage, if they knew the facts.

Next, it is urgent that Chinese bad actors be excluded from accessing U.S. capital markets—or at least be forced to disclose their malevolent past activities because of the material risks involved. To be candid, when it comes to China, there is a question whether one can even speak of good actors. Article 7 of the National Intelligence Law of China allows every commercial entity to be instantly weaponized—to commit espionage, technology theft, or whatever else is deemed to be in China’s national interest—by simple order of the government. That’s a matter of public record. In other words, for some fund managers who wish to eliminate bad actors from their portfolios, one solution is simply to eliminate Chinese enterprises. For others, careful, security-minded diligence is required.

Some detractors of this initiative will object that it is detrimental to the free flow of global capital—that it contracts the investable universe of fund managers, narrowing what they can buy in seeking a better yield. “Don’t politicize the markets,” will be a popular refrain. It’s an unfortunate fact that you can’t appeal to Wall Street on the basis of patriotism, doing the right thing, and safeguarding America’s security interests. You’ll generally get a big yawn.

So instead we need to speak to them in market terms: “Where’s the prudent risk management? Where’s the required disclosure of material risks? Where’s the good corporate governance? Where’s the concern over share value, corporate reputation, and brand?” That’s Wall Street’s lingo. It’s much more difficult for them to ignore. Failure to disclose material risks is illegal. And although the SEC apparently doesn’t consider egregious corporate human rights and national security abuses as material risks, the kind of material risk I am talking about is based on the idea that a company’s stock will likely decline when it becomes known that the company is providing, for example, surveillance cameras for concentration camps or producing ICBMs targeting American cities. You would think that this kind of disclosure would be unobjectionable—but then why is it so hard? Is it because China would be offended?

The good news is that we can win this economic and financial war. America dominates the global economic and financial domain—period. Our capital markets are roughly the size of the rest of the world’s combined, and we hold about 60 percent of the world’s liquidity. Wall Street might argue that if we safeguard our capital markets, China will just go to another international exchange, in which case our country will be the one hurt. The problem with that argument is that no other country has anywhere near the depth and volume of our markets. China’s need for dollars is so voracious that it would likely use up the volume of a Frankfurt or London in months, not years. There is nowhere else for a player the size of China to go. Just as in the early 1980s, when we had a monopoly on oil and gas equipment and technology for Arctic-like conditions, we have most of the world’s money today—and the leverage that goes with it.

The bottom line is clear. The Chinese are waging economic and financial warfare against us every day. We are in a position to prevail. The problem is that we’ve not seriously taken the field. In terms of our capital markets, we’re not even at the stadium. It’s time to mobilize our national assets and declare, “Not on my watch.” After all, it’s our money.

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Recent DOD Contracts

MISSILE DEFENSE AGENCY

The Boeing Co., Huntsville, Alabama, was awarded a $150,000,000 undefinitized contract modification (P000057) to previously awarded HQ0147-12-C-0004/-19-C0004 on the Ground-based Midcourse Defense development and sustainment contract (DSC). The scope of work under the current DSC includes development, fielding, test, systems engineering, integration and configuration management, equipment manufacturing and refurbishment, training and operations and sustainment for the Ground-based Midcourse Defense weapon system and associated support facilities. Under this undefinitized modification, the Missile Defense Agency executes the procurement of four additional Configuration 2 Ground Based Interceptor boost vehicles to maintain the fleet and flight test programs. The value of this contract, including options, is increased from $11,337,396,890 to $11,487,396,890. The work will be performed in Chandler, Arizona, and the period of performance is from July 10, 2020, to July 30, 2023. This acquisition was executed on a sole-source basis. Fiscal 2020 procurement funds in the amount of in the amount of $72,000,000 have been obligated at the time of award. The Missile Defense Agency, Huntsville, Alabama, is the contracting activity.

NAVY

Asmd LLC, Honolulu, Hawaii, is awarded a $100,000,000 maximum amount, indefinite-delivery/indefinite-quantity, architect-engineer contract for design and engineering services for various projects funded by the government of Japan (GOJ) direct cash contributions or otherwise referred to as the Mamizu funds and U.S. funds for the development of infrastructure and facilities covered by the Defense Policy Review Initiative under the cognizance of Navy Facilities Engineering Command (NAVFAC) Pacific. Work will be performed at various Navy, Marine Corps, Air Force and other government facilities within the NAVFAC Pacific area of responsibility, including but not limited to, Hawaii and Guam, and may include work in the Commonwealth of the Northern Marianas Islands. The work to be performed provides for design and engineering services for the execution and delivery of plans and specifications, including design-build request for proposal contract documents and design-bid-build contract documents; technical surveys and reports including engineering investigation, site investigation, topographical survey, geotechnical investigation and munitions of explosive concern investigation; functional analysis concept development/design charrettes; construction cost estimates; and post construction award services. Work is expected to be completed by July 2025. Contract funds in the amount of $20,000 are obligated on this award and will not expire at the end of the current fiscal year. Contract funds are GOJ direct cash contributions. Future task orders will be primarily funded by GOJ direct cash contributions. This contract was competitively procured via the Navy Electronic Commerce Online website with two proposals received. The Naval Facilities Engineering Command Pacific, Joint Base Pearl Harbor-Hickam, Hawaii, is the contracting activity (N62742-20-D-0001).

Lockheed Martin Corp., Lockheed Martin Aeronautics Co., Fort Worth, Texas, is awarded an $87,498,287 cost-plus-fixed-fee, indefinite-delivery/indefinite-quantity contract. This contract provides non-recurring engineering for the development and maturation of the Autonomic Logistics Information System (ALIS) in support of data migration and transition to the newly developed F-35 Operational Integrated Data Network (ODIN). ALIS and ODIN provide maintenance capabilities to support worldwide F-35 operations. Additionally, this contract provides software and hardware engineering in support of F-35 ODIN development, delivery and associated data management activities for the Navy, Marine Corps, Air Force and non-Department of Defense participants. Work will be performed in Orlando, Florida (75%); and Fort Worth, Texas (25%), and is expected to be completed by June 2022. No funds will be obligated at the time of award. Funds will be obligated on individual orders as they are issued. This contract was not competitively procured pursuant to 10 U.S. Code 2304(c)(1). The Naval Air Systems Command, Patuxent River, Maryland, is the contracting activity (N00019-20-D-0007).

Northrop Grumman Systems Corp., McLean, Virginia, is awarded a $70,337,682 firm-fixed-price, cost-plus-fixed-fee, indefinite-delivery/indefinite-quantity contract. This contract provides for the development and delivery of the PC-based Open-architecture for Reconfigurable Training Systems (PORTS). Work will be performed in Middletown, Rhode Island (60%); Orlando, Florida (13%); San Diego, California (7%); Newport, Rhode Island (5%); Point Loma, California (5%); Norfolk, Virginia (1%); Dam Neck, Virginia (1%); Virginia Beach, Virginia (1%); Mayport, Florida (1%); Everett, Washington (1%); Point Mugu, California (1%); Pearl Harbor, Hawaii (1%); Fort Worth, Texas (1%); Fallon,
Nevada (1%); and Yokosuka, Japan (1%). Additionally, this contract provides PORTS life cycle support to include training system modifications, trainer hardware purchases, configuration, installation and disposal, distance simulation software deficiency analysis, engineering distance simulation software, on-site simulation software troubleshooting, Training Equipment Change Request (TECR) corrections, TECR installation and test, spare parts and simulation software product delivery for PORTS-related trainers around the world. Work is expected to be completed by July 2025. No funds will be obligated at the time of award. Funds will be obligated on individual orders as they are issued. This contract was not competitively procured pursuant to 10 U.S. Code 2304(c)(1). The Naval Air Warfare Center Training Systems Division, Orlando, Florida, is the contracting activity (N61340-20-D-0016).

Raytheon Co., Tucson, Arizona, is awarded a $17,229,374 cost-plus-fixed-fee, firm-fixed-price order (N00019-20-F-0493) against previously issued basic ordering agreement N00019-15-G-0003. This order provides non-recurring engineering in support of upgrading the existing Tactical Tomahawk Guidance Test Set (TTGTS) product baseline to eliminate obsolescence and production issues. Additionally, this order provides for the development, test and delivery of six new TTGTSs. Work will be performed in Tucson, Arizona (77%); Clearwater, Florida (4%); Glenrothes Fife, United Kingdom (3%); Midland, Ontario (3%); Huntsville, Alabama (2%); Scottsdale, Arizona (2%); North Salt Lake, Utah (1%); various locations within the continental U.S. (7.5%); and various location outside the continental U.S. (0.5%). Work is expected to be completed by December 2022. Fiscal 2020 weapons procurement (Navy) funds in the amount of $17,229,374 will be obligated at time of award, none of which will expire at the end of the current fiscal year. The Naval Air Systems Command, Patuxent River, Maryland, is the contracting activity.

Raytheon Integrated Defense Systems, Tewksbury, Massachusetts, was awarded a $9,686,463 cost-plus-fixed-fee and firm-fixed-price order under basic ordering agreement N00024-18-G-5501 for engineering design and component replacement parts to support the Dual Band Radar systems. Work will be performed in Andover, Massachusetts (25%); Marlborough, Massachusetts (25%); Tewksbury, Massachusetts (25%); and Portsmouth, Rhode Island (25%), and is expected to be completed by November 2022. Fiscal 2018 other procurement (Navy); fiscal 2019 other procurement (Navy); fiscal 2020 other procurement (Navy); and fiscal 2020 operations and maintenance (Navy) funding in the amount of $9,686,463 will be obligated at time of award and funding in the amount of $2,975,360 will expire at the end of the current fiscal year. This order was procured under the statutory authority of 10 U.S. Code 2304(c)(1); one responsible source and no other supplies or services will satisfy agency requirements. The Naval Sea Systems Command, Washington, D.C., is the contracting activity (N00024-20-F-5505). (Awarded July 8, 2020)

Lockheed Martin, Rotary and Mission Systems, Moorestown, New Jersey, is awarded a $7,344,470 cost-plus-incentive-fee modification to previously awarded contract N00024-16-C-5102 to exercise an option for AEGIS Platform Systems Engineering Agent efforts for the integration and delivery of AEGIS Baseline 9 capabilities. Work will be performed in Moorestown, New Jersey. The contract provides for the completion of the development and fielding of the AEGIS Baseline 9 AEGIS Weapon System and integrated AEGIS Combat System on the remaining AEGIS Technical Insertion (TI) 12 configured destroyers as well as TI 12 and TI 08 configured cruisers. Work is expected to be completed by July 2021. Fiscal 2013 shipbuilding and conversion (Navy); fiscal 2020 operations and maintenance (Navy); fiscal 2020 other procurement (Navy); and fiscal 2020 research, development, test and evaluation funding in the amount of $7,344,470 will be obligated at time of award and funding in the amount of $1,380,964 will expire at the end of the current fiscal year. The Naval Sea Systems Command, Washington, D.C., is the contracting activity.

AIR FORCE

TAC Industries, Springfield, Ohio, has been awarded a $69,422,312 requirements contract for the production of cargo nets for the support equipment and vehicles division at Robins Air Force Base, Georgia. The base contract year has a value of $13,469,074; Option One has a value of $13,565,182; Option Two has a value of $13,842,626; Option Three has a value of $14,127,218; and Option Four has a value of $14,418,212. The contract provides for the production of 40,600 low profile side nets and 17,000 top nets under the basic period, and best estimated quantities of 40,600 low profile side nets and 17,000 top nets during each option period thereafter. Work will be performed in Springfield, Ohio, and is expected to be completed by July 10, 2025. This award is the result of a sole-source acquisition. Fiscal 2020 other procurement funds in the amount of $13,469,074 are be obligated at the time of first delivery or services will satisfy agency requirements. The Naval Sea Systems Command, Washington, D.C., is the contracting activity (N00024-20-F-5505).

Johns Hopkins University Applied Physics Laboratory LLC, Laurel, Maryland, has been awarded a $29,702,388 cost-plus-fixed-fee modification (P00013) to contract FA9453-18-D-0018, task order FA9453-18-F-0007, to provide technical and programmatic sup-
port of Tactical Space and Small Satellite Portfolio’s core competencies and mission lifecycle. This includes support of the mission phases from concept through design, implementation, operations and transition of space assets. Work will be performed in Laurel, Maryland, and is expected to be completed Sept. 29, 2023. This modification brings the total cumulative face value of the contract to $53,550,559. Fiscal 2020 research, development, test and evaluation funds in the amount of $1,329,250 are being obligated at time of award. Air Force Research Laboratory, Kirtland Air Force Base, New Mexico, is the contracting activity.

Howell Instruments Inc., Fort Worth, Texas, has been awarded an $8,034,280 firm-fixed-price, requirements-type contract, for the production of environmental control test sets. Work will be performed in Fort Worth, Texas, and is expected to be completed July 9, 2025. This award is the result of a sole-source acquisition. No funds are being obligated at the time of award. The Air Force Support Equipment Directorate, Robins Air Force Base, Georgia, is the contracting activity (FA8533-20-D-0006).

ARMY

Phylway Construction LLC,* Thibodaux, Louisiana, was awarded a $51,702,210 firm-fixed-price contract for construction of hurricane protection features in Plaquemines Parish, Louisiana. Bids were solicited via the internet with six received. Work will be performed in New Orleans, Louisiana, with an estimated completion date of Aug. 31, 2026. Fiscal 2020 civil construction funds in the amount of $51,702,210 were obligated at the time of the award. U.S. Army Corps of Engineers, Vicksburg, Mississippi, is the contracting activity (W912P8-20-C-0032).

Pine Bluff Sand and Gravel Co., Pine Bluff, Arizona, was awarded a $48,002,240 firm-fixed-price contract for flood control on the Mississippi River and tributaries. Bids were solicited via the internet with two received. Work locations and funding will be determined with each order, with an estimated completion date of July 10, 2022. U.S. Army Corps of Engineers, New Orleans, Louisiana, is the contracting activity (W912P8-20-D-0011).

Speegle Construction Inc.,* Niceville, Florida, was awarded a $10,373,085 firm-fixed-price contract to construct two new facilities at Eglin Air Force Base. Bids were solicited via the internet with 10 received. Work will be performed at Eglin Air Force Base, Florida, with an estimated completion date of Aug. 30, 2022. Fiscal 2020 research, development, test and evaluation (Air Force) funds in the amount of $10,373,085 were obligated at the time of the award. U.S. Army Corps of Engineers, Mobile, Alabama, is the contracting activity (W91278-20-C-0020).

Mike Hooks LLC, Westlake, Louisiana, was awarded a $10,207,400 firm-fixed-price contract for pipeline dredging of the Matagorda Ship Channel. Bids were solicited via the internet with three received. Work will be performed in Bay City, Texas, with an estimated completion date of Jan. 31, 2021. Fiscal 2019 and 2020 civil construction funds in the amount of $10,207,400 were obligated at the time of the award. U.S. Army Corps of Engineers, Galveston, Texas, is the contracting activity (W912HY-20-C-0023).

Ashford Leebcor Enterprises III,* Williamsburg, Virginia, was awarded an $8,134,009 firm-fixed-price contract to renovate Building 11 at the Defense Logistics Agency. Bids were solicited via the internet with 11 received. Work will be performed in Richmond, Virginia, with an estimated completion date of Sept. 22, 2021. Fiscal 2016 facilities sustainment, restoration and modernization funds in the amount of $8,134,009 were obligated at the time of the award. U.S. Army Corps of Engineers, Norfolk, Virginia, is the contracting activity (W91236-20-C-2021).

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Northrop Grumman Systems Corp., Baltimore, Maryland, has been awarded a $19,660,934 cost-plus-fixed fee contract for the base period of a research project for hypersonic boost glide systems. Work will be performed in Baltimore, Maryland, with an estimated completion date of March 2023. Fiscal 2019 research and development funds in the amount of $549,419; and fiscal 2020 research and development funds in the amount of $17,449,429 are being obligated at time of award. This contract is a sole-source award. The Defense Advanced Research Projects Agency, Arlington, Virginia, is the contracting activity (HR0011-20-C-0054).

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NAVY

Lockheed Martin Corp., Lockheed Martin Aeronautics Co., Fort Worth, Texas, is awarded a $56,100,000 not-to-exceed, undefinitized contract modification (P00018) to previously awarded cost-plus-incentive-fee contract N00019-19-C-0010. This modification provides systems integration engineering support and procures long lead material to ensure the ASQ-239 electronic warfare/countermeasures production capability remains on track to meet Lot 17 deliveries. This modification provides for the continuation of Block 4 electronic warfare development without creating a gap in engineering resources in support of the Navy, Air Force and non-Department of Defense (DOD) participants. Work will be performed in Nashua, New Hampshire (85%); and Fort Worth, Texas (15%), and is expected to be completed by December 2020. Fiscal 2020 research, development, test and evaluation (Air Force) funds in the amount of $6,986,000; and non-DOD participant funds in the amount of $1,000 are obligated on this award and will not expire at the end of the current fiscal year. Future task orders will be primarily funded by the appropriate fiscal year O&M, DW funds. This contract was competitively procured via the NAVFAC AOR. No task orders are being issued at this time. Work will be performed at various government installations within the NAVFAC AOR including, but not limited to, Washington (75%); Alaska (22%); Idaho (1%); Montana (1%); and Oregon (1%). The work to be performed provides for environmental restoration services under the Defense Department’s Environmental Restoration Program, which includes the Installation Restoration Program and Munitions Response Program, complies with the Comprehensive Environmental Response, Compensation and Liability Act, and supports the Navy and Marine Corps base realignment and closure effort and similarly complex local and state environmental investigations. The term of the contract is not to exceed 60 months and work is expected to be completed by July 2025. Fiscal 2020 operations and maintenance (Navy) contract funds in the amount of $1,000 are obligated on this award and will expire at the end of the current fiscal year. Future task orders will be primarily funded by environmental restoration (Navy). This contract was competitively procured via the Navy Electronic Commerce Online website and four proposals were received. The Naval Facilities Engineering Command Northwest, Silverdale, Washington, is the contracting activity (N44255-20-D-5006).

Jacobs-Ewing Cole JV, Pasadena, California, is awarded a $29,944,543 firm-fixed-price task order (N62473-20-F-4714) under an indefinite-delivery/indefinite-quantity contract for post-award design services (PADS) and post-construction award services (PCAS) to support multiple construction projects related to the fiscal 2020 and 2021 military construction (MILCON) earthquake recovery and repair program at Naval Air Weapons Station (NAWS), China Lake, California. The task order also contains one unexercised option, which if exercised, will increase cumulative task order value to $36,456,778. Work will be performed in Ridgecrest, California. The work to be performed provides for PADS and PCAS for various fiscal 2020 and 2021 MILCON and repair projects; 18 MILCON projects; and 25 repair projects will be constructed at NAWS China Lake as a part of the earthquake recovery program. The contractor will provide architect-engineer services to address any post-award design and construction related issues for the MILCON and repair projects. The contractor will also provide assistance to the government during the development of responses and requests for information from the contractors performing the construction effort for the projects. Work is expected to be completed by April 2024. Fiscal 2020 MILCON (Navy) contract funds in the amount of $29,944,543 are obligated on this award and will not expire at the end of the current fiscal year. One proposal was received for this task order. The Naval Facilities Engineering Command Southwest, San Diego, California, is the contracting activity (N62473-18-D-5801).

Salient CRGT Inc., Fairfax, Virginia, is awarded a $21,984,298 firm-fixed-price, indefinite-delivery/indefinite-quantity, single award contract to provide support with program management, program planning and execution, Joint Staff actions process training, Actions Division customer service help desk services, strategic planning and analysis assistance, correspondence management and communications and editorial functions in support of the Joint Staff Actions Division. The contract will include a 60-month base ordering period, with no option period. Work will be performed in Arlington, Virginia (85%); Fairfax, Virginia (10%); and Suffolk, Virginia (5%). The ordering period will be completed by July 2025. Fiscal 2020 operations and maintenance (O&M) (Defense-wide) (DW) funds in the amount of $10,000 will be obligated to fund the contract’s minimum amount and will expire at the end of the current fiscal year. Subsequent task orders will be funded with the appropriate fiscal year O&M, DW funds. This contract was competitively procured with the solicitation posted through the joint post award services (PCAS) to support multiple construction projects related to the fiscal 2020 and 2021 military construction (MILCON) earthquake recovery and repair program at Naval Air Weapons Station (NAWS), China Lake, California. The task order also contains one unexercised option, which if exercised, will increase cumulative task order value to $36,456,778. Work will be performed in Ridgecrest, California. The work to be performed provides for PADS and PCAS for various fiscal 2020 and 2021 MILCON and repair projects; 18 MILCON projects; and 25 repair projects will be constructed at NAWS China Lake as a part of the earthquake recovery program. The contractor will provide architect-engineer services to address any post-award design and construction related issues for the MILCON and repair projects. The contractor will also provide assistance to the government during the development of responses and requests for information from the contractors performing the construction effort for the projects. Work is expected to be completed by April 2024. Fiscal 2020 MILCON (Navy) contract funds in the amount of $29,944,543 are obligated on this award and will not expire at the end of the current fiscal year. One proposal was received for this task order. The Naval Facilities Engineering Command Southwest, San Diego, California, is the contracting activity (N62473-18-D-5801).

Lockheed Martin, Baltimore, Maryland, is awarded a $16,345,048 firm-fixed-price contract for the refurbishment of rocket motors and thrust vector control used on
launch assemblies for anti-submarine rocket assisted torpedoes. If the option is exercised, the work will be completed by July 2023, bringing the total value of the contract to $30,630,048. Work will be performed in Baltimore, Maryland (44%); Dulles, Virginia (29%); and Owego, New York (27%). The base period of this contract is expected to be completed by October 2022. Weapons procurement funds (Navy) in the full amount of $16,345,048 will be obligated at time of award and will expire at the end of the current fiscal year. One company was solicited for this sole-source requirement pursuant to the authority set forth in 10 U.S. Code 2304 (c)(1) and one offer was received. The Naval Supply Systems Command Weapon Systems Support, Mechanicsburg, Pennsylvania, is the contracting activity (N00104-20-C-K045).

DEFENSE LOGISTICS AGENCY

AM General LLC, South Bend, Indiana, has been awarded a maximum $44,095,015 firm-fixed-price requirements contract for High Mobility Multi-Purpose Wheeled Vehicle diesel engines with containers. This was a sole-source acquisition using justification 10 U.S. Code 2304 (c)(1), as stated in Federal Acquisition regulation 6.302-1. This is a three-year contract with no option periods. Location of performance is Indiana, with a July 8, 2023, ordering period end date. Using military service is Army. Type of appropriation is fiscal 2020 through 2023 Army working capital funds. The contracting activity is the Defense Logistics Agency Land and Maritime, Warren, Michigan (SPRDL1-20-D-0118).

Marlex Pharmaceuticals Inc., New Castle, Delaware, has been awarded a maximum $9,274,712 fixed-price with economic-price-adjustment, indefinite-delivery/indefinite-quantity contract for various pharmaceutical products. This was a competitive acquisition with one response received. This is a one-year base contract with nine one-year option periods. Location of performance is Delaware, with a July 8, 2021, ordering period end date. Using customers are Army, Navy, Air Force, Marine Corps and federal civilian agencies. Type of appropriation is fiscal 2020 through 2021 Warstopper funds. The contracting activity is the Defense Logistics Agency Troop Support, Philadelphia, Pennsylvania (SPE2D0-20-D-0008).

ARMY

VS2 LLC, Alexandria, Virginia, was awarded a $36,672,648 cost-plus-fixed-fee contract for logistics support services (maintenance, supply and transportation) at Fort Benning, Georgia. Bids were solicited via the internet with nine received. Work will be performed in Chattahoochee, Georgia, with an estimated completion date of July 8, 2025. Fiscal 2020 operations and maintenance (Army) funds in the amount of $2,077,440 were obligated at the time of the award. U.S. Army Contracting Command, Rock Island Arsenal, Illinois, is the contracting activity (W52P1J-20-F-0305).

Manson Construction Co., Seattle, Washington, was awarded an $8,330,800 firm-fixed-price contract for dredge work in the Mississippi River. Bids were solicited via the internet with three received. Work will be performed in Venice, Louisiana, with an estimated completion date of Oct. 30, 2021. Fiscal 2020 civil operations and maintenance funds in the amount of $8,330,800 were obligated at the time of the award. U.S. Army Corps of Engineers, New Orleans, Louisiana, is the contracting activity (W912P8-20-C-0030).

DEFENSE INTELLIGENCE AGENCY

IT Concepts Inc., Vienna, Virginia, was awarded a $26,308,755 labor-hour contract (HHM402-20-C-0038) to develop, update, sustain, operate and enhance a software tool capability to be used by members of the acquisition, requirements, operational and intelligence communities to support and aid in the identification of intelligence requirements, management of priorities, planning and production of intelligence products, enterprise data analytics, communication and other associated processes. Work will be conducted in Vienna and Charlottesville, Virginia, with an expected completion date of June 2025. Fiscal 2020 operations and management funds in the amount of $1,023,586 are being obligated at time of award. This contract was awarded through an 8(a) set-aside and five offers were received. The Virginia Contracting Activity, Washington, D.C., is the contracting activity.

AIR FORCE

Innovative Scientific Solutions Inc., Dayton, Ohio, has been awarded a not-to-exceed $20,000,000 indefinite-delivery/indefinite-quantity modification (P00005) to contract FA8650-13-D-2343 for advanced propulsion concepts and cycles research and development. Work will be performed in Dayton, Ohio, and is expected to be completed June 18, 2022. Fiscal 2020 research, development, test and evaluation funds in the amount of $1,750,000 are being obligated at the time of award under task order FA8650-17-F-2009. Total cumulative face value of the contract is not-to-exceed $64,560,000. Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio, is the contracting activity.

Ball Aerospace & Technologies Corp., Beavercreek, Ohio, has been awarded a $7,687,489 cost-plus-fixed-fee contract for Infrared Radiation Effects Laboratory (IRREL) operation and improvements program. The objective of this effort is to provide radiometric and radiation characterizations of focal plane arrays (FPAs) and associated devices. The effort includes developing innovative techniques to advance the state of the art in the characterization of infrared and visible FPAs and associated devices. These innovative techniques include the develop-
ment of characterization and analytical techniques, test hardware and operational and test procedures that advance the experimental capabilities of the IRREL. Work will be performed in Albuquerque, New Mexico, and is expected to be completed Oct. 10, 2025. This award is the result of a competitive acquisition with one offer received. Fiscal 2020 research, development, test and evaluation funds in the amount of $150,000 are being obligated at time of award. The Air Force Research Laboratory, Kirtland Air Force Base, New Mexico, is the contracting activity (FA9453-20-C-0015).

ARMY

BFBC LLC, Bozeman, Montana, was awarded a $138,335,455 modification (P00005) to contract W912PL-20-C-0002 to modify the existing electrical attributes (closed-circuit TV, linear ground detection system and shelters) on the Barry M. Goldwater Range, Yuma 10/27 design-build border infrastructure project. Work will be performed in Yuma, Arizona, with an estimated completion date of June 29, 2021. Fiscal 2020 military construction (Army) funds in the amount of $138,335,455 were obligated at the time of the award. U.S. Army Corps of Engineers, Albuquerque, New Mexico, is the contracting activity is the contracting activity.

Venegas JV Inc.*, Ponce, Puerto Rico, was awarded a $45,000,000 firm-fixed-price contract to support the advanced contract initiative for emergency temporary roof repairs for the eastern region of Puerto Rico. Bids were solicited via the internet with eight received. Work locations and funding will be determined with each order, with an estimated completion date of May 31, 2027. U.S. Army Corps of Engineers, Omaha, Nebraska, is the contracting activity (W9128F-20-D-0032).

MDJ Contracting Inc.*, Dallas, Texas (W911S7-20-D-0006); Olgonik Specialty Contractors LLC,* St. Robert, Missouri (W911S7-19-D-0007); Reese Equipment Co. LLC,* Dixon, Missouri (W911S7-19-D-0008); and Vazquez Commercial Contracting LLC,* Kansas City, Missouri (W911S7-19-D-0009), will compete for each order of the $42,000,000 firm-fixed-price contract for construction requirements at Fort Leonard Wood, Missouri. Bids were solicited via the internet with 11 received. Work locations and funding will be determined with each order, with an estimated completion date of July 7, 2023. U.S. Army Field Directorate Office, Fort Eustis, Virginia, is the contracting activity.

BAE Systems Land and Armaments L.P., San Jose, California, was awarded a $10,066,599 modification (P00140) to contract W56HZV-15-C-0099 for technical support services for the Bradley Fighting Vehicle family of vehicles, the Multiple Launch Rocket System carrier and the M113 Armored Personnel Carrier family of vehicles. Work will be performed in San Jose, California; Sterling Heights, Michigan; and Phoenix, Arizona, with an estimated completion date of July 26, 2021. Fiscal 2020 research, development, test, and evaluation (Army) funds in the amount of $10,066,599 were obligated at the time of the award. U.S. Army Contracting Command, Detroit Arsenal, Michigan, is the contracting activity.

BAE Systems Land and Armaments L.P., San Jose, California, was awarded an $8,488,692 modification (P00138) to contract W56HZV-15-C-0099 for technical support services for the Bradley Fighting Vehicle family of vehicles, the Multiple Launch Rocket System carrier and the M113 Armored Personnel Carrier family of vehicles. Work will be performed in San Jose, California; Sterling Heights, Michigan; Phoenix, Arizona; Temple, Texas; and York, Pennsylvania, with an estimated completion date of July 2, 2021. Fiscal 2018 Army working capital funds; fiscal 2019 operations and maintenance (Army) funds; fiscal 2018 and 2020 weapons and tracked combat vehicle procurement (Army) funds; and fiscal 2020 research, development, test and evaluation (Army) funds in the amount of $8,488,692 were obligated at the time of the award. U.S. Army Contracting Command, Detroit Arsenal, Michigan, is the contracting activity.

NAVY

MNDPI Pacific JV, Honolulu, Hawaii, is awarded a $99,000,000 maximum amount, indefinite-delivery/indefinite-quantity, architect-engineer contract for architect-engineer services for various structural, waterfront and other projects at locations under the cognizance of Naval Facilities Engineering Command (NAVFAC) Pacific. No task orders are being issued at this time. Work will be performed at various Navy, Marine Corps, Air Force and other government facilities within the NAVFAC Pacific area of responsibility including but not limited to, Guam and the Commonwealth of the Northern Marianas Islands (70%); Australia (10%); Japan (10%); and Hawaii (10%). The work of architect-engineer services include, but are not limited to, the execution and delivery of military construction (MILCON) project documentation (Department of Defense Form 1391); functional analysis and concept development workshops; design charrettes; design-build request for proposal; design-bid-build design contract documents; technical surveys and reports including concept and engineering studies, site engineering investigation, topographic survey, geotechnical investigation, hazardous material survey, munitions of explosive concern survey, hydrographic survey and others; construction cost estimates; collateral equipment buy packages; comprehensive interior design including structural interior design and furniture, fixtures and equipment; and post construction award services. The term of the contract is not to exceed 60 months and work is expected to be completed by July 2025. Fiscal 2018 MILCON (planning and design) contract funds in the amount of $10,000 are obligated on this award and will not expire at the end of the current fiscal year. Future task
orders will be primarily funded by MILCON (planning and design). This contract was competitively procured via the Navy Electronic Commerce Online website and two proposals were received. The Naval Facilities Engineering Command Pacific, Joint Base Pearl Harbor-Hickam, Hawaii, is the contracting activity (N62742-20-D-0004).

**Appleton Marine Inc.**, Appleton, Wisconsin, is awarded a $23,375,696 firm-fixed-price, indefinite-delivery/indefinite-quantity, cost-plus-fixed-fee contract for the replacement of up to 35 Navy slewing arm davits (SLADs), associated test reports and spare parts for each SLAD, and 11,300 hours of engineering support services for the Naval Surface Warfare Center, Philadelphia Division. Work will be performed in Appleton, Wisconsin (80%); and onboard Navy ships in the following locations: Norfolk, Virginia; Philadelphia, Pennsylvania; Mayport, Florida; Everett, Washington; San Diego, California; Williamsburg, Virginia; Pearl Harbor, Hawaii; Yokosuka, Japan; and Rota, Spain (20%), as determined on individual task orders. Work is expected to be completed by July 2025. Fiscal 2020 other procurement (Navy) funding in the total amount of $2,256,000 will be obligated at time of award and will not expire at the end of the current fiscal year. The contract was competitively procured as a small-business set-aside via the beta.SAM.gov website and two offers were received. The Naval Surface Warfare Center, Philadelphia Division, Philadelphia, Pennsylvania, is the contracting activity (N64498-20-D-4018).

**Huntington Ingalls Industries** - Newport News Shipbuilding, Newport News, Virginia, is awarded a $36,566,645 cost-plus-fixed-fee option exercise modification to previously awarded contract N00024-20-C-2109 for engineering, technical, trade and program management support of industrial type work for operational and decommissioning submarines, submarines undergoing availabilities/conversion, special mission submersibles and submarine support facilities. Work will be performed in Newport News, Virginia (90%); Kings Bay, Georgia (3%); Bremerton, Washington (2%); Pearl Harbor, Hawaii (2%); Kittery, Maine (2%); and Groton, Connecticut (1%). This contract includes advanced submarine research and development, including studies to support the future development, production and sustainment phases of the platforms. Work is expected to be completed by September 2022. This contract was not competitively procured. Fiscal 2020 other procurement (Navy) funding in the amount of $5,461,081 will be obligated at time of award and will not expire at the end of the current fiscal year. The Naval Sea Systems Command, Washington, D.C., is the contracting activity.

**L3 Technologies Inc.** KEO, Northampton, Massachusetts, is awarded a $25,713,600 cost-plus-incentive-fee contract for engineering and technical services for the design, development, testing, system support and production of submarine photonics masts. This contract includes options which, if exercised, will bring the cumulative value of this contract to $135,810,491. Work will be performed in Northampton, Massachusetts, and is expected to be completed by June 2025. Fiscal 2020 shipbuilding and conversion (Navy) funding in the amount of $25,514,600; and fiscal 2020 research, development, test and evaluation funding in the amount of $199,000 will be obligated at time of award. Funds will not expire at the end of the current fiscal year. The Naval Sea Systems Command, Washington, D.C., is the contracting activity (N00024-20-C-6249).

**Bristol General Contractors LLC**, Anchorage, Alaska, is awarded a $22,974,412 firm-fixed-price contract for the Mission Training Complex at Shaw Air Force Base. Work will be performed in Sumter, South Carolina. The work to be performed provides for the construction of a small standard design mission training complex, to include the following: security access facility, tactical operations center pads, building information systems, energy monitoring and control system connection and intrusion detection system installation. Work is expected to be completed by May 2022. Fiscal 2018 military construction contract funds in the amount of $22,974,412 are obligated on this award and will expire at the end of fiscal 2023. This contract was competitively procured via the Navy Electronic Commerce Online website and four proposals were received. The Naval Facilities Engineering Command, Southeast, Jacksonville, Florida, is the contracting activity (N69450-20-C-0040).

**R. A. Burch Construction Co. Inc.**, Ramona, California, is awarded an $8,359,504 firm-fixed-price task order (N62473-20-F-4857) under a multiple award construction contract for the design and construction to renovate Building F at Naval Air Station North Island (NASNI), Naval Base Coronado. The task order also contains one planned modification, which, if issued will increase cumulative task order value to $9,045,991. Work will be performed in San Diego, California. The work to be performed includes all services, labor, materials and equipment necessary to design and build critical infrastructure to support installation and renovation to Building F at NASNI. The project also includes interior improvements to create additional office space on the north side of the building, landscape improvements for the southern courtyard and provide exposed ceilings in the building. The planned modification, if issued, provide for furniture, fixtures and equipment. Work is expected to be completed by January 2022. Fiscal 2020 operations and maintenance (Navy) contract funds in the amount of $8,359,504 are obligated on this award and will expire at the end of the current fiscal year. Five proposals were received for this task order. The Naval Facilities Engineering Command, Southwest, San Diego, California, is the contracting activity (N62473-15-D-2485).
Product Highlights

VNA Extension Modules
OML offers three configurations of the VNA Frequency Extension Module to expand your existing Keysight or Anritsu vector network analyzer to millimeter frequencies: T/R, T, and S. Depending on your S-parameter needs, refer to the following block diagrams to configure our module(s) with your existing VNA test port(s). With flexible ordering configurations, we can satisfy your preferences for economical and high performance needs.

OML
omlinc.com

Handheld MM-wave Solution
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 military & defense.

OML
omlinc.com

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Isolators, Circulators

Cernexwave’s CSC and CSI series SMT isolators and circulators are offered to cover the frequency range of UHF to 18 GHz. These isolators and circulators are designed and manufactured to provide low insertion loss and high isolation for SMT component and module integrations. The 50Ω input and output SMT line configuration is immediately ready for circuit insertion. While the isolator is an important device where port isolation or VSWR is concerned, the circulator offers duplexing functions in many radar and communication systems.

CernexWave
cernexwave.com

Power Amp

Qorvo’s QPA2610 is a packaged, high performance power amplifier fabricated on Qorvo’s production 0.15 um GaN on SiC process (QGaN15). Covering 8.5 - 10.5 GHz, the QPA2610 provides > 2 W of saturated output power and 23 dB of large-signal gain while achieving an impressive 47% power-added efficiency.

Packaged in a small 5 x 5 mm plastic overmold QFN, tight lattice spacing requirements for phased array radar applications is easily supported. RF input and output ports are matched to 50Ω and include integrated DC blocking capacitors. QPA2610 is part of a three-amplifier family and is pin compatible to QPA2612 and QPA2611.

Qorvo
qorvo.com
**Power Sensor with Direct TTL Connectivity**

LadyBug Technologies’ LB5944A self-contained thermally stabilized power sensor delivers accurate first-tier NIST traceability directly to a microcontroller, FPGA or other device. The sensor utilizes the company’s patented No-Zero No-Cal before use technology which allows it to make accurate measurements from its -60 dBm noise floor up to +26 dBm with no drift or measurement interruption. All this with no computer or power meter attached.

The multi-path square-law diode based sensor is designed using the latest available technology and is fully self-contained. Measurements can be made on a trigger and measure basis, or the sensor can free-run and measurements can be collected when requested. The sophisticated system can provide pre-trigger data.

**LadyBug Technologies LLC**
ladybug-tech.com

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**Limiter**

PMI Model No. LM-10M14G-100W-1KWP-SFF-OPT17 is a limiter that operates over the 1.0 to 7.0 GHz frequency range.

It has a maximum insertion loss of 2 dB; a maximum VSWR of 2.0:1 (at -10 dBm input); Input Power: 100 W CW Max. (1.0 to 7.0 GHz), 1 kW Peak (1% Duty Cycle, 1 us Pulse Width), 100 W Peak (10% Duty Cycle, 10 us Pulse Width); Maximum Flat Leakage: 17 dBm Typ @ 100 W CW - Measured 16.62 dBm; P1dB: 5 dBm Min; and Recovery Time: 100 ns Typ. - Measured 16.22 ns.

This model is outfitted with a SMA male and a SMA female connector in a housing measuring 0.90” x 0.38” x 0.38”.

**Planar Monolithics Industries**

pmi-rf.com
VNA Cal Kits

Pasternack's expanded line of VNA calibration kits are available in 12 versions including short circuit, open circuit and load kits (SOL) as well as short circuit, open circuit, load and thru kits (SOLT) with 2.4mm, 2.92mm, 3.5mm, 7/16 DIN, 7mm, BNC and N-Type interface options.

Each of these new VNA calibration kits from Pasternack include all of the necessary short circuit, open circuit, loads and thru (model dependent) components required for VNA calibration. The kits are suitable for many vector network analyzers from the industry's leading providers such as Agilent, Rohde & Schwarz, Anritsu and Copper Mountain. These RF test and measurement kits come packaged in protective wooden boxes.

Pasternack
pasternack.com

Test Adapters

Withwave's precision test adapters are designed based on precision microwave interconnection technologies. These new 2.92 mm to 3.5 mm types are manufactured to precise microwave specifications and constructed with male and female gender on both sides.

The precision microwave connector interfaces ensure an excellent microwave performance up to 34 GHz.

Withwave
with-wave.com
Type N Female 4-hole Flange Precision Adapters
- Frequency Range: DC to 18 GHz (Mode FREE)
- Electrical: 50 Ohm, Low VSWR & Low Insertion Loss
- VSWR: 1.15:1 Max @ 18 GHz (Typical VSWR 1.05:1 through 18 GHz)
- Materials: Passivated 303 Stainless Steel or Nickel Plated Brass available
- Dielectric Fluorocarbon (PTFE)
- PN: 111-21-21-000 N Female to N Female (4) Hole Flange (In-Series Adapter)
- Available for immediate delivery – Same day shipping for all stock items

SGMC Microwave
gmcmicrowave.com

Mixers: Handheld 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.

OML
omlinc.com
Continuing Education: Your Key to Success

Studies reveal that within each 3-5 year period, one-half of an engineer's technical knowledge becomes obsolete. New graduates soon discover that university education provides only the foundation of knowledge that is realistically needed to perform well in the industry. Continued education is a must for survival in today's competitive market. Application of modern computer-aided engineering to RF and microwave circuit and system design is vital to manufacturing products with high quality and yield. Modernization of the design laboratory and production floor is critical to maintaining a competitive edge.

A well-planned continuing education program will enable your company to meet these goals. As a recognized international leader in continuing education, Besser Associates is dedicated to serving the needs of RF and wireless professionals.

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Our instruction combines theory and practice into one complete and “user-friendly” package that attendees July apply on the job immediately. Whether it's reviewing basics for the inexperienced, or the latest CAD techniques for more seasoned designers, Besser Associates’ courses offer meaningful education for every participant.

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Product Highlights

Comb Generators and Much More
Herotek, Inc. 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

Modular Assembly Expandable to 192 Attenuators
Many of today’s RF test labs require the ability to expand testing capacity for future needs. JFW Model 50PA-1068 is an attenuator assembly that meets that requirement. The 50PA-1068 is a controller module which can be connected up to as many as 8 attenuator modules. The SMA version has 24 attenuators per module and the N attenuator module has 12.

Features:
200-6000 MHz operating band
0 to 95dB by 1dB step attenuators
+27dBm RF input power
Expandable up to 192 attenuators w/ SMA female
Expandable up to 96 attenuators w/ N female

Below is an example image of the controller with four N attenuator modules (48 attenuators shown). The controller and attenuator modules are each 2RU in height.

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jfwindustries.com
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Aerospace, Defense, and More

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Ducommun serves the avionics, communications, defense, industrial, intelligent traffic systems, medical, and test equipment markets with millimeter wave products. We design and manufacture products including amplifiers, antennas (horn and patch), mixers, oscillators, multipliers, radar sensors, industrial grade phase shifters, lab components, up/down-converters, along with sub-systems and integrated assemblies.

Ducommun
ducommun.com
Permanent Magnet YTOs

Permanent magnet technology delivers our lowest DC voltage (prime power) available and is offered in 2 to 44 GHz standard models and in high performance models up to 44 GHz using frequency doublers. Our surface mount MLSMO and MLOTF series and TO-8 MLTO oscillators are extremely small and offer excellent phase noise and frequency stability. They’re the perfect choice for next generation PXI and compact PCI synthesizer applications.

Our MLPB Series offers a plug-in board design; our MLPM series offers 2 GHz tuning range; our MLPF series is a fixed-frequency design; our MLPW series offers a 4 GHz tuning range; and our MLPX series uses frequency doublers to take MLPW models to 44 GHz. All these oscillator models utilize either a bi-polar, FET or the latest SiGe transistor technology, making them excellent choices for PC Board, PCI, PXI, VME & VXI applications. Commercial and extended temperature range models are available throughout the permanent magnet line.

Micro Lambda Wireless
microlambdawireless.com

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- Matched Input for Excellent VSWR**
- Extremely Flat Frequency Response**
- Very High Sensitivity (DZ Series)
- ** (DZR & DZM Series)
- Applications:
  - Precision Test Equipment
  - Transmitter Monitoring
  - Power and Signal Monitoring
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  - Lab Testing

Herotek
herotek.com
Waveguide Switches

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Logus Microwave
logus.com

2 Way Power Dividers

Pulsar Microwave manufactures a large selection of 2-way power dividers in narrowband and broadband configurations, covering frequencies from 225 MHz to 70 GHz. They are designed to handle from 10 to 30 watts input power in a 50-ohm transmission system. Microstrip or stripline designs are utilized, and optimized for best performance.

Units come standard with SMA or N female connectors, or 2.92mm, 2.40mm, and 1.85mm connectors for high frequency components.

Pulsar Microwave
pulsarmicrowave.com
Cables, Cable Assemblies, and More

Microwave Components, Inc., was established in 1980 as a specialized RF/Microwave and more recently, millimeter wave stocking distributor. We specialize in interconnect products and low loss cable/cable assemblies and several other RF components from antennas to board level components.

More recently, we offer customers an avenue to integrated microwave assemblies for a custom designed solution for evolving market needs for miniaturized multi-function devices.

The markets we serve include aerospace/defense, telecommunications, test & instrumentation and others. We hold preferred status from many Government Prime Contractors and support their contractual flow downs passed on.

Microwave Components
mwc-llc.com

High Speed End Launch Connectors

- Reusable low VSWR edge launch connectors
- Narrow profile options save PCB space
- Coverage up to 40, 50, 67 and 110 GHz
- Solder or solder-less end launch installation
- Supports Gbps SerDes

Fairview Microwave is a leading provider of high-quality RF and microwave components including adapters, connectors, attenuators, coaxial cables, terminations, and much more. Specializing in immediate product needs, we offer same-day shipping on thousands of in-stock items with no minimum purchasing requirements. Since 1992, Fairview has been recognized for delivering unsurpassed quality, but our true strength lies on our customer service. We go to great lengths to get you the component you need as rapidly as possible and we do it all with a passion. Located in Lewisville, TX, just north of the Dallas/Fort Worth Metroplex we have grown to become one of the premier suppliers of passive microwave components in the U.S. and across the globe. Fairview boasts over 5,000 microwave and RF parts, most in stock and ready to ship, which over 1 million products can be built and shipped as soon as same day.

Fairview Microwave
fairviewmicrowave.com
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**High Frequency Electronics** (USPS 024-316) is published monthly by Summit Technical Media, LLC, 3 Hawk Dr., Bedford, NH 03110. Vol. 19 No. 07 July 2020. Periodicals Postage Paid at Manchester, NH and at additional mailing offices.

POSTMASTER: Send address corrections to High Frequency Electronics, PO Box 10621, Bedford, NH 03110-0621.

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