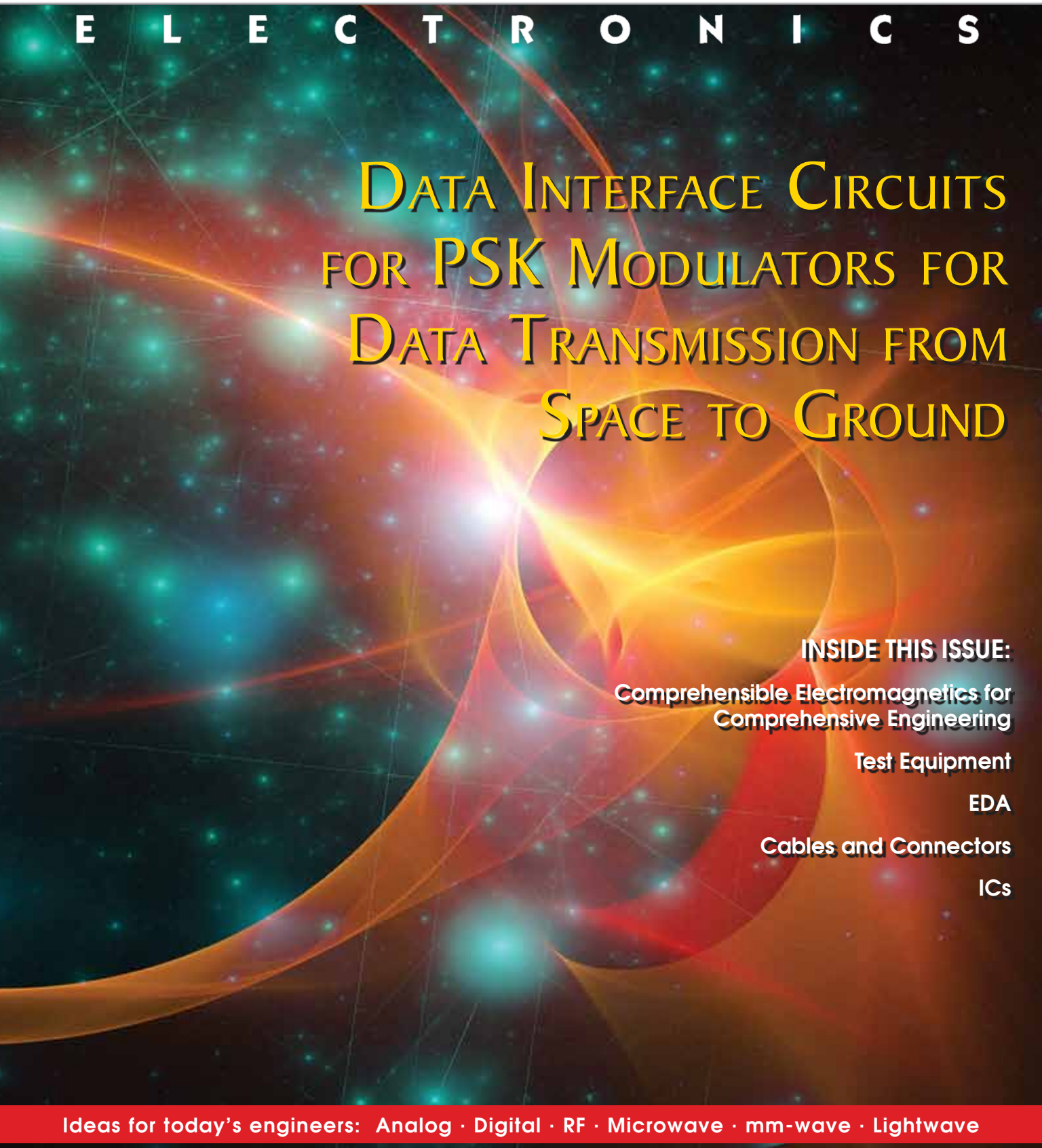
ALSO PUBLISHED ONLINE:
www.highfrequencyelectronics.com

JANUARY2012

HIGH FREQUENCY ELECTRONICS



Data Interface Circuits for PSK Modulators for Data Transmission from Space to Ground

INSIDE THIS ISSUE:

Ideas for today's engineers: Analog · Digital · RF · Microwave · mm-wave · Lightwave

C.W. SWIFT & Associates, Inc.

C.W. Swift & Associates distributes our extensive inventory of Midwest Microwave's quality products ... OFF THE SHELF!

Midwest Microwave
Connectivity Solutions

Attenuators
Adapters
Terminations
& More

EMERSON
Network Power

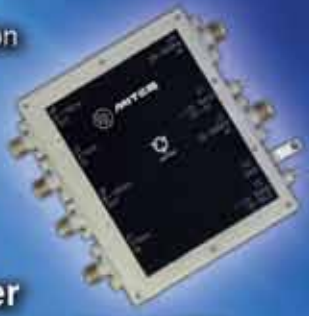
Midwest Microwave Components are In Stock — Call Today for a Quote!

C.W. SWIFT & Associates, Inc.
15216 Burbank Blvd.
Van Nuys, CA 91411
Tel: 800-642-7692 or 818-989-1133
Fax: 818-989-4784
sales@cwswift.com
www.cwswift.com

INTEGRATED ASSEMBLIES

3-Channel Receiver with Limiter

- RF input frequency 11 GHz
- IF frequency range 25 to 50 MHz
- 28 dB conversion gain
- 3.3 dB noise figure
- 20 dB image rejection
- High and low gain selectable



Integrated Dual-Channel Block Converter

- RF input frequency range 18 to 40 GHz
- IF output frequency range 2 to 16 GHz
- Integrated LO multipliers and filters
- Integrated RF and IF filters

Low Noise Block Downconverter

- RF input range 18 to 22 GHz
- Internal LO 17 GHz
- IF output 1 to 5 GHz
- Noise figure 2.9 dB
- 60 dB image rejection

Sub-Harmonic Upconverter and Power Amplifier Module

- RF output range 36 to 37 GHz
- LO input frequency 17.5 GHz
- Output 1 dB compression point +24 dBm
- Conversion gain 20 dB
- Carrier suppression 40 dB
- High reliability miniature hermetic MIC construction

Low Noise Block Converter with Fiber Optic IF Output

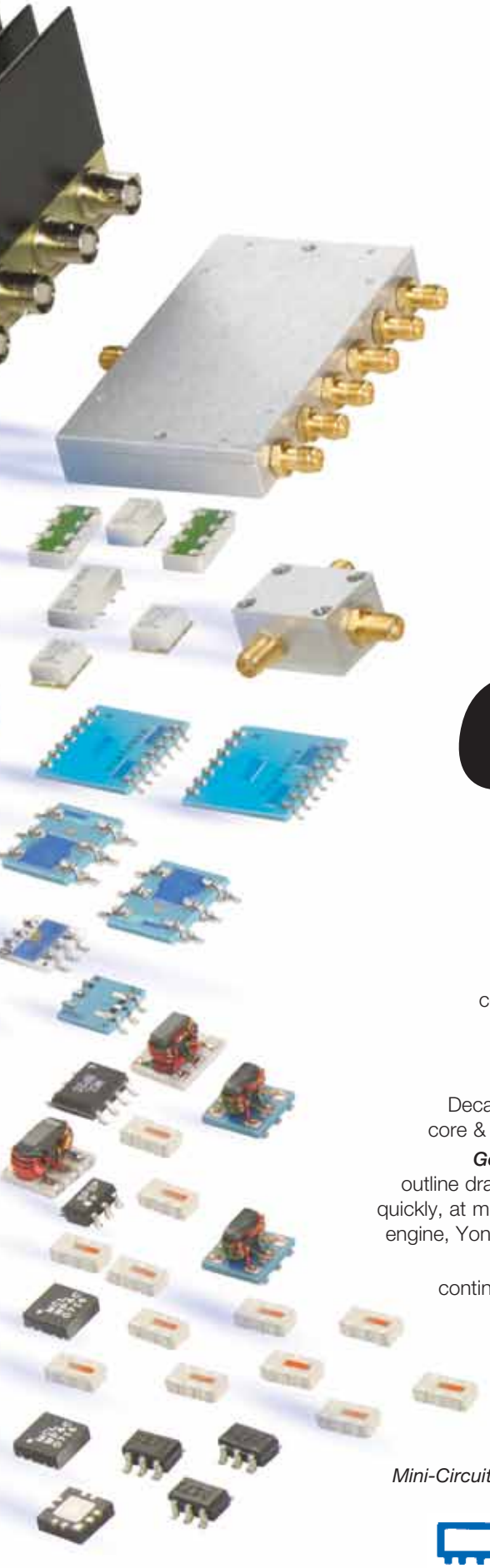
- RF input frequency range 24 to 40 GHz
- IF output frequency range 2 to 18 GHz
- Instantaneous bandwidth 16 GHz
- Noise figure 4 dB typical
- Conversion gain 50 dB including fiber optic receiver

For additional information or technical support, please contact our Sales Department at (631) 439-9220 or e-mail components@miteq.com

MITEQ

100 Davids Drive, Hauppauge, NY 11788
(631) 436-7400 FAX: (631) 436-7430

www.miteq.com



POWER SPLITTERS/ COMBINERS

NOW! from **2 kHz to 18 GHz** as low as **79¢**

The Industry's Largest Selection includes THOUSANDS of models, from 2 kHz to 18 GHz, at up to 300 watts power, and in coaxial, flat-pack, and surface-mount housings for 50 and 75 systems.

From 2-way through 48-way designs, with 0°, 90°, or 180° phase configurations, Mini-Circuits power splitters/combiners offer outstanding performance for insertion loss, isolation, and VSWR. Decades of experience with multiple technologies make it all possible, from core & wire, microstrip, and stripline, to semiconductors and LTCC ceramics.

Get easy-to-find, detailed data and performance curves, S-parameters, outline drawings, PCB layouts, and everything else you need to make a decision quickly, at minicircuits.com. Just enter your requirements, and our patented search engine, Yoni2, searches *actual test data* to find the models that meet your needs.

All Mini-Circuits catalog models are in stock, continuously replenished, and backed by our 1-year guarantee. We even list *current stock quantities and real-time availability*, as well as pricing, to help our customers plan ahead and make quick decisions. So why wait? Take a look at minicircuits.com today!

RoHS Compliant
Product availability is listed on our website.

Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Yoni2® U.S. Patents 7739260, 7761442 ***The Design Engineers Search Engine*** *finds the model you need, Instantly* • For detailed performance specs & shopping online see minicircuits.com

IF/RF MICROWAVE COMPONENTS

TRUtest™ Series

General Purpose Test Cable Assemblies

- Matched performance to 18 GHz
- Repeatable, stable performance
- Low insertion loss and VSWR
- 100% RF tested
- MIL-STD-348 test interfaces
- Stainless steel connectors
- Excellent cable-connector retention
- Ideally suited for production test stations and engineering labs

Proven performance and reliability

TRUtest™ Series cable assemblies combine MIL-standard test-grade interfaces with flexible and durable cable construction to provide repeatable, reliable performance and long service life.

AVAILABLE NOW FOR QUICK DELIVERY		
Part Number	**Description**	**Cable Length**
TRU-16002-03	TRUtest 18 – SMA straight plug to SMA straight plug	36 in (915 mm)
TRU-16003-03	TRUtest 18 – N straight plug to N straight plug	36 in (915 mm)
TRU-16001-03	TRUtest 18 – 3.5 mm straight plug to 3.5 mm straight plug	36 in (915 mm)

To learn more about our TRUtest™ Series of test cables and precision adapters, visit our website: trucorporation.com

CELEBRATING 60 YEARS

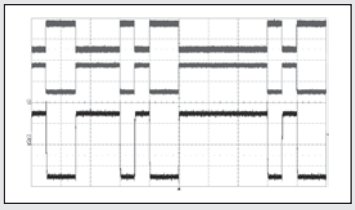
TRU Corporation | Peabody, MA 01960 USA
1 800 262-9878 (1 800 COAX-TRU) | 978 532-0775
To request TRUtest™ literature: marketing@trucorporation.com
trucorporation.com

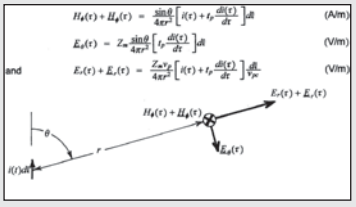
EXPERIENCE. TRU INNOVATION.

ALSO PUBLISHED ONLINE AT:
www.highfrequencyelectronics.com

JANUARY2012
Vol. 11 No. 1

HIGH FREQUENCY ELECTRONICS





ON Semiconductor introduces a new family of Schottky rectifiers.

Anderson Power Products introduces a high power connector series.

Jim Williams is remembered at the Computer History Museum.

HFE enters its 10th year.

HIGH FREQUENCY
ELECTRONICS

Vol. 11 No. 1, January 2012

Publisher
Scott Spencer
scott@highfrequencyelectronics.com
Tel: 603-472-8261
Fax: 603-471-0716

Associate Publisher/Managing Editor
Tim Burkhard
tim@highfrequencyelectronics.com
Tel: 707-544-9977
Fax: 707-544-9375

Senior Technical Editor
Tom Perkins
tom@highfrequencyelectronics.com
Tel: 603-472-8261
Fax: 603-471-0716

Vice President, Sales
Gary Rhodes
grhodes@highfrequencyelectronics.com
Tel: 631-274-9530
Fax: 631-667-2871

Business Office
Summit Technical Media, LLC
One Hardy Road, Ste. 203
PO Box 10621
Bedford, NH 03110

Also Published Online at
www.highfrequencyelectronics.com

Subscription Services
Sue Ackerman
Tel: 651-292-0629
Fax: 651-292-1517
circulation@highfrequencyelectronics.com

Send subscription inquiries and address changes to the above contact person. You may send them by mail to the Business Office address above.

Our Environmental Commitment

High Frequency Electronics is printed on paper produced using sustainable forestry practices, certified by the Program for the Endorsement of Forest Certification (PEFC™), www.pefc.org

SUMMIT Technical Media LLC

Getting Connected in 2012

Scott L. Spencer
Publisher

January 2012 marks the beginning of our 10th year as *High Frequency Electronics* magazine. Of the numerous topics we cover during a 12-month editorial cycle none is more popular than cables and connectors. This may be the case because most engineers must familiarize themselves with the nomenclature and performance characteristics of not only the numerous types of transmission lines available, but also with the host of connector families available.

In the 1980s I worked for Omni Spectra, a leading supplier of a variety of products including SMA connectors. We didn't call them SMAs; instead they were referred to as OSMs -- Omni Spectra Miniatures. Omni Spectra engineers knew that by not just meeting -- but exceeding -- the requirements of prevailing Mil-Spec, Mil-C-39012, the OSM would outperform the generic SMA every time. So, by design and via strict controls on machining and assembly operations, Omni Spectra was able to produce a superior connector that users preferred. By holding positions of the center conductor and dielectric in a tight tolerance position with respect to the connector reference plane, performance was improved to behave more like a continuous transmission line. Tighter manufacturing tolerances could sometimes lead to poor yields and delivery slippages, but these problems were soon overcome. The OSM brand name was synonymous with quality. Component designers knew that input and output VSWR requirements were more likely to be met with an OSM. Savvy system-level integrators knew that solid transmission line interconnects served to cut tuning time and rework costs.

The Connector Kings

If such statistics are even kept, it is likely that no one man ever purchased more microwave connectors than Mike Peacock. Mike recently retired from Raytheon in Goleta, Calif. He began purchasing connectors for Raytheon in 1962. Legendary Southern California microwave distributor C.W. "Chuck" Swift was the Omni Spectra distributor in California for much of Mike's career. Raytheon Goleta used boatloads of OSMs on phase-matched cables made from .141 semi rigid cable for use on their Surface Navy Electronic Warfare suites. The systems used large beam-forming lenses driven by miniature TWTs and semi-rigid cable was everywhere. All of it terminated with OSMs.

Chuck pilots a Beechcraft Bonanza that he purchased at the height of Omni Spectra's business success. The vanity tail numbers on the plane read "201 Whiskey Charlie." In what may be pure coincidence, 201 was the part

number Omni Spectra assigned to its largest selling connector--the OSM that terminates .141 semi-rigid.

Today there are numerous suppliers of precision SMA connectors and, to a large degree, they are a price-driven commodity. On the development front, smaller line sizes, more use of air dielectrics, improvements in cable performance, better durability, blind mating considerations, and color coding standards are the trends.

2012 Outlook

Many analysts believe that global GDP growth will slow in 2012 to around 3.2% with modest improvements in 2013. The U.S. could see domestic GDP grow as slow as 2% in 2012. There has been dialogue from Washington that the Super Committee impasse may trigger massive spending cuts to our defense programs. The Secretary of Defense recently warned that cutting $1 trillion from the nation's defense spending over the next 10 years would gut almost every high-priority program. The F-35 Joint Strike Fighter, the Air Force's next generation bomber program, the Navy's SSBN-X submarine replacement program, the Navy's next generation Littoral Combat Ship, new satellite, surveillance and reconnaissance systems -- all could be affected. This would have a significant adverse impact on suppliers heavily invested in those programs and to their subcontractors and vendors. Another concern for 2012 is possible fallout from the unresolved European sovereign debt crisis which has the potential to put a heavy burden on the global financial system, slowing the growth of emerging economies.

On the other hand, the end of 2011 saw almost every major indicator of economic health moving in the right direction. The DJIA ended the year well above 12,000. Let's say Europe starts to stabilize and fast-growing places like China, India, Indonesia, Brazil and Russia continue to grow at a faster pace than the U.S. If that scenario plays out and Washington comes up with a plan that addresses deficit reduction while continuing to invest in vital defense programs like the F-35, then economic opportunity will grow not only for this industry but also for the larger economy as a whole.

Upcoming

Don't forget DesignCon 2012. This year it is being held at the Santa Clara, Calif., Convention Center from January 30 through February 2, and is billed as the event "Where Chipheads Connect." HFE

Conferences

January 15 – 18, 2012
IEEE Radio and Wireless Symposium

12th Topical Meeting on Silicon Monolithic Integrated Circuits in RF Systems (SiRF)

2012 IEEE Topical Conference on Biomedical Wireless Technologies, Networks, and Sensing Systems (BioWireleSS)

2012 IEEE Topical Conference on Wireless Sensors and Sensor Networks (WiSNET)

2012 Topical Conference on Power Amplifiers for Wireless and Radio Applications (PAWR)
Santa Clara, Calif.
Information: http://www.radiowirelessweek.org

February 6 – 8, 2012
Military Radar Summit
Washington, D. C.
Information: militaryradarsummit.com

March 5 – 7, 1012
IEEE International Workshop on Antenna Technology: Small Antennas and Unconventional Applications
Tucson, Ariz.
Information: http://www.cccmeetings.com/iwat2012.pdf

March 12 – 13, 2012
CS Europe
Frankfurt, Germany
Information: http://cseurope.net

April 1 – 4, 2012
IEEE Wireless Communications and Networking Conference
Paris, France
Information: http://www.ieee-wcnc.org/2012

April 3 – 5, 2012
Microwave & RF
Paris, France
Information: http://www.microwave-rf.com/?lang=EN

April 3 – 5, 2012
Forum Radiocoms
Paris, France
Information: http://www.microwave-rf.com/

April 10 – 14, 2012
28th International Review of Progress in Applied Computational Electromagnetics
Columbus, Ohio
Information: http://aces.ee.olemiss.edu

June 17 – 22, 2012
IMS 2012
Montreal, Canada
Information: http//ims2012.org

August 6 – 9, 2012
NIWeek 2012
Austin, Tex.
Information: http://www.niweek/

Short Courses

Besser Associates
Tel: 650-949-3300
Fax: 650-949-4400
Email: info@besserassociates.com
http://besserassociates.com
Online resources: bessernet.com

EMC/Shielding/Grounding Techniques for Chip & PCB Layout
January 23 – 27, 2012, Web Classroom, WebEx

Applied RF Techniques I
February 27 – March 2, 2012, San Diego, Calif.

Understanding DSP
February 27 – 29, 2012, San Diego, Calif.

Frequency Synthesis and Phase-Locked Loop Design
February 27 – 29, 2012, San Diego, Calif.

Applied Design of RF/Wireless Products and Systems
February 27 – 29, 2012, San Diego, Calif.

Wireless LANs
February 27 – 29, 2012, San Diego, Calif.

Digital Predistortion Techniques for RF Power Amplifier Systems
March 1 – 2, 2012, San Diego, Calif.

GaN Power Amplifier Design
March 12 – 16, 2012, Web Classroom, WebEx

RF and High Speed PC Board Design Fundamentals
March 19 – 21, 2012, San Jose, Calif.

Transceiver and Systems Design for Digital Communications
March 19 – 21, 2012, San Jose, Calif.

Practical Digital Wireless Signals – Measurements and Characteristics
March 19 – 23, 2012, San Jose, Calif.

LTE & LTE-Advanced: A Comprehensive Overview
March 19 – 21, 2012, San Jose, Calif.

RF Measurements: Principles & Demonstration
April 23 – 27, 2012, San Jose, Calif.

CMOS RF Design
April 23 – 25, 2012, San Jose, Calif.

Modern Digital Modulation Techniques
May 21 – 25, 2012, Burlington, Mass.

Antennas & Propagation for Wireless Communications
May 21 – 23, 2012, Burlington, Mass.

Radio System Design – Theory and Practice
May 21 – 25, 2012, Burlington, Mass.

Applied Analog/Mixed-Signal Measurements
May 21 – 25, 2012, Burlington, Mass.

SPDT & DPDT WAVEGUIDE SWITCHES

RLC has the standard and custom design solutions you're looking for.

RLC Electronics' electromechanical waveguide switches offer a compact design utilizing a proprietary non-contacting actuator mechanism that requires low current. Precision machined parts insure optimum electrical performance over the entire waveguide band.

- Frequencies from 7.05 to 40 GHz
- Failsafe, Latching, Manual Override or Manual
- Indicator and TTL Options
- Standard Waveguide Sizes
- Switching Times As Fast As 25 Milliseconds
- High Isolation
- Low Insertion Loss
- Low VSWR
- 5, 12 or 28v DC Coil
- Environmentally Conforms to MIL-DTL-3928

For more detailed information on SPDT & DPDT Waveguide Switches, visit our web site.

RLC ELECTRONICS, INC.

83 Radio Circle, Mount Kisco, New York 10549 • Tel: 914.241.1334 • Fax: 914.241.1753

E-mail: sales@rlcelectronics.com • www.rlcelectronics.com

ISO 9001:2000 CERTIFIED

RLC is your complete microwave component source...
Switches, Filters, Power Dividers, Terminations, Attenuators, DC Blocks, Bias Tees & Detectors.

Power Conversion & Regulation Circuits for VLSI Systems
May 22 – 25, 2012, Burlington, Mass.
Wireless/Computer Network Security
May 23 – 25, 2012, Burlington, Mass.
RF Fundamentals
June 25 – 29, 2012, Web Classroom, WebEx

Company-Sponsored Training & Tools

National Instruments
LabVIEW Core 1
Online
http://sine.ni.com/tacs/app/fp/p/ap/ov/pg/1/
LabVIEW Core 2
Online
http://sine.ni.com/tacs/app/fp/p/ap/ov/pg/1/
Object-Oriented Design and Programming in LabVIEW
Online
http://sine.ni.com/tacs/app/fp/p/ap/ov/pg/1/

Agilent Technologies
Introduction to Agilent VEE Pro
February 14 – 17, 2012, Las Vegas, Nev.
http://www.home.agilent.com/agilent/eventDetail.jspx?cc=US&lc=eng&ckey=701878-14&nid=-34787.0.00&id=701878-14
RF and Microwave Fundamentals
February 14 – 17, 2012, Las Vegas, Nev.
http://www.home.agilent.com/agilent/eventDetail.jspx?cc=US&lc=eng&ckey=701878-14&nid=-34787.0.00&id=701878-14
Advanced Agilent VEE Pro
June 19 – 22, 2012, Las Vegas, Nev.
http://www.home.agilent.com/agilent/eventDetail.jspx?cc=US&lc=eng&ckey=701878-14&nid=-34787.0.00&id=701878-14

AWR
On-site and online training, and open training courses on design software.
http://web.awrcorp.com/Usa/News--Events/Events/Training/

Linear Technology
LTSpice IV
LTpowerCAD
LTpowerPlay
Amplifier Simulation & Design
Filter Simulation & Design
Timing Simulation & Design
Data Converter Evaluation Software
http://www.linear.com/designtools/software/

Call for Papers

2012 IEEE 13th Annual Wireless and Microwave Technology Conference (WAMICON)
April 16 – 17, 2012, Cocoa Beach, Fla.
Abstract Deadline: January 9, 2012
Final Paper Deadline: February 13, 2012
http://ieee.org/web/callforpapers

2012 IEEE International Conference on Wireless Information Technology and Systems (ICWITS)
July 29 – August 3, 2012, Honolulu, Hawaii
Abstract Deadline: April 1, 2012
http://ieee.org/web/callforpapers

2012 Workshop on Integrated Nonlinear Microwave and Millimetre –Wave Circuits
September 3 – 4, 2012, Dublin, Ireland
Abstract Deadline: May 4, 2012
Final Paper Deadline: August 3, 2012
http://ieee.org/web/callforpapers

2012 IEEE International Conference on Ultra-Wideband (ICUWB2012)
September 17 – 20, 2012, Syracuse, N.Y.
Abstract Deadline: March 9, 2012
Final Paper Deadline: June 15, 2012
http://ieee.org/web/callforpapers

2012 37th International Conference on Infrared, Millimeter, and Terahertz Waves
September 23 – 28, 2012, Wollongong, NSW, Australia
Abstract Deadline: April 20, 2012
Final Paper Deadline: July 6, 2012
http://ieee.org/web/callforpapers

2012 IEEE 21st Conference on Electrical Performance of Electronic Packaging and Systems
October 21 – 24, 2012, Tempe, Ariz.
Abstract Deadline: July 1, 2012
Final Paper Deadline: July 8, 2012
http://ieee.org/web/callforpapers

Why Coilcraft wirewound chip inductors are your #1 choice

Higher Q Compared to non-wirewounds, our chip inductors usually have Qs that are 50 to 150% higher.

Lower DCR Put up to 3 times more current through our chip inductors thanks to their low DC resistance.

Higher SRF The solenoid winding of our inductors gives them a much higher SRF than multilayer parts.

Tighter tolerance Precision manufacturing lets us consistently make parts with ±2% inductance tolerance. Many popular values also come in ±1%.

Better support With our engineer-friendly web site, interactive design tools and generous free samples, Coilcraft is just plain easier to do business with.

Visit **www.coilcraft.com** for information on all our high performance wirewound inductors.

coilcraftdirect.com
No min order. Next day delivery.

Coilcraft®

WWW.COILCRAFT.COM

Business News

Analog Devices Inc. was named one of the world's most innovative companies, according to the **Thomson Reuters 2011 Top 100** Global Innovator SM program. The program analyzes patent data and related metrics in a proprietary methodology to identify the organizations that lead the world in innovation activity. Analog Devices was one of 14 semiconductor and electronic component manufacturers named to the top 100, and the only analog company on the list of global innovators. "Analog Devices was built on the strength of our ability to differentiate our products, our signal processing technology and our approach to design collaboration and customer support. This is how we define innovation at ADI," said **Robert McAdam**, vice president, Core Products and Technologies Group, Analog Devices. The Thomson Reuters 2011 Top Global innovators program evaluates innovation performance according to companies that invent on a significant scale, work on developments that are acknowledged as innovative by others around the world, and whose inventions are globally protected due to their importance. The program's methodology is based on four principle criteria: patent approval success rate, global reach of patent portfolio, patent influence in literature citations and overall patent volume.

Micronetics, Inc. announced that it has been awarded an initial production order valued at approximately $2.4 million from a leading precision antenna system manufacturer for the supply of **high performance microwave subsystems.** Each subsystem, which consists of a transceiver, on board computer, power supply, and a high power amplifier (HPA), will help satisfy the demanding need for a reliable, high-speed broadband satellite based connection into commercial and military aircraft for a broad range of uses. Hardware deliveries are targeted to commence in this fiscal year with a 6-month period of performance. **David Robbins,** Micronetics' CEO stated, "We are happy to have secured this initial contract. This product and design win reflects our latest in engineering expertise and we are optimistic that demand for this product will contribute to our growth. We targeted airborne high speed data links based on the strength and diversity of commercial and military applications, consistent with our strategy to leverage our strong technology capabilities and breadth of product offerings across multiple end markets."

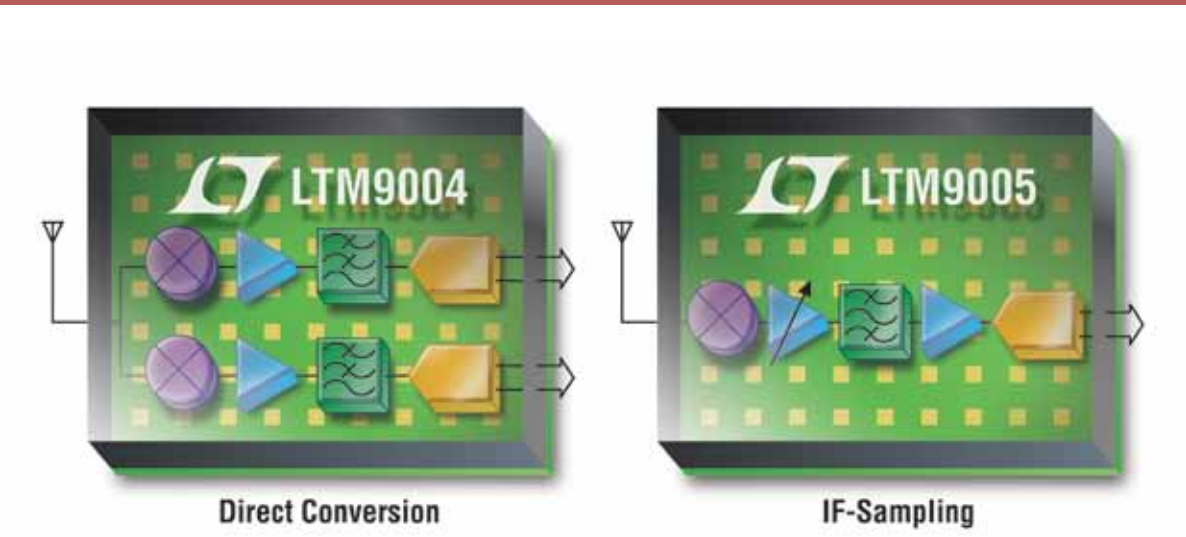
STMicroelectronics has been recognized as among the world's four best semiconductor companies in design, according to a report **from Gary Smith EDA,** a provider of market intelligence and advisory services for the global Electronic Design Automation (EDA), Electronic System Level (ESL) design, and related technology markets. In the report, founder and Chief Analyst Gary Smith, highlights ST's leadership in Electronic System Level (ESL) design, the depth of its expertise, and the contribution of its Computer-Aided Design (CAD) group. "ST has pioneered many of the tools and design methodologies presently used today. The design industry owes them their thanks for ST's design group's leadership in developing the ESL (Electronic System Level) methodology, said Gary Smith. **Philippe Magarshack,** Group Vice President of STMicroelectronics' Central CAD & Design Solutions Division, said, "Mr. Smith has extensive experience in assessing chip-design businesses, and his opinions are valued and recognized throughout the global semiconductor industry. The report findings further highlight ST's focus on design, which is a key source to providing our customers competitive advantage, and underpin ST's commitment to merging first-rate skills and facilities to deliver products with superior characteristics for our customers."

RF Micro Devices, Inc. announced that **Huawei Technologies Corp., Ltd.,** a leading global information and communications technology (ICT) solutions provider, has honored RFMD with Huawei's 2011 "Best Supplier Award." The prestigious award was accepted by RFMD's president and CEO, **Bob Bruggeworth,** at an awards ceremony held earlier today in Shenzhen, China. Mr. Bruggeworth commented following the ceremony, "It is a distinct honor to receive this award from Huawei in recognition of RFMD's commitment to excellence in on-time product delivery, local customer support, and product and technology leadership. RFMD is proud to support Huawei across multiple product applications, including cellular handsets, smartphones, wireless infrastructure, and point-to-point cellular backhaul." **Anders Karlborg,** Vice President of Huawei Supply Chain Management, said, "RFMD is a strategic partner to Huawei whose dedication to customer service and support contribute directly to our success, especially in the areas of technology development and performance, field applications support, and product delivery."

Technology News

u-blox, the Swiss positioning and wireless chip and module company, and **Rohde & Schwarz (R&S),** a leading supplier of test and measurement equipment, have successfully concluded a simulation of the Russian **GLONASS satellite navigation system.** The test, carried out with the R&S SMBV100A vec-

RF-to-Bits



Complete µModule® Receivers Simplify Radio Design

The LTM®9004 (Direct Conversion) and LTM9005 (IF-Sampling) µModule receivers offer unprecedented integration for smaller, low power designs and dramatically faster time-to-market. Integrating the RF, signal filtering, gain stages and high-speed ADCs, these receivers eliminate time-consuming design, layout and component sourcing associated with high-performance communication systems. With no performance compromise, they enable dense, multichannel macrocells or compact remote radio heads.

Features

- Fully Integrated RF-to-Digital Receivers
- 14-Bit, 125Msps Low Power ADC
- Direct Conversion Architecture (LTM9004)
  - 800MHz to 2.7GHz RF Input Range
  - I/Q Demodulation & Dual ADC
  - 5V & 3V Supplies, 1.8W Total
- IF-Sampling Architecture (LTM9005)
  - 400MHz to 3.8GHz RF Input Range
  - 20MHz SAW Filter, 140MHz IF
  - 3.3V Supply, 1.3W Total
- 22mm x 15mm LGA Package

LTM9004 Demo Board

Info & Free Samples

www.linear.com/9004

1-800-4-LINEAR

Free Wireless Solutions Brochure

www.linear.com/wireless

LINEAR TECHNOLOGY

tor signal generator and its GNSS simulation options, verified the u-blox proof-of-concept and the compatibility of u-blox receiver technology with the GLONASS transmission protocol. The GLONASS satellite system is Russia's answer to the **US NAVSTAR** GPS satellite positioning system. It will provide a high-accuracy positioning system with global coverage once completed. GLONASS will also be used in hybrid receivers around the world in conjunction with GPS to ensure improved coverage especially in dense cities and thus improve the location accuracy. "Our close cooperation with Rohde & Schwarz has proven to be a valuable and strategic asset, allowing us to develop advanced satellite receiver technology well before the actual satellites are available" said said **Thomas Nigg,** VP Product Marketing at u-blox. "u-blox, with its depth of expertise in GNSS technologies, has helped us to validate our satellite simulator technology," said **Andreas Pauly,** Head of R&D Signal Generators Baseband at Rohde & Schwarz. "Now we have enhanced our cutting-edge test equipment for GLONASS that simulates the protocol and physical layer."

People in the News

Texas Instruments Incorporated announced the election of three of its engineers to **IEEE Fellow,** a distinction reserved for select IEEE members whose extraordinary accomplishments are deemed fitting of this prestigious honor. TI's **Ajith Amerasekera,** director of Kilby Labs, **Ahmad Bahai,** Analog Chief Technology Officer, and **Luigi Colombo,** TI Fellow in the External Development and Manufacturing (EDM) group, received the IEEE's highest level of membership for their innovative contributions in the semiconductor industry. They join 19 other TI engineers who hold the prestigious title of IEEE Fellow. "Innovation is the foundation upon which TI's 80-plus year history is built," said Rich Templeton, chairman, president and CEO of Texas Instruments. "The election to IEEE Fellow is an extraordinary accomplishment, recognizing those who have driven significant innovations impacting our industry and the world we live in. We're fortunate to have some of the brightest minds working at TI." The IEEE Grade of Fellow is conferred by the IEEE Board of Directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest. The total number selected in any one year cannot exceed one-tenth of one- percent of the total voting membership. IEEE Fellow is the highest grade of membership and is recognized by the technical community as a prestigious honor and an important career achievement. Three hundred and twenty-one individuals have been elevated to IEEE Fellow for 2011.

Giga-tronics announced that **Robert Waldeck** has been named Vice President of Business Development for Switching Solutions. Mr. Waldeck has held positions as a Sales Representative and in Sales Management in the T&M instrument industry during the past 15 years and prior to that worked in the Defense and Space industry. Mr. Waldeck spent over 16 years developing Automated Test Equipment for various branches of the Armed Forces at a prominent Defense contractor. He holds a BSEE from NY Institute of Technology and an MBA from CW Post, Long Island University. "With the addition of Bob, Giga-tronics significantly strengthens its business of delivering high performance RF and Microwave signal switching solutions to its customers," said **Malcolm Levy,** Executive VP of Sales.

A new exhibit at the Computer History Museum in Mountain View, Calif., features work and artifacts from the life of **Jim Williams,** a towering figure in the world of engineering and one of the world's best analog circuit designers. A longtime employee of **Linear Technology,** Mr. Williams passed away in June 2011. According to the Museum, "The practice of designing analog circuits and systems is as much art as science. Real world signals vary continuously and can be complex and sometimes unpredictable. Analog engineers must combine technical knowledge with a great deal of experience and intuition in order to harness them. Analog designers often work under a master engineer, such as Jim Williams, for many years to learn the secrets of good analog design. This long apprenticeship gives them a special status among other engineers who consider analog design to be a mysterious process. Williams himself did not consider it a mystery." Information: computerhistory.org/highlights/analoglife/.

Low Power 16-Bit High Speed ADCs

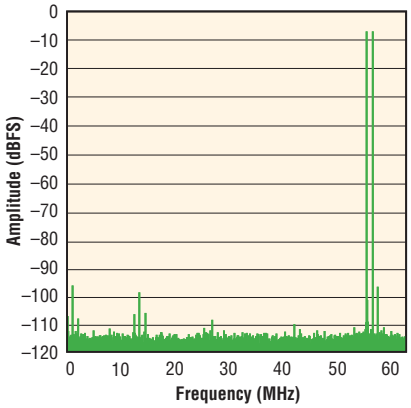
Flexible Digital Outputs: CMOS, DDR CMOS, DDR LVDS, Serial LVDS

Our lowest power 16-bit, 25Msps to 125Msps single and dual ADC families offer a choice of full-rate CMOS, DDR CMOS/LVDS or serial LVDS digital outputs with programmable timing, programmable LVDS current and optional LVDS termination. The ADCs feature Linear's digital output randomizer for reducing digital feedback. Designers can benefit from the choice of flexible interfaces to minimize pin count and ease routing to FPGAs.

Features

- 16-bit, 25Msps-125Msps ADCs
- 76.8dB SNR, 90dB SFDR
- Single 1.8V Supply
- Flexible Digital Interfaces:
  - LTC2185/LTC2165: DDR LVDS, DDR CMOS or CMOS Outputs
  - LTC2195: Serial LVDS
- Selectable Input Ranges: $1V_{P-P}$ to $2V_{P-P}$
- 550MHz Full-Power Bandwidth S/H
- Optional Data Output Randomizer
- Optional Clock Duty Cycle Stabilizer
- Shutdown & Standby Modes
- Serial SPI Port for Configuration

LTC®2185 2-Tone FFT, f_{IN} = 70MHz and 69MHz



Info & Free Samples

1-800-4-LINEAR

For our complete
High Speed ADC Portfolio
visit www.linear.com/HSADC

LINEAR TECHNOLOGY

Test and Measurement

USB Power Sensors

Tektronix, Inc., introduced a family of compact RF and microwave power sensors/meters that feature the industry's fastest measurement speed, cover a wide frequency range, and provide extensive power measurements from basic average power to pulse profiling. The Tektronix PSM RF Power Meter Series come fully calibrated over their entire operating temperature range, eliminating the need for sensor zeroing and meter reference calibration. The new PSM3000, PSM4000, and PSM5000 Series are compact USB power sensors/meters that can be used for a broad range of CW and pulse modulation measurements depending on the model selected. They are delivered with Microsoft Windows-based power meter application software for controlling the meter, displaying readings and recording data. This combination provides a complete test solution, eliminating the need for a separate meter mainframe. PSM Series power sensors feature the industry's fastest measurement speed, rated at 2000 readings per second. They are highly versatile thanks to a wide dynamic range (–60 dBm to +20 dBm) and frequencies ranging from 10 MHz up to 26.5 GHz.

Tektronix, Inc.
tektronix.com

2G/3G/3.5G Test Set

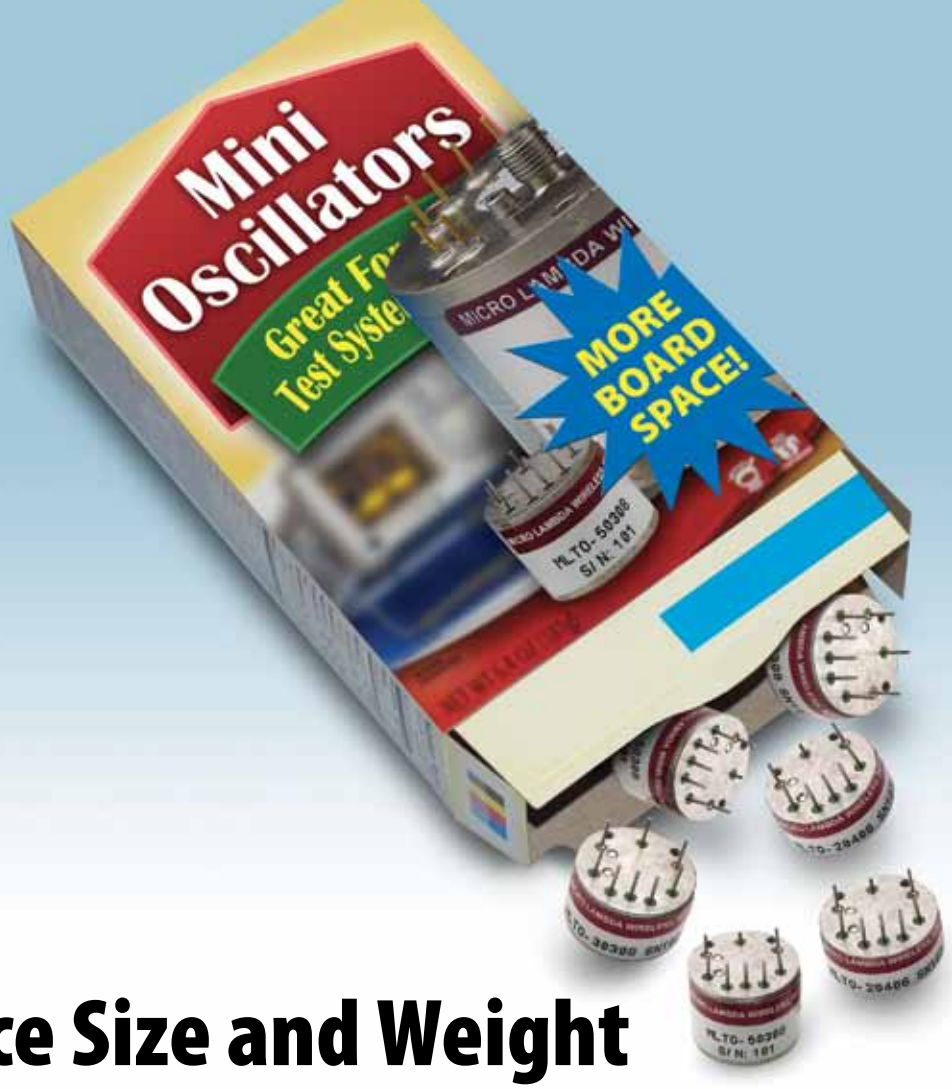
Agilent Technologies Inc. announced the new E5515E 8960 Series 10 wireless communications test set, designed for R&D engineers who need to stress their 2G/3G/3.5G designs at the maximum data rates. The E5515E, an enhancement to the industry-preferred 8960 wireless test set, is equipped with dual downlink paths, a more powerful processor and other significant hardware improvements. It includes advanced features such as sustained 42-Mb/sec DCHSDPA throughput and extensive handovers between 2G/3G and LTE, for comprehensive 2G/3G/3.5G/LTE testing together with the Agilent PXT E6621A wireless communication test set for LTE. In addition, the E5515E wireless test set supports the latest TDSCDMA advancements such as TDHSDPA 2.8-Mb/sec IP data connections, TDHSUPA signaling and test-mode connections, and TDSCDMA protocol logging.

Agilent Technologies
agilent.com

Cables and Connectors

Silicone Encased Cables

Cicoil's highly flexible and durable flat silicone cables are designed for use on Unmanned Ground Based Military Robotic Vehicles that require absolute reliability in Mission Critical and Extreme Environment Conditions. Unlike bulky and stiffer round cables, Cicoil's flat silicone cables provide space and weight savings, enhanced flexibility, greater current carrying capacity, reduced skewing effects and better electrical characteristics. Cicoil utilizes



Reduce Size and Weight

The MLTO and MLTM-Series TO-8 YIG-Tuned oscillators from Micro Lambda Wireless provide designers a small compact and easy to use alternative for tuneable oscillator applications. These miniature oscillators provide wide tuning ranges covering 2 to 9 GHz, excellent phase noise performance of -125 dBc/Hz at 100 kHz offset in a TO-8 sized package. Both electromagnetic and permanent magnet designs operate off +8 Vdc and -5 Vdc and do not require a heater.

If PC board space is a premium, then these miniature oscillators are just what you are looking for.

Same great performance as standard oscillators at less than one third the size!

For more information about the MLTO & MLTM Series or other products, please contact Micro Lambda Wireless.

See our complete line of YIG-Tuned Oscillators

Mini-Oscillators
.5 to 10 GHZ

1" cube Oscillators
.5 to 18 GHZ

Low Noise Oscillators
2 to 20 GHZ

Millimeterwave Oscillators
18 to 40 GHZ

www.microlambdawireless.com

MICRO LAMBDA WIRELESS, INC.

"Look to the leader in YIG-Technology"

46515 Landing Parkway, Fremont CA 94538 • (510) 770-9221 • sales@microlambdawireless.com

a process of encapsulating conductors in silicone that renders them unaffected by exposure to severe vibration, G-forces, shaking motion, abrasion, water, coarse sand, extreme temperatures (-65°C to +260°C), flames and harsh weather conditions. Cicoil's specialized silicone jacket functions as a shock absorbing material, completely surrounding and supporting each individual component. Unlike PVC, Polyurethane or Teflon jacketed cables, Cicoil cable does not require a clamping system because the conductors cannot creep out of the silicone encasing them.

Cicoil
cicoil.com

Cable Assembly

LW. L. Gore & Associates, Inc., has added a rugged 18 GHz cable assembly specifically engineered for high throughput production test applications in the wireless infrastructure market. Its stable performance ensures precise measurements and repeatability, which reduces the risk of testing errors and the need for time-consuming troubleshooting and system calibration. The robust connectors on these assemblies minimize failure by incorporating maximum strain relief at the point where the cable and connector meet. The assembly's internally ruggedized construction is more durable, delivering crush resistance of 187 pounds per linear inch (85 kg/cm). Available in 1.0 and 1.5 meter lengths with both SMA and N-type male connectors, this cable assembly is easier for the operator to use because it is smaller and lighter weight, and it can be connected and disconnected manually.

These assemblies withstand 100,000 flexures at a minimum bend radius of one inch.

W. L. Gore & Associates
gore.com

Adapters

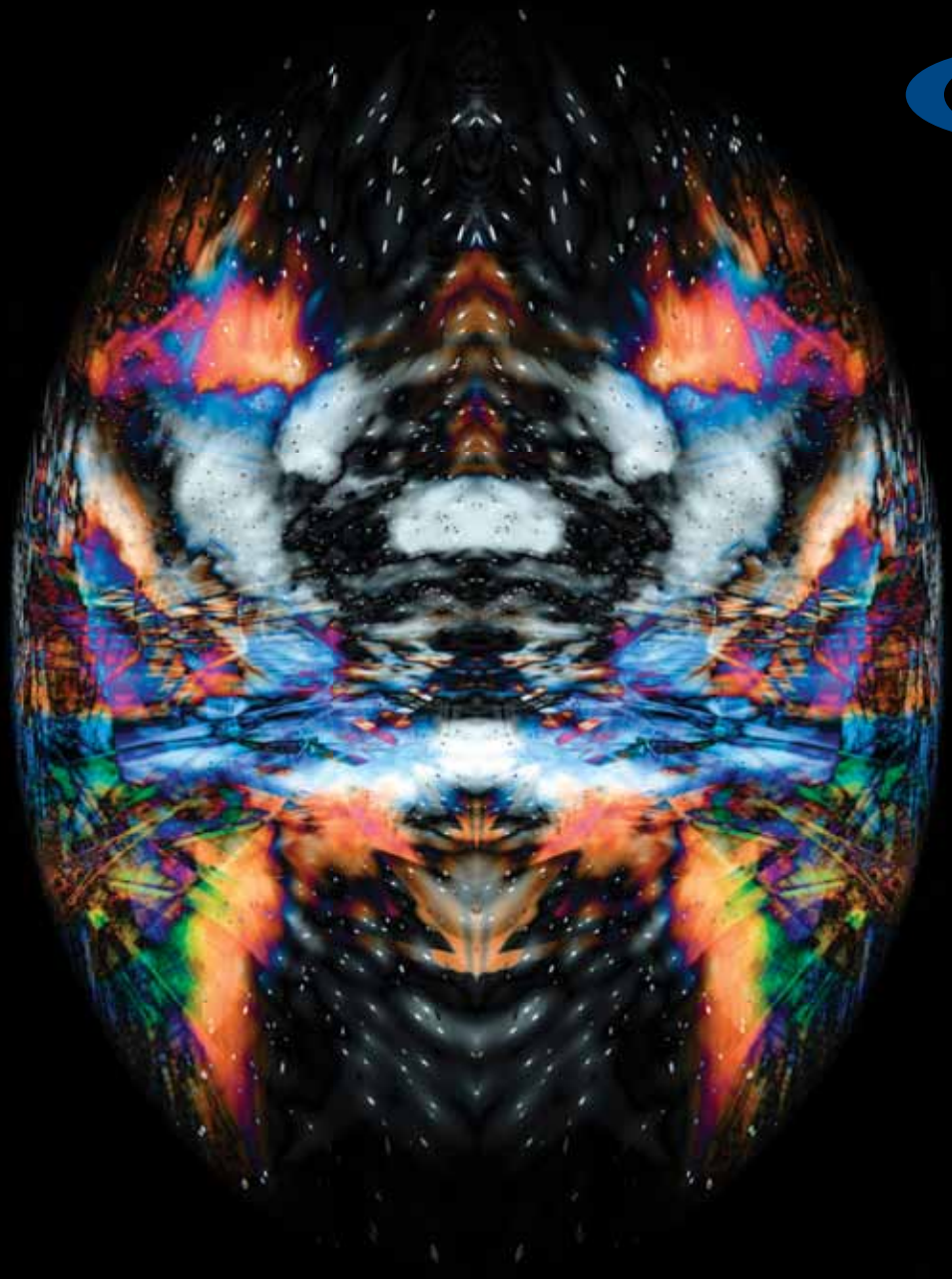
2.4mm to 2.92mm (40 GHz) Between Series Right Angle Precision Adapters allow you the advantage of connecting a 2.4mm Male or Female straight cabled connector to a 2.92mm Male or Female straight cabled connector where tight spaces make it difficult to attach a straight cable connector of the opposite sex or series to its mating connector. SGMC offers a wide variety of both in-series and between-series precision adapters in multiple configurations offering low VSWR, captivated center contact, and rugged construction for repeatability and reliability.

SGMC Microwave
sgmcmicrowave.com

Fiber Optic Cables

Cables Unlimited offers Corning fiber assemblies using Multi-fiber Termination Push-on (referred to as MTP) connectors designed by USConec. This compact design allows high-density connections between network equipment. A simple push-pull latching mechanism provides easy insertion and removal. Where space is an issue, the MTP allows for more connectors on the overcrowded faceplate, thus reducing the footprint of the

AWR®



EM speed that will turbocharge your design creativity.

Stop waiting and wishing for an EM tool that keeps pace with your own creative ideas. AXIEM is capable of solving big problems fast — typically 10x faster than current alternatives for designs of 10K unknowns or more. And now that it handles antennas, too, your creativity will know no bounds. For the most accurate EM results in minutes rather than hours, go with AXIEM. Grab a test copy today at awrcorp.com/AXIEM.

Stop waiting and start designing™

AXIEM®
3D PLANAR EM

FEATURED PRODUCTS

systems. It will interface with current MPO connectors. It is the same size as an SC connector, but since it can hold up to 12 fibers, it provides up to 12 times the density.

Cables Unlimited
cables-unlimited.com

High Power Connector

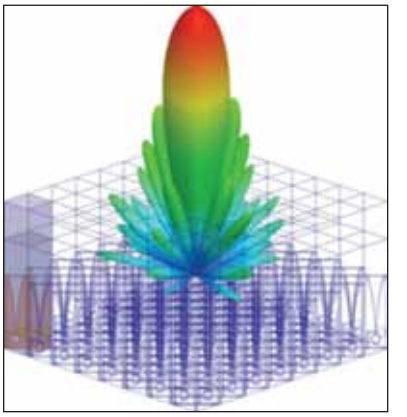
Anderson Power Products® introduced the SPEC Pak™ High Power Connector, APP's latest addition to the SPEC Pak™ Connector series of sealed power for environmental conditions. The SPEC Pak™ High Power Connector has power handling capacity from 75 to 260 amps and an IP68-rated waterproof environmentally sealed shell, making it ideal for portable and test equipment; solar, wind and traditional power generation; traffic control equipment; as well as transportation, industrial, agricultural, and military applications. The SPEC Pak™ line's housing design and materials create a rugged, watertight and weather-proof enclosure to protect electrical components from water, dust, and other harsh environmental contaminants. The SPEC Pak™ High Power Connector features a UL94 V-0 flammability rating and a UL 746C F1 weather-ability rating. It is compatible with industry-standard PG threaded sealing glands and has sturdy aluminum latches with lockout/tag-out capability.

Anderson Power Products
andersonpower.com

EDA/Simulation

Simulation Suite

ANSYS launched the newest release of its engineering simulation technology suite, ANSYS® 14.0, which includes hundreds of new, advanced features that make it easier, faster and less costly for organizations to bring new products to market. The framework for the industry's broadest and deepest suite of advanced engineering simulation technology, ANSYS Workbench™, delivers unprecedented productivity. Tighter integration, for example, brings more physics applications together to power customers' simulation efforts, enabling them to predict with confidence that their products will thrive in the real world. Workbench at ANSYS 14.0 goes well beyond enhancing customized workflows, automatic parametric evaluations, and transparent sharing of common data between different applications. Embedded design optimization capabilities enable design of experiments as well as parametric and six sigma studies to reach the right design.



ANSYS
ansys.com

FPGA Design Tool

4DSP LLC simplifies the process of FPGA design by releasing the new Stellar IP tool. Stellar IP is designed to automate the creation of an FPGA image by reusing proven IP cores. It offers a platform for software engineers to target FPGA devices. Knowledge of a HDL language is not required. This provides software engineers the ability to create new FPGA designs by relying on existing IP and extend their domain of influence to the entire system. Stellar IP offers many ben-

Amphenol

SV MICROWAVE®

ATTENUATORS & TERMINATIONS...

SV Microwave offers the most comprehensive line of standard and QPL (Mil-Approved) Coaxial Attenuators and terminations in the industry today. Microwave Components Inc. has been delivering SV Microwave precision components from stock for more than a decade !!!

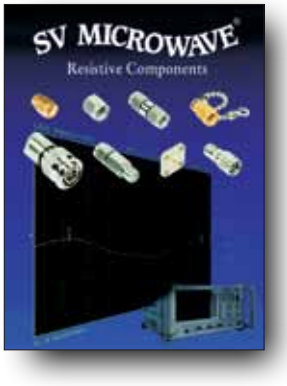
Call us today and put our experience to work for you...

Attenuators

- SMA, TNC, N, 2.4 mm, 2.9 mm
- Nominal Impedance: 50 ohms
- Frequency Range: DC-50 GHz
- Interfaces IAW MIL-PRF-39012
- Meet requirements of MIL-A-3933
- Environmental Standards per MIL-STD-202

Terminations

- SMA, TNC, N, 2.4 mm, 2.9 mm, ZMA
- Nominal Impedance: 50 ohms
- Frequency Range: DC-50 GHz
- Interfaces IAW MIL-PRF-39012
- Meet requirements of MIL-DTL-39030
- Environmental Standards per MIL-STD-202



Mil Approved Products in Stock:

- M39012 – Connectors
- M3933 – Attenuators
- M39030 – Terminations
- M55339 – Adapters
- M83571 – Receptacles

Contact us today for a Resistive Components Brochure

VISA MasterCard AMERICAN EXPRESS

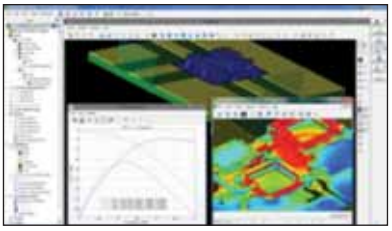
MICROWAVE COMPONENTS

Phone: (888) 591-4455 or (772) 286-4455 Fax: (772) 286-4496
E-mail: admin@microwavecomponentsinc.com
Web Site: www.microwavecomponentsinc.com

AS 9120
ISO 9001:2000
CERTIFIED

efits such as simplifying the integration of new cores that can be reused across multiple designs. It provides a library of off-the-shelf IP cores and automates the creation and compilation of ISE projects in addition to simulation scripts. Stellar IP is available for free as part of the 4DSP Board Support Package targeting the 4DSP FMC and Virtex-6 FPGA product lines (http://www.4dsp.com/fmc, http://www.4dsp.com/v6).

4DSP
4dsp.com



3-D Modeler

Agilent Technologies Inc. announced shipment of the latest release of its Electromagnetic Professional software, EMPro 2011.11. The updated 3-D modeling and simulation platform features enhancements to further speed and improve RF design and verification. EMPro is used to create 3-D models and analyze electrical performance of packages, connectors, antennas and other RF components. The EMPro 2011.11 release builds on advances made available in the 2011.07 release, introducing key improvements to the finite-element method simulator: • A fast FEM iterative solver that doubles the speed of simulations that include internal ports (which had already been doubled in the previous release). This continuous improvement reflects Agilent's ongoing commitment to fast-paced advancements in simulation technology. • A user-defined passive loads capability. This allows users to include ideal passive loads directly in an FEM simulation to represent matching circuits and surface-mount components. (The loads are defined in the EM setup environment, which consists of common series and parallel RLC network topologies. This capability enables accurate field visualization results and radiation patterns that take into account passive loads.) • A fast, two-dimensional port solver that simplifies FEM simulation port setup. The solver allows users to quickly and easily determine the number of modes, as well as reference impedance and optimum impedance line placement.

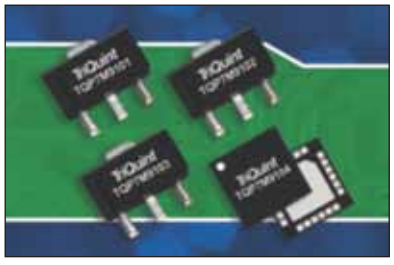
Agilent Technologies
agilent.com

ICs

Bluetooth IC

Nordic Semiconductor announced that an enhanced revision of its nRF8001 Bluetooth 4.0 low energy Connectivity IC will further extend the current device's class-leading power-saving performance and benefit from an upgraded Bluetooth core software stack. The revision - which will be called the nRF8001 'Build D' and is already sampling to selected leading customers - is fully drop-in compatible (hardware and software) with the current Nordic nRF8001 (Build C) ensuring a smooth migration path for existing customers. The new power saving features and enhanced Bluetooth stack (see below) are easily accessible through an expanded Application Controller Interface (ACI) command set that can be used by extending existing application code. The nRF8001 Build D includes all Bluetooth core stack features required for the newly adopted Bluetooth low energy human interface device (HID) profile. This makes the nRF8001 an ideal solution for emerging Bluetooth low energy wireless PC peripherals and advanced navigational remotes for connected TV and set-top boxes (STB).

Nordic Semiconductor
nordicsemi.com



RFICs

TriQuint Semiconductor, Inc. has released two new linear RF amplifier family members that lower power consumption while protecting mobile networks from disruption and service failures. Setting these amplifiers apart are patent-pending integrated protection features that can guard against ESD and DC over-voltage electrical spikes. TriQuint also integrates RF over-drive protection to reduce the chance of damage from high signal levels often seen in systems employing digital pre-distortion linearization techniques commonly utilized in 3G/4G BTS network transceivers. The new 1 Watt TQP7M9103 and 2 Watt TQP7M9104 are ideal for 3G/4G wireless infrastructure applications including base transceiver stations, repeaters, boosters, remote radio heads, defense/aerospace and other wireless systems requiring high linearity and gain with low power consumption. The new devices help designers simplify RF connectivity through reduced bills of materials, increased efficiency and packaged design convenience.

Triquint Semiconductor
triquint.com

Times SilverLine® Test Cables Rugged *and* Flexible!

- *High Volume Production Test Stations*
- *Research & Development Labs*
- *26 and 40 GHz VNA Test Port Replacement Cables*
- *Field RF Testing*
- *Cellular Infrastructure Site Testing*

The SilverLine family of test cables are cost effective, rugged, high performance cables used in a broad range of test and interconnect applications and include:

- **Standard SilverLine:** armored and unarmored with more than 20 connector series & configurations
- **SilverLine-VNA:** 18 to 40 Ghz, RF stable, low loss, flexible yet torque & crush resistant
- **SilverLine-TuffGrip:** Steel armored, fast mating, phase stable for cell site testing
- **TuffGrip-CI:** Changeable interfaces for increased utility
- **SilverLine-LP:** The first flexible, super-rugged, long life low PIM test lead
- **SilverLine-ULA:** Ultra low attenuation for flight line and antenna test range applications

Our test cables out-perform the competition. For more details contact us at (800) 867-2629.

TIMES MICROWAVE SYSTEMS
An Amphenol Company

World Headquarters: 358 Hall Avenue, Wallingford, CT 06492 • Tel: 203-949-8400, 1-800-867-2629 Fax: 203-949-8423
International Sales: 4 School Brae, Dysant, Kirkcaldy, Fife, Scotland KY1 2XB UK • Tel: +44(0) 1592655428
China Sales: No.318 Yuan Shan Road Shanghai China • Tel: 86-21-51761234 Fax: 86-21-64424098
www.timesmicrowave.com

Data Interface Circuits for PSK Modulators For Data Transmission from Space to Ground

By Jolie. R and D.V. Ramana

In Indian Remote Sensing Satellites, payload data is transmitted from space to ground using a PSK modulator. The PSK modulator may be BPSK, QPSK or 8PSK depending on the volume of data to be transmitted.

In Indian Remote Sensing Satellites, payload data is transmitted from space to ground using a PSK modulator. The PSK modulator may be BPSK, QPSK or 8PSK depending on the volume of data to be transmitted. Different data standards such as TTL, RS-422 and LVDS can be used for transmission of payload data to the modulator onboard the satellite. An interface circuit is required to convert the received data to bipolar levels required for the modulator. This article discusses various interface circuits, hardware realization, and test results.

Introduction

A PSK modulator is used to modulate a high frequency carrier. The carrier frequency should be in the band allotted for data transmission (20 MHz in S-band and 375MHz in X-band), from space to ground. The PSK modulator used is either BPSK or QPSK, depending on the data throughput. In future, it is also envisaged to use an 8-PSK modulator for higher data rate transmission. The payload data from an on-board satellite camera is processed and fed to the modulator. Various logic interfaces such as TTL, RS422 and LVDS can be used. The payload data needs to be converted from the chosen logic level to bipolar levels required to switch the diodes in the modulator.

The data interface circuit for the modulator needs to be designed carefully since the data levels control all the characteristics of the modulator. The main characteristics of a modulator include carrier suppression, phase imbalance and amplitude imbalance. Each characteristic of the modulator is dependent on its drive levels, i.e., the level of data input. The interface circuit can be tuned to get optimized modulator performance. The number of streams of data depends on the PSK modulation scheme used.

In this paper, various modulator data interface circuits such as TTL, RS-422 and LVDS, which are used in Indian Remote Sensing Satellites, are discussed.

Transistor-Transistor Logic (TTL) Interface Circuit

For many years, TTL logic has been used for data transfer between the on-board data processing circuits and the RF modulator. The TTL logic family is relatively slow compared to many of the fast switching logic families available today. However, it was used recently in satellite applications where the data rate is 52.5 Mbps per stream. The total data rate transmitted using QPSK modulation is 105Mbps.

A TTL driver circuit for the modulator, designed and realized for space applications, is shown in Fig.1. The TTL logic levels are 0V and 5V. Initially, the data transmission rate was 5.2Mbps and TTL interface was used for a BPSK modulator. As the volume of payload data increased, the data transmission rates using TTL have been set to as high as 52.5Mbps per channel and QPSK modulation is used.

Three RG316/U cables (for I-data, Q-data and Clock) are used for data transmission

HAND FLEX™

CABLES

Hand Flex Cables conform to any shape required.

from $8.69 ea. (qty.1-9) IN STOCK

DC to 18 GHz

Get the performance of semi-rigid cable, and the versatility of a flexible assembly. Mini-Circuits Hand Flex cables offer the mechanical and electrical stability of semi-rigid cables, but they're easily shaped by hand to quickly form any configuration needed for your assembly, system, or test rack. Wherever they're used, the savings in time and materials really add up!

Excellent return loss, low insertion loss, DC-18 GHz. Across their entire bandwidth, Hand Flex cables deliver excellent return loss (>27 dB for up to 24" runs) and low insertion loss (0.2 dB typ at 9 GHz for a 3-inch cable). So why waste time measuring and bending semi-rigid cables, when you can easily install a Hand Flex interconnect?

Two popular diameters to fit your needs. Hand Flex cables are available in 0.086" or 0.141" diameters, with a turn radius of 6 or 8 mm, respectively. Straight SMA connectors are standard, and now we've added right-angle connectors to our Hand Flex lineup, for applications with tightly-packed components.

Standard lengths in stock, custom models available. Standard lengths from 3 to 24" are in stock for same-day shipping. You can even get a Designer's Kit, so you always have a few on hand. Custom lengths, or two-right-angle models, are also available by preorder. Check out our website for details, and simplify your high-frequency connections with Hand Flex! RoHS compliant

Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

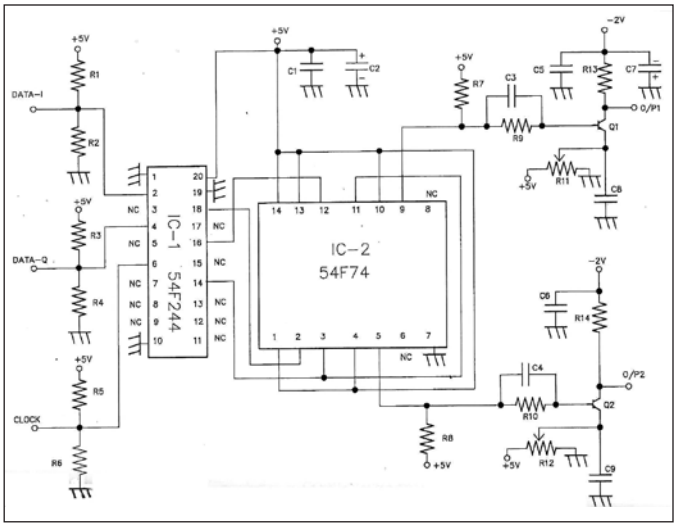


Figure 1 • TTL driver circuit

between the data processing package and the RF modulator package. The data processing and modulator packages are mounted at different locations on the satellite panels and the length of the cables carrying 52.5Mbps data is of the order of 3.9m each. As the data passes through lengthy cables, it is observed that the data quality degrades in terms of rise/fall time and duty cycle. This is due to parasitic capacitance in the long length of cables. The data quality is regenerated by passing through a buffer.

The TTL driver circuit consists of a buffer (54F244), D-flip flop (54F74), switching transistors (NE 88908) and passive components. The high speed buffer (54F244) is used at both the transmitting and receiving ends of the data transmission cables. The buffered I-data, Q-data and Clock are fed to a latch 54F74 IC. Here, the clock is used to synchronize the two data streams so that both appear at the modulator at the same time. The latched I and Q data are fed to switching transistors to convert them to bipolar levels required for biasing the PIN diodes in the reflection type modulator. The potentiometers in the circuit are fine-tuned to achieve the appropriate bias levels required for the modulator to meet its specifications of carrier suppression, amplitude imbalance, and phase imbalance. The

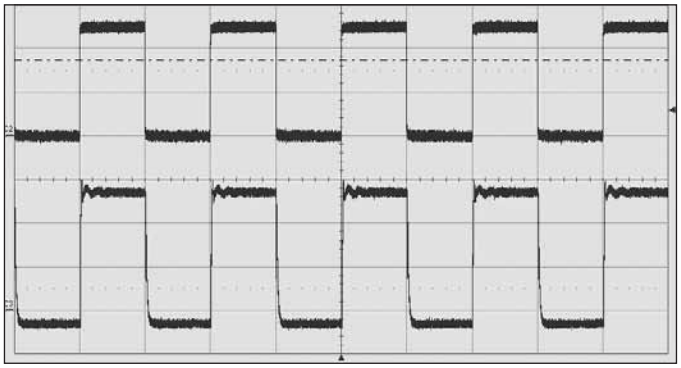


Figure 2 • Input and output of TTL data interface circuit

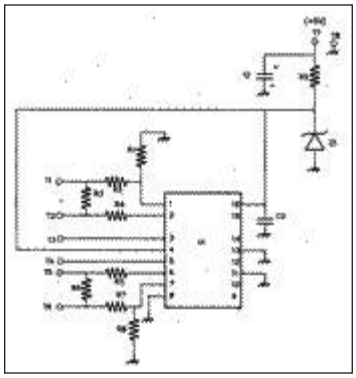


Figure 3 • RS422 Line Receiver circuit

input and output waveforms of the TTL data interface circuit are shown in Fig.2.

RS 422 Interface Circuit

Another logic interface used for data transfer onboard the satellite was RS422. A modulator interface circuit was developed to accept the RS422 levels.

The RS-422 is a differential, or balanced, signaling technique. A termination resistance of 100 is required at the input of the 422 receiver. The RS422 offers a maximum prescribed common mode voltage range of -7V to +7V, which helps to counter transient spikes and ground shifts.

A twisted pair shielded cable is used for data transmission between the payload and the RF modulator package. At the transmitter end, 26LV31 IC is used. The interface circuit consists of a line receiver and level converter. The line receiver (26LV32) shown in Fig.3 converts RS422 levels to TTL levels. The data is converted to bipolar levels using the level converter shown in Fig.4. The potentiometers are tuned to get bipolar levels which are suitable for biasing the modulator. The differential inputs and the bipolar output of the RS422 data interface circuit is shown in Fig.5.

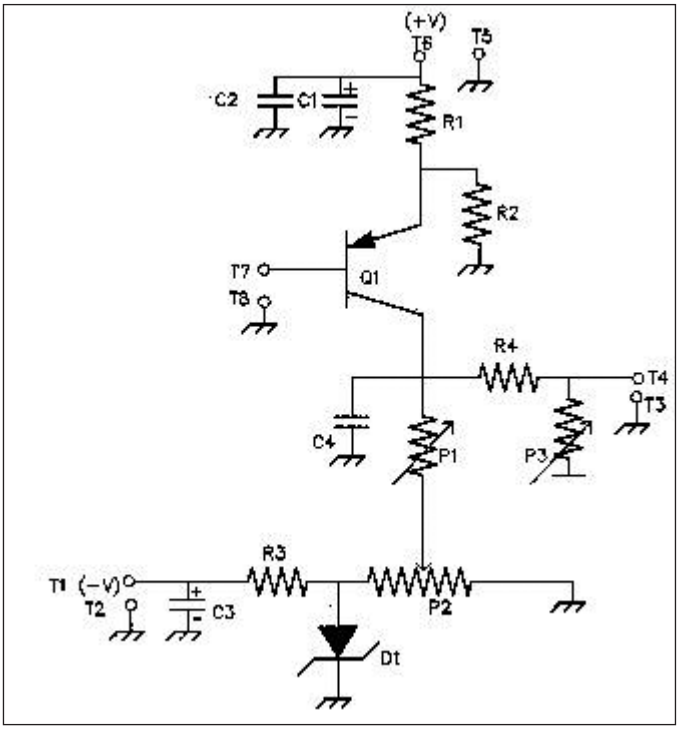


Figure 4 • Level converter in the RS422 driver interface circuit

Industry pros are talking about us behind our backs ...*and we love it!*

IW designs and manufacturers high performance microwave cable and cable assemblies for both military and commercial markets. Applications include telecommunications, data links, satellite systems, airborne electronic warfare and counter measures, missile systems, UAV applications, avionics and instrumentation, fire control systems, medical electronics, and geophysical exploration.

We offer a wide variety of products providing extremely low attenuation at frequencies up to 67 GHz and ranging from .050 inch to 0.50 inch in diameter. Our unique PTFE lamination process, combined with our high performance shield design, has made us one of the leaders in low-loss microwave transmission lines. IW's broad range of microwave cables and connectors assures every customer the proper cable assembly for each of their specific application needs.

Our major products include:

- Low-loss microwave cables optimized for use to 11, 18, 26.5, 40, 50, and 67 GHz
- Microwave cable assemblies with connectors for SMA, TNC, N, SC, 7/16, 1.85mm, 2.4mm, 2.92mm, 3.5mm, 7mm, ZMA, SMP, SMPM & more
- RE-FLEX™ semi flexible assemblies
- TUF-FLEX™ assemblies – improved crush resistance without using armor
- Water-blocked cables for submarines
- Composite cables – combination microwave/signal/power/data
- PTFE insulated hook-up wires
- Multi-conductor cables
- Dielectric cores
- Twisted pair and triaxial cables
- Low smoke, zero halogen cable jackets
- Cable protection options such as armor, PEEK, NOMEX, Neoprene weatherproofing, PET monomer braid

ISO 9001:2008 certified with AS9100 pending.

INSULATED WIRE, INC.

203.791.1999

www.iw-microwave.com

sales@iw-microwave.com

Scan code to find out how you can ***get wired***

We're how the microwave industry ***gets wired!***

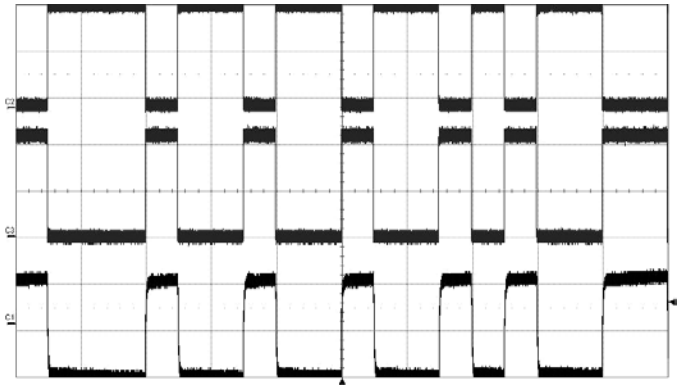


Figure 5 • Differential inputs and output of RS422 interface circuit

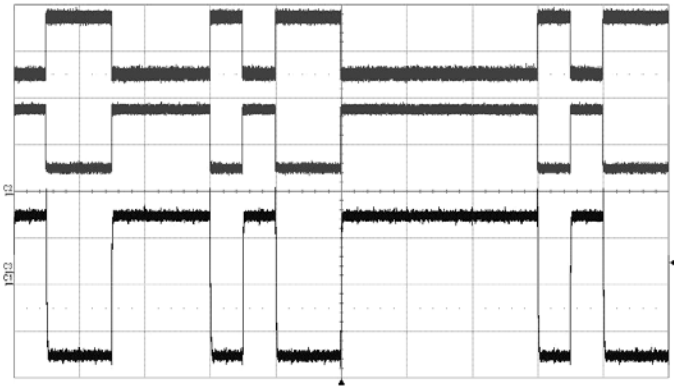


Figure 7 • Differential inputs and output of LVDS driver interface circuit

Low Voltage Differential Signaling (LVDS) Interface Circuit

The latest interface level currently being used on-board satellite is Low Voltage Differential Signaling (LVDS). An LVDS transmitter (90LV31) converts the processed data into a low voltage differential signal. This is received at the modulator input through twisted pair differential cable. The data interface circuit shown in Fig.6 consists of an LVDS receiver (90LV32) that translates the differential signal into a TTL/CMOS signal. The LVDS receiver has simple termination requirements – usually one resistor at the input of the receiver compared to multiple resistor solutions for other standards. The characteristic impedance of the PCB trace or cable should match with the termination resistor of 100Ω which in turn should be placed as close as possible to the input of the receiver. A 100Ω twisted pair differential cable is used to carry data from the data processing circuits to the modulator.

The output of the LVDS receiver is fed to a latch (54F74) for latching the I and Q data with respect to the clock. This is required to synchronize both the data streams. The clock input to the circuit and the latch can be avoided provided exact length of cables is maintained between the LVDS transmitter and receiver. Also, there should be no skew between the differential pair of lines on the PCB. The latch is followed by a level converter circuit.

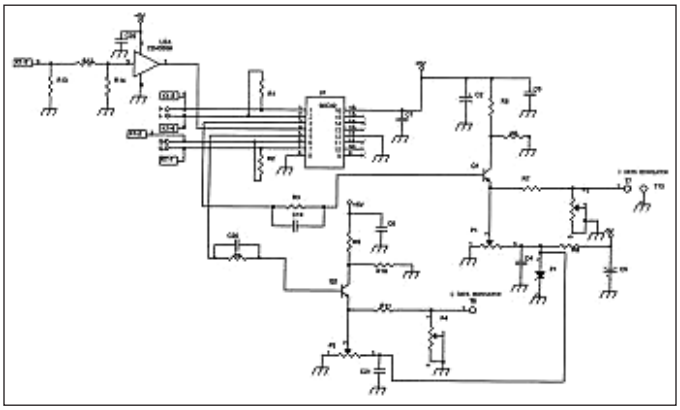


Figure 6 • LVDS driver interface circuit

Potentiometers in the circuit are used to provide suitable bias levels to the modulator. The differential inputs and the output of the LVDS driver interface circuit are shown in Fig.7.

Conclusion

This article discusses various data interface circuits which are practically realized for PSK-based payload data transmission from space to ground. The modulator requires an interface circuit to convert data from different logic levels to the bipolar levels. Data interface circuits such as TTL, RS422 and LVDS are discussed and hardware test results are presented.

About the Authors

Jolie.R received her B.Tech from University of Kerala and M.Tech from Cochin University of Science and Technology. She joined ISRO Satellite Centre, Bangalore in 2000 and is a design engineer for data transmitting systems for IRS satellites. Her work includes development of high bit rate modulators, data transmitters at X and Ka-band and investigations into spectrally efficient data transmission systems for space communication links. She is currently registered for a PhD (part time) at VTU, Bangalore. jolier@isac.gov.in.

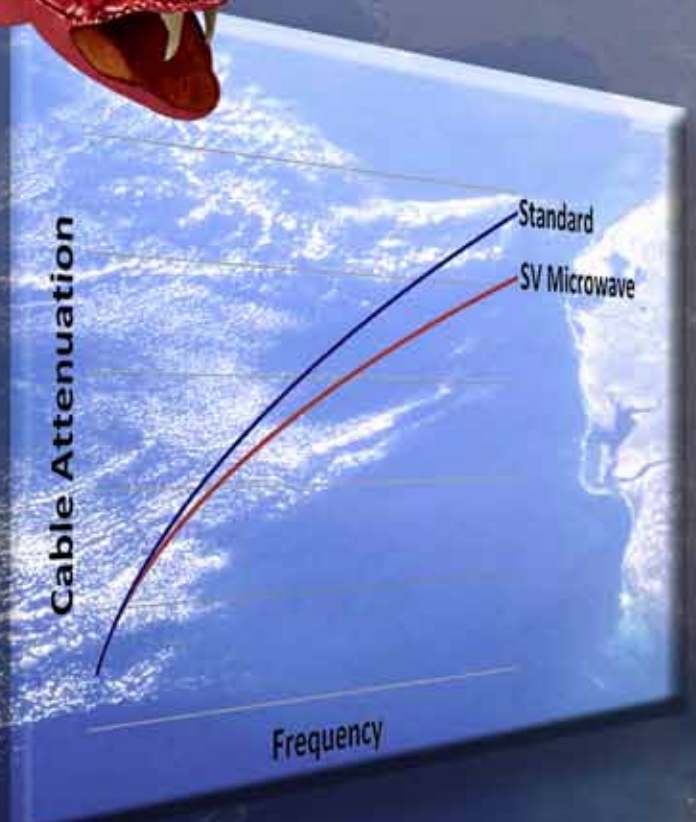
Dr. D. Venkata Ramana holds an M.Tech degree from National Institute of Technology, Surathkal and a Ph.D from Indian Institute of Science, Bangalore, India. He joined ISRO Satellite Centre, Bangalore in 1983 and has been associated with the Communication Systems Group. He is involved in the design and development of high bit rate data transmitters and advanced modulation schemes for various Indian Remote Sensing Satellites. He currently heads a Ka-band data transmitter development team for satellite applications. He has published papers in various national and international journals. He is a Senior Member-IEEE, Fellow-IETE, Fellow-IE, LM-IMAPS. dvramana@isac.gov.in.

Amphenol

SV MICROWAVE®

www.svmicrowave.com

The smallest cables making the BIGGEST news! Slither out of loss and flexibility problems.



SV introduces a family of high flexibility low loss 0.047" diameter cable assemblies. Available in multiple variants based on your unique need for speed and flexibility. Choose from a wide variety of industry standard connector styles or a custom design to meet your specific requirements.

To meet the challenge of high performance RF cable assemblies in small spaces – think SV!

Comprehensible Electromagnetics for Comprehensive Engineering

By W. Scott Bennett, Ph.D.

Dr. W. Scott Bennett derives a nanoscale approach to describe the strengths of magnetic and electric near fields that offers an accurate alternative to traditional Hertzian doublet calculations.

Electromagnetic theory has long been based on abstract mathematics; however, to be well-engineered, physical causes and effects must be well understood. That has inspired the cause-based explanations of electromagnetic fields that follow.

Charged Particle Fields

One microscopic particle with an electric charge of q (Coulombs) in an otherwise empty medium causes the *r-directed electric field* E_{1r} (Volts/meter).

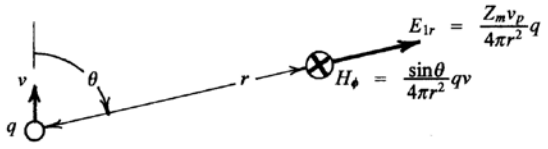
Z_m (Ohms) is the *characteristic impedance* of the medium containing q;

v_p (meters/second) is the *field propagation velocity* in that medium;

r (meters) is the *distance from q to the observation point of* E_{1r} (V/m); and

$4\pi r^2$ is an *imaginary sphere* in which q is centered and on which E_{1r} is observed.

If q moves with a *constant velocity* of v (meters/second), then qv adds to E_{1r} (V/m) the ϕ – *directed magnetic field* H_ϕ (Amperes/meter).



An electric dipole is two particles of charge $+q$ and $-q$ separated by a distance $d\ell \to 0$. And, at any distance $r >> d\ell$ measured from the midpoint of $d\ell$, the charges $+q$ and $-q$ together cause the electric fields E_{2r} and $E_{2\theta}$ (V/m).

These expressions for E_{2r} and $E_{2\theta}$ result, because $d\ell \to 0$ and $r >> d\ell$ for almost all r. And, when $r >> d\ell$, the propagation distances from $\pm q$ to (r, θ , ϕ) effectively equal

$r \mp \cos\theta d\ell/2$. So, the added electric fields of $+q$ and $-q$ can be accurately viewed as

$$E_{2r} = \frac{r^2 E_{1r}}{\left(r - \frac{\cos\theta d\ell}{2}\right)^2} - \frac{r^2 E_{1r}}{\left(r + \frac{\cos\theta d\ell}{2}\right)^2}$$

$$= \frac{\left(r + \frac{\cos\theta d\ell}{2}\right)^2 - \left(r - \frac{\cos\theta d\ell}{2}\right)^2}{\left(r^2 - \left(\frac{\cos\theta d\ell}{2}\right)^2\right)^2} r^2 E_{1r} = \frac{2\cos\theta d\ell}{r} E_{1r} \quad \text{(V/m)}$$

and

$$E_{2\theta} = \frac{\sin\theta d\ell/2}{r - \frac{\cos\theta d\ell}{2}} E_{1r} + \frac{\sin\theta d\ell/2}{r + \frac{\cos\theta d\ell}{2}} E_{1r}$$

$$= \frac{\left(r + \frac{\cos\theta d\ell}{2}\right) + \left(r - \frac{\cos\theta d\ell}{2}\right)}{r^2 - \left(\frac{\cos\theta d\ell}{2}\right)^2} \frac{\sin\theta d\ell}{2} = \frac{\sin\theta d\ell}{r} E_{1r} \quad \text{(V/m)}$$

because

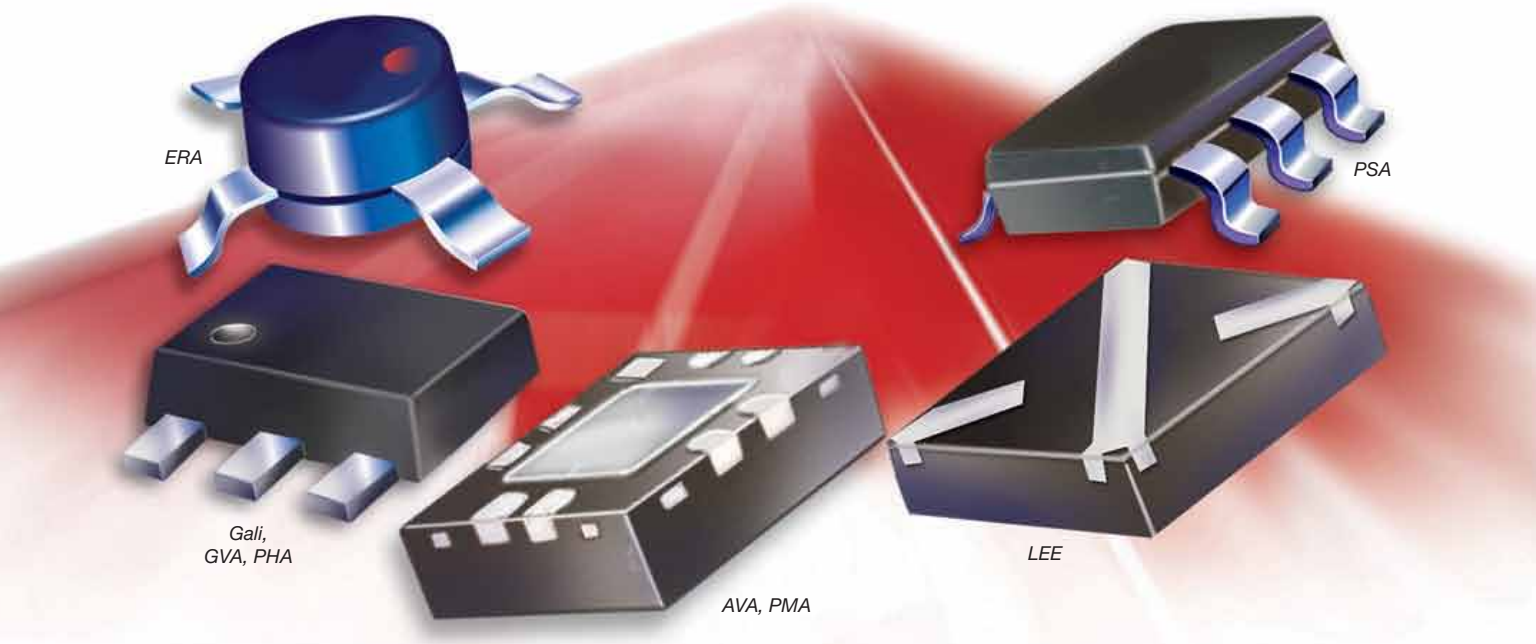
$$\left(\frac{\cos\theta d\ell}{2}\right)^2 \leq \left(\frac{d\ell}{2}\right)^2 \quad \text{and} \quad \left(\frac{d\ell}{2}\right)^2 \cong 0$$

Point Source Fields

A stationary volume dV containing numerous microscopic particles that have a *net electric charge* of Q (C) causes the *electric field* E_{1r} (V/m).

MMIC AMPLIFIERS

DC to 20 GHz from 73¢ qty.1000



NF *from* **0.5 dB, IP3** *to* **+48 dBm, Gain 8** *to* **31 dB, Pout** *to* **+30 dBm**

Think of all you stand to gain. With more than ~~124~~ 145 catalog models, Mini-Circuits offers one of the industry's broadest selection of low-cost MMIC amplifiers. Our ultra-broadband InGaP HBT and PHEMT amplifiers offer low noise figure, high IP3, and a wide selection of gain to enable optimization in your commercial, industrial or military application.

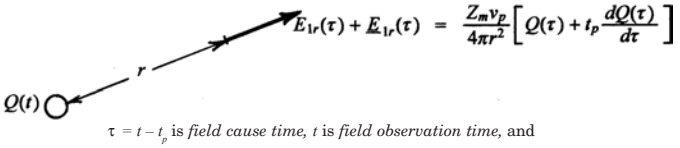
Our tight process control guarantees consistent performance across multiple production runs, so you can have confidence in every unit. In fact, cascading our amplifiers often results in less than 1dB total gain variation at any given frequency. These MMIC amplifiers can even meet your most critical size and power consumption requirements with supply voltages as low as 2.8 V, and current consumption down to 20 mA, and packages as small as SOT-363.

Visit our website to select the amplifier that meets your specific needs. Each model includes pricing, full electrical, mechanical, and environmental specifications, and a full set of characterization data including S-Parameters. So why wait, place your order today and have units in your hands as early as tomorrow. RoHS compliant

Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

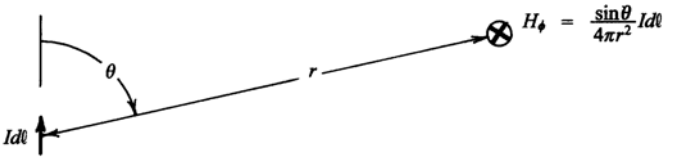
A *time-varying net charge* of $Q(t)$ (C) in dV will cause the *two-component electric field* $E_{1r}(\tau) + E_{1r}(\tau)$ (V/m).



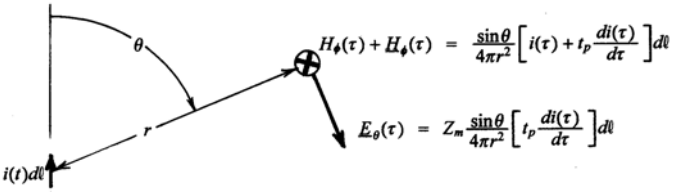
$\tau = t - t_p$ is *field cause time*, t is *field observation time*, and

$t_p = r/V_p$ is *field propagation time*.

If some of the particles in dV are *moving* in the direction of its *length* $d\ell$, a *steady movement of net charge*, $Id\ell$ (Axm), causes the *magnetic field* H_ϕ (A/m).



A time-varying charge movement $i(t)d\ell$ (Axm) causes the *two-component magnetic field* $H_\phi(\tau) + \underline{H}_\phi(\tau)$ (A/m) and the *electric field* $\underline{E}_\theta(\tau) = Z_m H_\phi(\tau)$ (V/m).



A *nanocurrent* $i(t)d\ell$ is a volume dV of length $d\ell$ and cross-sectional area dA, that contains *both* the *moving charge* $i(t)d\ell$ (Axm), and the *net charge*

$$Q(t) = \int_0^t (i_{in}(t) - i_{out}(t))dt = d\ell \int \frac{di(t)}{d\ell} dt$$

$$= \frac{d\ell}{v_{pc}} \int di(t) = \frac{i(t)d\ell}{v_{pc}} \quad \text{(C)}$$

where $v_{pc} = d\ell/dt$ (m/s) is the field propagation velocity in dV.

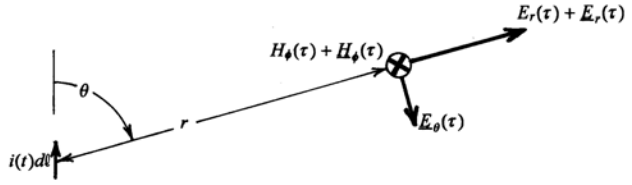
Therefore, a *nanocurrent* $i(t)d\ell$ *has the point-source fields*

$$H_\phi(\tau) + H_\phi(\tau) = \frac{\sin\theta}{4\pi r^2}\left[i(\tau) + t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(A/m)}$$

$$E_\theta(\tau) = Z_m \frac{\sin\theta}{4\pi r^2}\left[t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$

and

$$E_r(\tau) + E_r(\tau) = \frac{Z_m v_p}{4\pi r^2}\left[i(\tau) + t_p \frac{di(\tau)}{d\tau}\right]\frac{d\ell}{v_{pc}} \quad \text{(V/m)}$$



The Hertzian Dipole and Its Fields

A Hertzian dipole would be two nanocurrents, one that has end-currents of 0 and - $i(t)$, and the other with end-currents of $i(t)$ and 0. So, *an isolated Hertzian dipole* would have *net charges* of

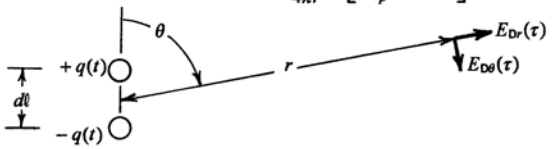
$$\int (0 - i(t))dt = -q(t) \quad \text{and} \quad \int (i(t) - 0)dt = +q(t) \quad \text{(C)}$$

separated by $d\ell$, and the fields of $+q(t)$ and $-q(t)$ would add the same as the fields of $+q$ and $-q$ of an electric dipole, to be

$$E_{Dr}(\tau) = \frac{2\cos\theta d\ell}{r}[E_{1r}(\tau) + E_{1r}(\tau)] = 2\frac{Z_m \cos\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau)\right]d\ell \quad \text{(V/m)}$$

and

$$E_{D\theta}(\tau) = \frac{\sin\theta d\ell}{r}[E_{1r}(\tau) + E_{1r}(\tau)] = \frac{Z_m \sin\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau)\right]d\ell \quad \text{(V/m)}$$

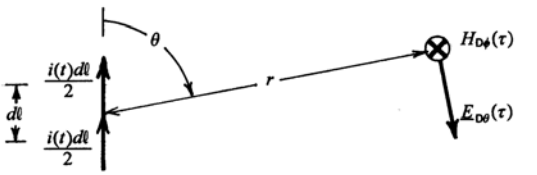


The fields of moving charge would be those of two adjacent nanocurrents, each with an average current of $i(t)/2$ and length $d\ell$. Therefore, because $d\ell \rightarrow 0$, for all $r >> d\ell$ the fields of moving charge would equal those of one nanocurrent $i(t)d\ell$.

$$H_{D\phi}(\tau) = 2\left[\frac{H_\phi(\tau)}{2} + \frac{H_\phi(\tau)}{2}\right]d\ell = \frac{\sin\theta}{4\pi r^2}\left[i(\tau) + t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(A/m)}$$

and

$$E_{D\theta}(\tau) = \frac{E_\theta(\tau)}{2} + \frac{E_\theta(\tau)}{2} = \frac{Z_m \sin\theta}{4\pi r^2}\left[t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$



Thus, a*n isolated Hertzian dipole's fields* would be

$$E_{Dr}(\tau) = \frac{2Z_m \cos\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau)\right]d\ell \quad \text{(V/m)}$$

$$H_{D\phi}(\tau) = \frac{\sin\theta}{4\pi r^2}\left[i(\tau) + t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(A/m)}$$

and

$$E_{D\theta}(\tau) + E_{D\theta}(\tau) = \frac{Z_m \sin\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau) + t_p \frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$

These field equations can be related to textbook equations [1 – 6] for the fields of a Hertzian dipole, as follows. If μ is the *permeability* of the medium *containing* $i(t)d\ell$, and ϵ is the *permittivity* of that medium, then

$$Z_m = \sqrt{\frac{\mu}{\epsilon}} \text{ (Ohms)} \quad \text{and} \quad v_p = \frac{1}{\sqrt{\mu\epsilon}} \left(\frac{\text{meters}}{\text{second}}\right)$$

CST STUDIO SUITE 2012

Discover what happens...

Making Sense of the Real World – System Level EM Simulation

Components don't exist in electromagnetic isolation. They influence their neighbors' performance. They are affected by the enclosure or structure around them. They are susceptible to outside influences. With System Assembly and Modeling, CST STUDIO SUITE 2012 helps optimize component as well as system performance.
Get the big picture of what's really going on. Ensure your product and components perform in the toughest of environments.

Choose CST STUDIO SUITE 2012 – complete technology for 3D EM.

CST

CHANGING THE STANDARDS

And, if *i(t)* is assumed to be a sinusoidal current, then as in [1], for example, the replacements

$$i(\tau) \leftarrow I_0 e^{j\omega(t-r/c)}, \quad q(\tau) \leftarrow \frac{I_0 e^{j\omega(t-r/c)}}{j\omega}, \quad \frac{di(\tau)}{d\tau} \leftarrow j\omega I_0 e^{j\omega(t-r/c)}$$

and

$$d\ell \leftarrow L, \quad v_p \leftarrow c, \quad t_p \leftarrow \frac{r}{c}, \quad \text{and} \quad Z_m \leftarrow \frac{1}{\epsilon c}$$

make

$$\begin{aligned} E_{Dr}(\tau) &= Z_m \frac{2\cos\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau)\right]d\ell \\ &= \frac{1}{\epsilon c}\frac{2\cos\theta}{4\pi r^2}\left[\frac{I_0 e^{j\omega\tau}}{j\omega r/c} + I_0 e^{j\omega\tau}\right]L \\ &= \frac{I_0 e^{j\omega(t-r/c)} L\cos\theta}{2\pi\epsilon}\left[\frac{1}{cr^2} + \frac{1}{j\omega r^3}\right] = E_r \end{aligned} \quad \text{(V/m)}$$

and

$$\begin{aligned} H_{D\phi}(\tau) &= \frac{\sin\theta}{4\pi r^2}\left[i(\tau) + t_p\frac{di(\tau)}{d\tau}\right]d\ell \\ &= \frac{\sin\theta}{4\pi r^2}\left[I_0 e^{j\omega\tau} + \frac{r}{c}j\omega I_0 e^{j\omega\tau}\right]L \\ &= \frac{I_0 e^{j\omega(t-r/c)} L\sin\theta}{4\pi}\left[\frac{j\omega}{cr} + \frac{1}{r^2}\right] = H_\phi \end{aligned} \quad \text{(A/m)}$$

and

$$\begin{aligned} E_{D\theta}(\tau) + E_{D\theta}(\tau) &= Z_m \frac{\sin\theta}{4\pi r^2}\left[\frac{q(\tau)}{t_p} + i(\tau) + t_p\frac{di(\tau)}{d\tau}\right]d\ell \\ &= \frac{1}{\epsilon c}\frac{\sin\theta}{4\pi r^2}\left[\frac{I_0 e^{j\omega\tau}}{j\omega r/c} + I_0 e^{j\omega\tau} + \frac{r}{c}j\omega I_0 e^{j\omega\tau}\right]L \\ &= \frac{I_0 e^{j\omega(t-r/c)} L\sin\theta}{4\pi\epsilon}\left[\frac{j\omega}{c^2 r} + \frac{1}{cr^2} + \frac{1}{j\omega r^3}\right] = E_\theta \end{aligned} \quad \text{(V/m)}$$

Conclusion

The *moving charge Idℓ* of a *nanocurrent Idℓ* causes the *magnetic field*

$$H_\phi = \frac{\sin\theta}{4\pi r^2} Id\ell \quad \text{(A/m)}$$

And, the *moving charge Idℓ* also causes the *net charge Idℓ/v_{pc}*, which is the cause of the *electric field*

$$E_r = \frac{Z_m v_p}{4\pi r^2}\frac{Id\ell}{v_{pc}} \quad \text{(V/m)}$$

A *time-varying nanocurrent i(t)dℓ* causes the *magnetic field*

(1) $$H_\phi(\tau) = \frac{\sin\theta}{4\pi r^2}\left[i(\tau) + t_p\frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(A/m)}$$

and the *electric field*

(2) $$E_\theta(\tau) = Z_m\frac{\sin\theta}{4\pi r^2}\left[t_p\frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$

Its *net charge i(t)dℓ/v_{pc}* causes the *electric field*

$$E_r(\tau) = \frac{Z_m k}{4\pi r^2}\left[i(\tau) + t_p\frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$

where $k = v_p / v_{pc}$. And, in very many, if not all, important cases $k = 1$, *and*

(3) $$E_r(\tau) = \frac{Z_m}{4\pi r^2}\left[i(\tau) + t_p\frac{di(\tau)}{d\tau}\right]d\ell \quad \text{(V/m)}$$

The velocities v_p and v_{pc} will be equal when the medium containing *i(t)dℓ* is either free space, a vacuum, or air, and the *i(t)* conductor is copper, lead, aluminum, silver, or gold, for example. That follows, because their relative permeabilities and relative permittivities are all equal to 1.

Based on [1 – 7], on [8], and all of the above – especially on equations (1), (2) and (3) immediately above – it is quite clear that nanocurrents should replace Hertzian dipoles as current elements. The result will undoubtedly be more accurate near-field computations and more comprehensible engineering electromagnetics.

References

1. John D. Kraus, *Antennas,* McGraw-Hill, 1950, pp. 127 – 135.

2. John D. Kraus & Keith R. Carver, *Electromagnetics* (2nd Edition), McGraw-Hill, 1973, p. 616.

3. Richard B. Adler, Lan Jen Chu, and Robert M. Fano, *Electromagnetic Energy Transmission and Radiation,* John Wiley & Sons, 1960, p. 576.

4. William H. Hayt, Jr., *Engineering Electromagnetics* (4th Edition), McGraw-Hill, 1981, p. 482.

5. Simon Ramo, John R. Whinnery & Theodore Van Duzer, *Fields and Waves in Communication Electronics,* John Wiley & Sons, 1965, p. 644.

6. Edward C. Jordan & Keith G. Balmain, *Electromagnetic Waves and Radiating Systems,* Prentice-Hall, 1968, pp. 319 – 320.

7. J.P. Neal, *Electrical Engineering Fundamentals,* McGraw-Hill, 1960.

8. W. Scott Bennett, "Basic Electromagnetics Made True and Clear with Concrete Mathematics," *High Frequency Electronics,* June 2011, pp. 54 – 61.

About the Author

W. Scott Bennett, Ph.D., served as Assistant Professor at Virginia Polytechnic Institute, where he taught electromagnetics and computer design. He later worked at Hewlett-Packard Company where for 16 years he designed computers and made those designs electromagnetically compatible. Since retiring he has worked to rid basic electromagnetics of abstract mathematics and thus make it easier to understand. He can be reached at: w.scottbennett@juno.com.

Bigger screen. Faster rise/fall time. Twice the sampling rate.

Agilent 8990B

Boonton 4500B

Peak power analyzers just got a whole new look.

Radar and wireless communications are increasingly complex, demanding higher performances than ever. The new Agilent peak power analyzer features 15 pulse characterization measurements, including automated pulse droop and delay measurements. Plus a vivid 15-inch touch-screen display to reveal even elusive signal trace details.

That's thinking ahead. That's Agilent.

	Agilent 8990B	Boonton 4500B**
Rise/fall time*	5 ns	7 ns
Sampling rate	100 MSa/s	50 MSa/s
Dynamic range*	-35 to +20 dBm	-50 to +20 dBm
Internal zero and calibration	Yes	No
USB sensor support	Yes	No

*Sensor dependent
**Data for competitive peak power analyzer from competitor publication PN B/4500B/0311/EN updated 2011

Test & Measurement World's TOP 50 2011

Trade-in your Boonton 4500B or HP 8990A/8991A
Receive a 10% credit on a new Agilent 8990B
www.agilent.com/find/8990tradein

u.s. 1-800-829-4444 canada 1-877-894-4414

Agilent Technologies

Attenuators

International Manufacturing Services, Inc. (IMS) introduced the AV-Series 0805 size temperature variable attenuators to 3GHz. The AV-0805 is available in 1dB to 10dB attenuation with 9 different temperature characteristics, N1 – N9. RoHS compliant terminals feature a nickel barrier layer for excellent solder leach resistance. These cost effective temperature variable attenuators have a short lead time with a minimum order quantity of 25 pieces. Applications for the AV-0805 temperature variable attenuators include power amplifiers, LNAs, transceiver modules, synthesizers, WIMax & WiFi equipment, fixed & mobile satellite radio and test & measurement instrumentation. Samples are available by contacting the factory or visiting their website.

International Manufacturing Services
ims-resistors.com

TWTA

The Model 176X/Ku TWT Amplifier provides up to 2 Kilowatts at duty cycles up to 6% from 1.0 to 18GHz and pulse widths up to 100µseconds. It has been designed specifically to operate pulsed traveling wave tubes in the 1 to 2kW peak power range at frequencies up to 18GHz. Particular emphasis has been placed on the generation of the output RF pulse shape without the use of RF switches. Pulse width control is with an external pulse. Internal power supplies are DC-DC converter designs with fast loop response times so that output level variations are minimal for any PRF including a non-periodic or burst type PRF. The modular power supplies and grid pulse generator have very low ripple, with attendant low phase noise in the TWT Amplifier.

Applied System Engineering Inc.
applsys.com

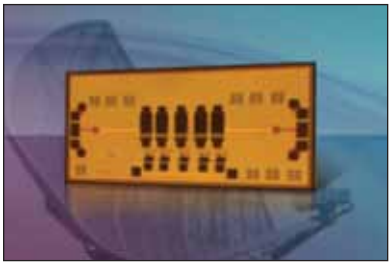
Power Dividers

KRYTAR, Inc., announced eight new 2-way power dividers offering high performance over the broadband frequency range of 6.0 to 40.0 GHz in single, compact, packages. The new 2-way power dividers complement KRYTAR's family offering the widest frequency coverage on the market. Targeting broadband electronic warfare (EW) systems and complex switch-matrix applications, for example, KRYTAR used its proprietary design to produce this 18-member family of matched-line directional dividers (MLDD) with ultra-high performance over the broadband frequency range of 0.5 to 45.0 GHz. The new power dividers offer high-pass frequency response to attain low insertion loss and high isolation.

KRYTAR
krytar.com

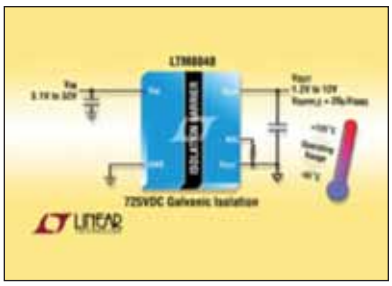
Filter

Hittite Microwave Corp. introduced a new Tunable MMIC Band Pass Filter ideal for hybrid and microwave integrated circuit (MIC) applications in wideband



test and measurement equipment, communication systems and electronic warfare (EW) subsystems to 38 GHz. This analog voltage tuned, solid state MMIC filter is insensitive to environmental conditions, and represents a space saving alternative to mechanically tuned and MEMS based filter solutions. The HMC899 Tunable MMIC Band Pass Filter (BPF) features a user selectable pass band frequency range of 19 and 38 GHz. The 3 dB filter bandwidth is approximately 18%, while the 20 dB bandwidth is approximately 35%. The pass band center frequency of the HMC899 is controlled by an analog tune voltage between 0 and 14V with a tuning speed of 200 ns. The HMC899 exhibits excellent microphonic immunity due to the monolithic design, and provides a dynamically adjustable filtering solution in advanced communications applications.

Hittite
hittite.com



DC/DC Converter

Linear Technology Corporation introduces the LTM8047 and LTM8048 1.5W output DC/DC µModule® converters with 725VDC galvanic isolation in a 9mm x 11.25mm x 4.92mm BGA (ball grid array) package. All components, including the transformer, control circuitry and power switches are housed in a small enclosed BGA package for superior

Smart RF SWITCH MATRIX

DC to 18 GHz from $385.00

Unmatched ease of use. Unmatched reliability. Unmatched immediate savings.

Smart, for faster setup. A plug-n-play Smart RF Switch Matrix really speeds things along, whether you're creating a new matrix from scratch or adding to an existing one. Our Smart Switch Matrix lineup includes models with 1, 2, 3, or 4 SPDT switches—just connect to a USB port on any HID-compliant host, and you're ready to go. Or, you can control up to 16 units simultaneously from almost any Windows® or Linux® computer, using a quick software download fully compliant with LabVIEW®, Delphi®, C++, C#, Visual Basic®, VEE and .NET.* However complex your setup, you'll be collecting data quicker than ever!

Mechanical, for more accurate data.
Very low insertion loss (≤0.3 dB typ.), excellent isolation (>66 dB typ.), and low VSWR (1.2:1 typ.) mean more accurate results over the whole DC-18 GHz range, fewer rejected DUTs, less time retesting failures, and less time tracing noise through your setup. Project after project, whatever you're testing, a Smart RF Switch Matrix will deliver results you can rely on.

Unmatched reliability, for long-term savings.
Mini-Circuits patented mechanical switches are the only ones available anywhere, at any price, providing up to 10 years and 100 million cycles of guaranteed performance.† See minicircuits.com for details and consider how much time and effort they can save you, year after year, for a surprising low price!

USB-1SPDT-A18	*$385.00*	*USB-3SPDT-A18*	*$980.00*
USB-2SPDT-A18	*$685.00*	*USB-4SPDT-A18*	*$1180.00*

*Linux is a registered trademark of Linus Torvalds. LabVIEW is a registered trademark of National Instruments Corporation. Delphi is a registered trademark of Codegear LLC. Visual Basic and Windows are registered trademarks of Microsoft Corporation. Neither Mini-Circuits nor the Mini-Circuits Smart RF Switch Matrix are affiliated with or endorsed by the owners of the above referenced trademarks.

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

Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

The Design Engineers Search Engine *finds the model you need, Instantly* • For detailed performance specs & shopping online see minicircuits.com

U.S. Patents 7739260, 7761442

IF/RF MICROWAVE COMPONENTS

interconnect reliability in high vibration applications. These compact and reliable products break ground loops in applications such as industrial, avionics and instrumentation equipment. Both devices operate from an input voltage of 3.1V to 32V, delivering a regulated output voltage on the secondary side, adjustable from 2.5V to 12V (LTM8047) and 1.2V to 12V (LTM8048). The LTM8048 includes a low noise linear post regulator that reduces the output ripple noise to 20µVrms at 300mA.

Linear Technology Corp.
linear.com

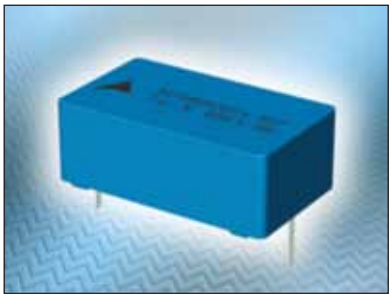
Coaxial Switch

The 2EL Series SPDT Coaxial Switches features SMA connectors and operates at a frequency of DC to 18 GHz and the 2ELE Series operates at DC to 26.5 GHz. Both series are available with failsafe and latching self-cut-off options. Operating Life: 5,000,000 cycles typical (3,000,000 min); RF Impedance: 50 ohms nominal; Operating Temperature (failsafe): -55°C to +85°C ambient; Operating Temperature (failsafe): -25°C to +85°C ambient; Switching Sequence: Break Before Make. Ducommun LaBarge Technologies has design Engineers who can create custom versions for your specific applications.

Ducommun LaBarge Technologies
ducommun.com

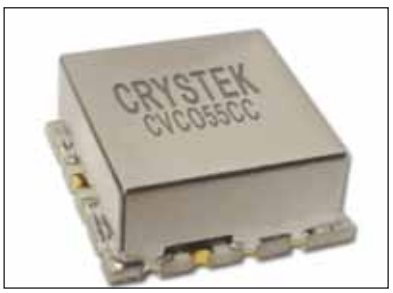
Capacitors

TDK-EPC has developed a wide range of EPCOS MKP and MKT film capacitors with low insertion heights. The new capacitors of the



B32*6T series with a lead spacing of 37.5 mm feature insertion heights of only 15 or 19 mm. These components are designed for rated voltages of between 63 and 2000 V DC or 250 to 400 V AC. Their capacitance ranges from 0.1 to 82 µF. Depending on type and technology (MKT or MKP), these capacitors are designed for maximum operating temperatures of 105, 110 or 125 °C. Applications include DC link circuits as well as DC or AC filtering in converters and power supplies. Their reduced insertion heights make these capacitors especially suitable for applications that require a low-profile design. These include induction cookers, photovoltaic micro inverters, power supplies for flat-screen TV sets and LED lighting. Thanks to their low insertion heights, they offer very high mechanical resistance to vibrations and shocks, making them equally suitable for subassemblies in automotive electronics.

TDK-EPC
epcos.com



VCO

Crystek's CVCO55CC-3750-3800 VCO (Voltage Controlled Oscillator) operates from 3750 MHz to 3800 MHz with a control voltage range of 0.5V~16V. This VCO features a typical phase noise of -105 dBc/Hz @ 10KHz offset and has excellent linearity. Output power is typically +2 dBm. Engineered and manufactured in the USA, the model CVCO55CC-3750-3800 is packaged in the industry-standard 0.5-in. x 0.5-in. SMD package. Input voltage is 5V, with a max. current consumption of 30 mA. Pulling and Pushing are minimized to 1.0 MHz and 2.5 MHz/V, respectively. Second harmonic suppression is -15 dBc typical.

Crystek
Crystek.com

Beamforming Networks

KRYTAR offers the widest frequency coverage in single-packaged beamforming network designs and provides superior performance in a wide range of RF and microwave applications. KRYTAR's long history of excellence in the design of broadband microwave components including directional couplers, detectors, quadrature hybrids, power dividers/combiners, terminations and coaxial adapters, offers the unique ability to produce ultra-broadband passive beamforming network solutions. RF and microwave system engineers can look to KRYTAR to take the confusion and complexity out of their design challenges with unique mechanical and electrical solutions using proprietary computer-aided-engineering (CAE) tools. KRYTAR beamforming networks are multifaceted assemblies for a wide range of applications including multiple antenna and antenna arrays used in military electronic systems and commercial communications systems.

KRYTAR
krytar.com

A high performance signal analyzer ready to take you into the wireless future.

Wireless technology never stops moving forward. Success depends on your ability to evolve. The Agilent PXA signal analyzer helps you keep ahead by maximizing flexibility, scalability and longevity so you can drive your evolution.

That's thinking ahead. That's Agilent.

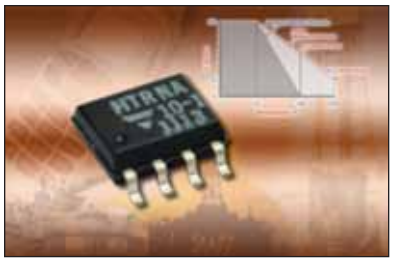
PXA Signal Analyzer (N9030A)
160 MHz analysis bandwidth
Up to -88 dBc 3GPP ACLR dynamic range
LTE and HSPA+; just two of over 25 measurement apps.
LTE-Advanced and 802.11ac with 89600 VSA software

Scan or visit http://goo.gl/c5PjF for videos on optimized signal analysis

Get the new 802.11ac app note
Request your wireless standards poster
www.agilent.com/find/PXA160

u.s. 1-800-829-4444 canada 1-877-894-4414

Agilent Technologies



Resistors

Vishay Intertechnology, Inc. introduced a new series of dual-in-line thin film resistor networks offering a wide operating temperature range of - 55 °C to + 215 °C. Providing nearly a 100 °C extension in operating temperature range over traditional thin film chip resistors, the HTRN series features low absolute TCR of ± 25 ppm/ºC, TCR tracking of 5 ppm/ºC, and tight ratio tolerances to ± 0.05 %. Featuring a rugged, molded 50 mil pitch construction with no internal solder, the HTRN series of resistor networks offers four isolated resistors with a wide resistance range of 1 k to 100 k per resistor, with divider ratios from 2:1 to 100:1. The devices feature very low noise of < - 35 dB, low voltage coefficients of 0.1 ppm/V, and a power rating of 100 mW per element (400 mW per package).

Vishay Intertechnology
vishay.com

Filter

Mini-Circuits' new ZX75LP-288+ is a 50 low pass filter built in a connectorized package. Covering DC to 288 MHz bandwidth, these units offer good matching within the passband and high rejection in stopband. This will find its applications in receivers and transmitters to suppress spurious emission and harmonics. It has repeatable performance across production lots and consistent performance across temperature. Features and advantages: Low passband insertion loss: suitable for high performance application; Fast roll-off -- Provides very good adjacent band rejection; Connectorized package: The connectorized package is easy to interface with other devices and well suited for test setups; Good VSWR: Provides good interface when used with other devices.

Mini-Circuits
minicircuits.com

LNA

MITEQ Inc. introduces a new addition to its family of high-performance waveguide LNAs. The Model AMFW-7F-17702130-120-23P-WP is a very low noise, high dynamic range weatherproof Ka-band front end, operating 17.7 to 21.3 GHz. With isolator protected and pressure sealed WR-42 waveguide input and K(F) connector output, in addition to being lightweight, this low-noise amplifier has a small profile and footprint. The aluminum alloy housing is sealed against most severe environmental conditions and also fully EMI shielded. This LNA includes reverse voltage, over current and over temperature protection in addition to full internal regulation. Total weight is approximately 800 grams, and dimensions are 156mm x 70mm x 51mm. The AMFW-7F-17702130-120-23P-WP has a minimum gain of 60 dB, flat to within ±1 dB, and maximum noise temperature of 120 K° and is capable of a minimum of 23 dBm P1dB across the full band.

MITEQ, Inc.
miteq.com

Switch

PMI Model P2T-18G40G-65-R-292FF is a Single Pole, Two Throw, Solid-State Switch which operates over the 18GHz to 40.0GHz frequency range. This model provides 55dB of isolation over the entire frequency range of operation and offers low insertion loss performance with fast switching speeds. Features: 18GHz to 40GHz Operation; High Isolation; Low Insertion Loss; High Speed; Compact Size.

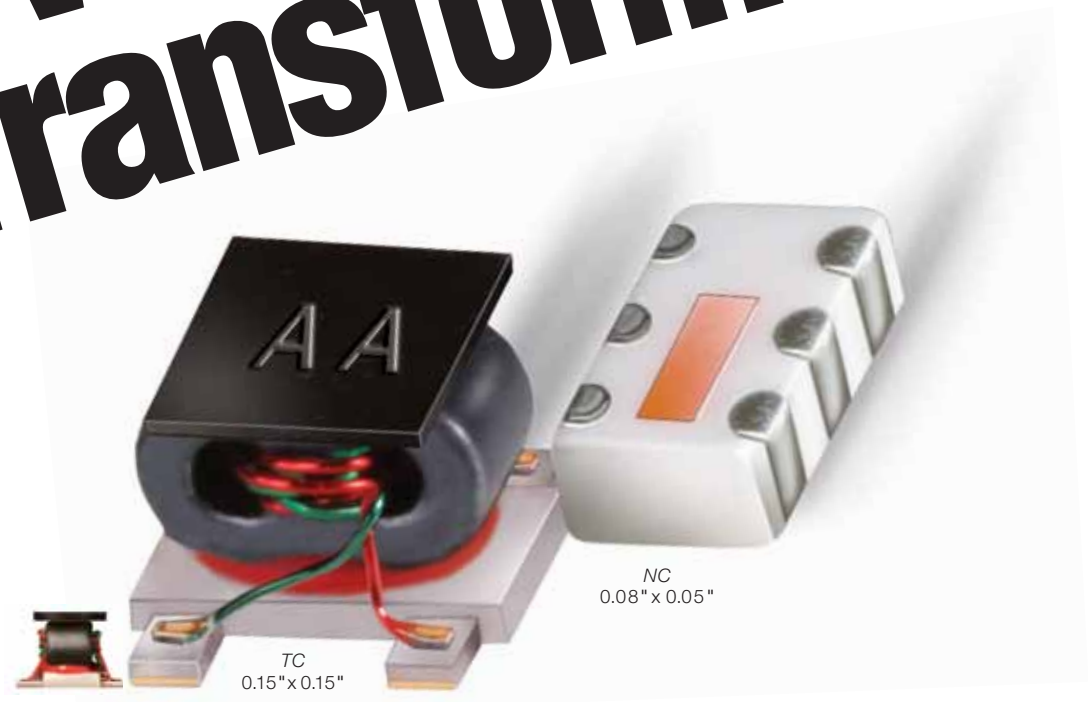
Planar Monolithics Industries
pmi-rf.com

PLL Chip Set

Hittite announced a new market leading PLL chip set. The HMC983LP5E DC to 7 GHz Fractional-N Divider and Frequency Sweeper and the HMC984LP4E Digital Phase-Frequency Detector and Charge Pump form a high performance PLL chip set solution targeted at PLL and Frequency Modulated Continuous Wave (FMCW) sweeper applications requiring ultimate performance. The HMC983LP5E integrates the industry's largest programmable 48-bit Delta-Sigma Modulator which allows the combined PLL to achieve unparalleled fractional frequency resolution of 180 nHz. A built-in frequency sweeper enables the combined PLL to generate identical, coherent, FMCW frequency sweeps that can

TINY

Wideband Transformers



0.15-6200 MHz *as low as* **99¢** each *(qty. 1000)* RoHS compliant.

Rugged, repeatable performance.
At Mini-Circuits, we're passionate about transformers. We even make own transmission line wire under tight manufacturing control, and utilize all-welded connections to maximize performance, reliability, and repeatability. And for signals up to 6 GHz, our rugged LTCC ceramic models feature wrap-around terminations for your visual solder inspection, and they are even offered in packages as small as 0805!

Continued innovation: Top Hat.
A Mini-Circuits exclusive, this new feature is now available on every open-core transformer we sell. Top Hat speeds customer pick-and-place throughput in four distinct ways: (1) faster set-up times, (2) fewer missed components, (3) better placement accuracy and consistency, and (4) high-visibility markings for quicker visual identification and inspection.

More models, to meet more needs
Mini-Circuits has over 200 different SMT models in stock. So for RF or microwave baluns and transformers, with or without center taps or DC isolation, you can probably find what you need at minicircuits.com. Enter your requirements, and Yoni2, our patented search engine, can identify a match in seconds. And new custom designs are just a phone call away, with surprisingly quick turnaround times gained from over 40 years of manufacturing and design experience!

See minicircuits.com for technical specifications, performance data, pricing, and real-time, in-stock availability!
Mini-Circuits...we're redefining what Value is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Yoni2® U.S. Patents 7739260, 7761442 *The Design Engineers Search Engine finds the model you need, Instantly* • For detailed performance specs & shopping online see minicircuits.com

IF/RF MICROWAVE COMPONENTS

be linear, user-defined, automatic or triggered.

Hittite Microwave Corp.
hittite.com

Front End Module

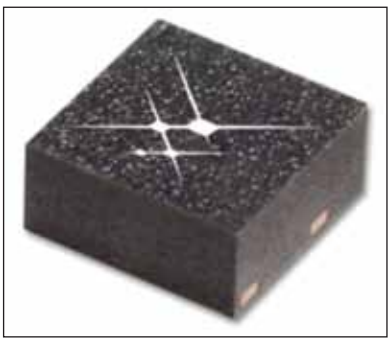
RFMD's new RFFM3482E Front End Module (FEM) is a single-chip integrated FEM for high-performance WiFi applications in the 2.4GHz to 2.5GHz ISM band. It addresses the need for aggressive size reduction for typical 802.11b/g/n front end designs and greatly reduces the number of components outside of the core chipset. RFFM3482E has an integrated b/g/n power amplifier, directional power detector, Rx balun, and Tx filtering. It is also capable of switching between WiFi Rx, WiFi Tx, and Bluetooth Rx/Tx operations. In a 3 mm x 3 mm x 0.45mm, 16-pin package, this module meets or exceeds the RF front end needs of 802.11b/g/n WiFi RF systems.

RFMD
rfmd.com

Attenuator

Mini-Circuits' new BW-N6W20+ precision fixed attenuator features: DC to 18 GHz operation; precise attenuation; excellent VSWR of 1:30:1 typical; and stainless steel N male and female connectors. Applications include matching, instrumentation; test set-ups, and high-power measurements. Maximum ratings: operating temperature: - 55 deg C to 100 deg C. Storage temperature: - 55 deg C to 100 deg C. The new BW-N6W20+ is RoHS compliant in accordance with EU Directive (2002/95/EC).

Mini-Circuits
minicircuits.com



PIN Diode

Skyworks Solutions has introduced a high power series PIN diode for transmit and receive switching applications. The SMP1325-087LF is a discrete solution available in a high-thermal dissipative package – making it ideal for large signal switching and attenuation applications. It combines very low-insertion (0.04 dB) loss, high linearity (90 dBm), good isolation, excellent power handling (35W) and low distortion in a very small package. Target markets include handsets, infrastructure, military and others that may require high-power switching.

Skyworks Solutions, Inc.
skyworksinc.com

D/A Converters

Analog Devices, Inc. introduced D/A (digital-to-analog) converters that provide high accuracy and ultra-low noise, simplifying the design of precision instrumentation and analytical equipment. The new high-accuracy D/A converters incorporate integrated precision reference conditioning circuitry, making them system ready and providing a 60 percent reduction in board space compared to competing standalone data converters. The high linearity and low noise of the AD5790 and AD5780 D/A converters reduce the need to calibrate systems for nonlinearity or to time-average multiple measurements. The high stability and low drift of the converters over time and temperature reduce the need to compensate systems for aging and temperature effects. These features combine to significantly improve repeatability, reduce system downtime, and lower system maintenance costs.

Analog Devices, Inc.
analog.com

LVFR

ON Semiconductor introduced of a new family of 100 volt (V) trench-based low forward voltage Schottky

You work in all kinds of conditions, so should your spectrum analyzer.

Scan the QR code or visit http://goo.gl/JgXjo to see a HSA N93442 demo guide video

Only Agilent analyzers give you benchtop performance in a lightweight MIL-PRF 28800F Class 2-compliant handheld. Including a rugged design with no fans and no vents for tough field environments. So even in worst-case conditions, you can perform at your peak.

That's thinking ahead. That's Agilent.

Handheld Spectrum Analyzers (HSA)

Key Specs	N9344C	N9343C	N9342C	N9340B
Frequency	1 MHz–20 GHz	1 MHz–13.6 GHz	100 kHz–7 GHz	100 kHz–3 GHz
DANL	-155 dBm/Hz	-155 dBm/Hz	-164 dBm/Hz	-164 dBm/Hz
Sweep time	< 0.9 s	< 0.7 s	< 0.4 s	< 0.1 s
Weight with battery	3.6 kg (7.9 lbs)	3.6 kg (7.9 lbs)	3.6 kg (7.9 lbs)	3.5 kg (7.7 lbs)

Agilent and our Distributor Network
Right Instrument.
Right Expertise.
Delivered Right Now.

Newark element14

800-463-9275
www.newark.com/agilent

View online HSA video demos
Download demonstration guides
www.newark.com/Agilent_HSA

Agilent Technologies

NEW PRODUCTS

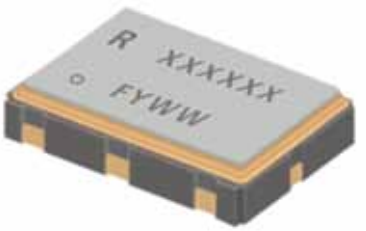
rectifiers (LVFR) for applications such as switching power supplies for notebook adapters or flat panel displays, reverse battery protection circuits, and high frequency DC-DC converters. The new NTST30100CTG, NTST20100CTG and NTSB20U100CTG family of devices utilize a trench topology that enables exceptionally low forward voltage drop and reduced leakage current. This results in low conduction losses and a substantial improvement in circuit efficiency, helping design engineers achieve regulatory requirements without the added complexity, such as synchronous rectification.

ON Semiconductor
onsemi.com

Sensor

API Technologies Corp. announced a new output option for its Spectrum Sensors line of H009 Hall Effect Position Sensors. The new 4-20mA output option joins the existing H009 series with Analog, PWR, and Serial output options. Hall Effect Position Sensors convert relative changes in a magnetic field into an electrical signal to provide position change information. Hall Effect Position Sensors are used in a variety of applications in the medical, wind measurement, green energy, robotics, and military and aerospace markets. The API Spectrum Sensors H009 Hall Effect Series are .875 inch in diameter with a .750 maximum length. They have a 12-bit resolution with a rotational life of over 100 million revolutions and feature an absolute linearity of +/- 0.1% at room ambient and +/- 0.3% at -40° to +125°C. They are available with several options including: lead wires, lead lengths and terminations; HR370 High TG printed circuit boards; and JST and Molex terminals. Special shaft, flange mounting, and gear mounting frame configurations are also available.

API Technologies Corp.
apitechnologies.com



VCXO

Rakon announced a new family of low noise, frequency selectable XO (RXO7050Q) and VCXO (RVX7050Q) products in industry standard 7 mm x 5 mm surface mount packages. The frequency select pins are used to select the output frequency from any combination of two or four pre-configured frequencies. The selectable capability increases design flexibility and reduces part count, to generate significant cost savings. The RXO7050Q and RVX7050Q deliver a frequency output from 8 MHz to 1.5 GHz with <1 ps RMS phase jitter (integrated 12 kHz to 20 MHz), to address high speed serial data communications, networking and telecom applications. The Q Series offer a low cost, pin-compatible alternative to SiLabs proprietary Si5xx selectable oscillators. Smaller footprints are available soon.

Rakon
rakon.com

"Testing 1-2-3"

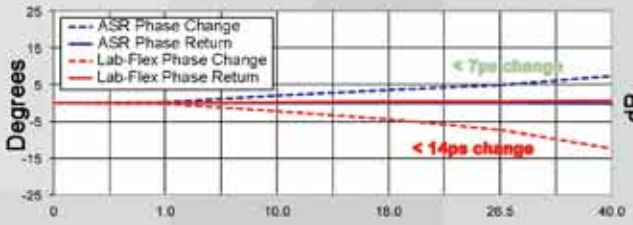
ASR
- VNA Test Port Assembly
- Durable Connector Designs
- Maintains Test Configuration
- Low-Loss Cable Construction
- Phase-Matched Pairs Available

Lab-Flex®
- Great General Purpose Test Assembly
- Low-Loss Construction
- 90dB Minimum Shielding
- Superior Connector Designs
- Excellent Strain Relief / Extended Boots

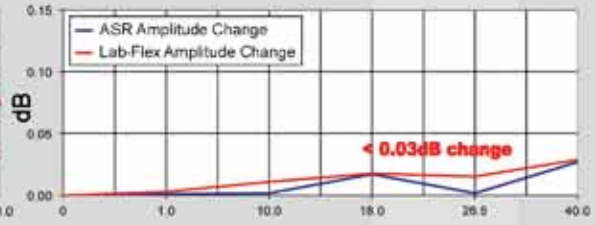
Mini-Flex & RG Cables
- Cost-Effective Test Assemblies
- Wide Variety of Connector Options
- Stainless Steel Connector Designs
- Up to 90dB Minimum Shielding
- Protective Coverings Available

All cable groups offer performance up to 50 GHz

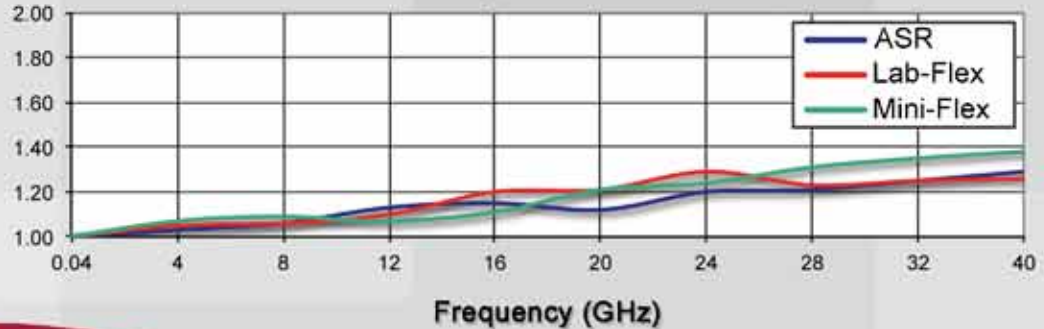
Lab-Flex® and ASR Cables
Phase Stability with Flexure



Lab-Flex® and ASR Cables
Amplitude Stability with Flexure



Typical SWR



Contact Us For
Your Test Cable Needs
sales@emc-rflabs.com

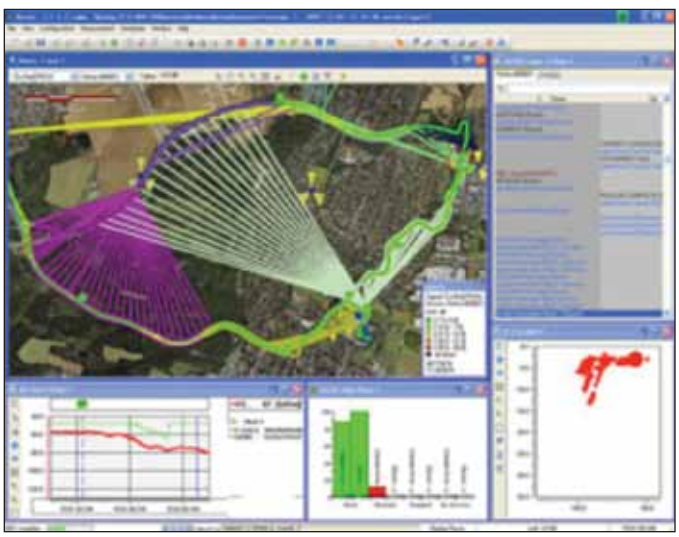
FLORIDA RF Labs
8851 SW Old Kansas Avenue, Stuart, FL 34997 USA
+1 772-286-9300 or 800-544-5594
www.emc-rflabs.com

Product Highlight

Universal Radio Network Analyzer

The R&S®TSMW universal radio network analyzer is a high-end platform for optimizing all conventional wireless communications networks. Two highly sensitive 20 MHz frontends for any input frequency from 30 MHz to 6 GHz, a dual-channel preselection and an FPGA-based software-defined architecture offer unsurpassed performance while providing maximum flexibility and operational readiness. In addition to functioning as a scanner for wireless communications networks in combination with theR&S®ROMES4 drive test software, the R&S®TSMW is also an ideal digital I/Q baseband receiver for customer-specific applications.

- User-definable input frequency range from 30 MHz to 6 GHz
- Two independent RF and signal processing paths, each with a bandwidth of 20 MHz
- Integrated preselection for high intermodulation suppression while dynamic range is high
- Support of LTE FDD and TD-LTE measurements together with the R&S®ROMES4 drive test software
- Parallel measurements in GSM, WCDMA, LTE, cdma2000®1xEV-DO, TETRA and WiMAX™ networks
- Spectrum measurements with the RF power scan option



- I/Q baseband streaming with Gigabit LAN interface to a PC or via R&S®digital I/Q interface to the R&S®IQR I/Q data recorder
- Integrated GPS with PPS

Drive Test Software

R&S®ROMES4 is a test platform for measurements in all mobile radio networks. In combination with R&S®TSMx network scanners and test mobile phones, it forms a complete system for coverage and quality of service (QoS) measurements. Besides pure recording and visualization of test parameters, data is processed instantly and statistics are calculated in realtime.

One software solution for all technologies: “all under one roof”

Flexible handling of software licenses reduces startup costs

Parallel measurement with up to 16 mobile phones per license; this saves time, allowing existing resources to be utilized more effectively: reduction of operating expenses (OPEX)

Use of highly accurate, fast RF test and measurement equipment (Rohde & Schwarz scanners):

many reliable measured values and results

Numerous advanced features for network troubleshooting

Automatic evaluation after completion of measurement by means of the integrated replay function or theR&S®ROMES4NPA (network problem analyzer), which considerably reduces OPEX

Automatic identification of GSM interferences: considerable OPEX reduction (up to 80 % potential savings compared with standard analysis)

Unique Scanner for LTE and TETRA networks in all bands and decoding of broadcast information

Rohde & Schwarz
Rohde-schwarz.com

Product Showcase

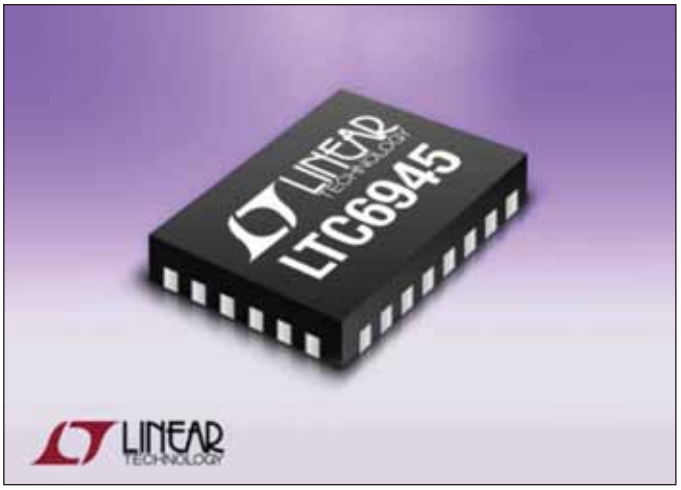
HFE's Product Showcase Classified Advertising

Your ad will stand out when it's displayed in our Product Showcase!

For more information, or to place your ad, please contact:

Joanne Frangides
Tel: 201-666-6698 • Fax: 201-666-6698
joanne@highfrequencyelectronics.com

Product Highlight



14-Bit A/D Converters

The LTC®2145-14/LTC2144-14/LTC2143-14 are 2-channel simultaneous sampling 14-bit A/D converters designed for digitizing high frequency, wide dynamic range signals. They are perfect for demanding communications applications with AC performance that includes 73.1dB SNR and 90dB spurious free dynamic range (SFDR).

Ultralow jitter of 0.08psRMS allows undersampling of IF frequencies with excellent noise performance.

DC specs include ±1LSB INL (typ), ±0.3LSB DNL (typ) and no missing codes over temperature. The transition noise is 1.2LSBRMS.

The digital outputs can be either full rate CMOS, double data rate CMOS, or double data rate LVDS. A separate output power supply allows the CMOS output swing to range from 1.2V to 1.8V.

The ENC+ and ENC– inputs may be driven differentially or single-ended with a sine wave, PECL, LVDS, TTL, or CMOS inputs. An optional clock duty cycle stabilizer allows high performance at full speed for a wide range of clock duty cycles.

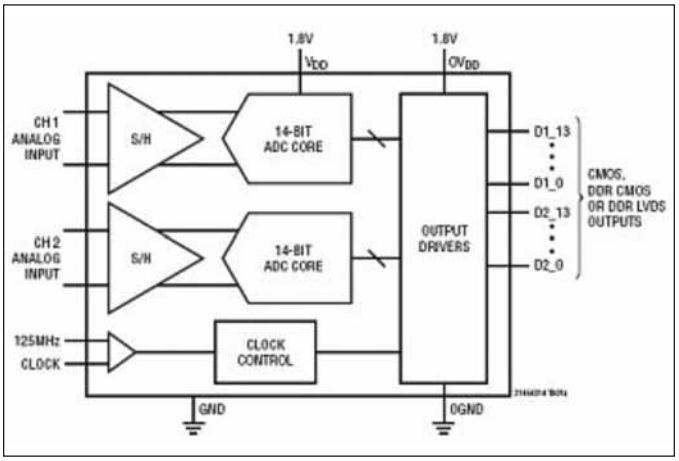
Integer-N PLL/Synthesizer

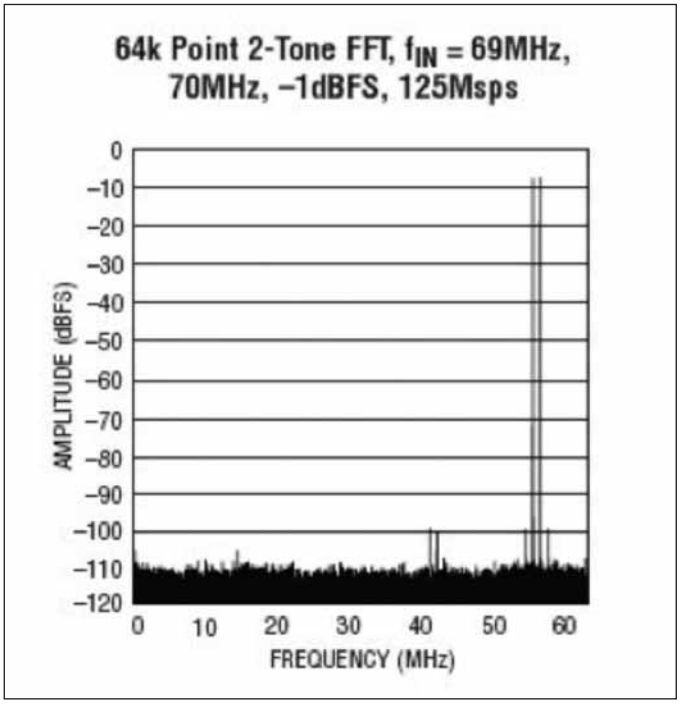
Linear Technology announces the LTC6945, a high performance 6GHz integer-N frequency synthesizer with outstanding -226dBc/Hz normalized closed-loop in-band phase noise, excellent -274dBc/Hz normalized in-band 1/f noise, a wideband phase noise floor of -157dBc/Hz and best-in-class -102dBc spurious output.

In a typical 900MHz application, these performance attributes enable a closed-loop phase noise of -100dBc/Hz at 1kHz offset. The LTC6945 is designed to work in conjunction with an external low noise VCO up to 6GHz. In addition, the device has an on-chip output divider that is programmable from 1 through 6 to extend the tuning frequency coverage to as low as 350MHz.

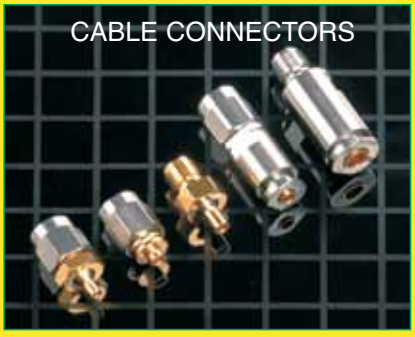
The LTC6945 comprises a low noise reference buffer, a reference divider, phase-frequency detector (PFD) with phase-locked indicator, an ultralow noise programmable charge pump and an integer feedback divider to attain very low noise PLL operation. The on-chip SPI-compatible bidirectional serial port allows frequency tuning and control, and read back of the register and loop status information.

Linear Technology
linear.com





Quality, Performance and Reliability in Precision Coaxial Connectors



ADAPTERS · CABLE CONNECTORS · RECEPTACLES · CUSTOM DESIGNS

Including These Connector Series					
1.85mm	**DC-65 GHz**	**2.92mm**	**DC-40 GHz**	**7mm**	**DC-18 GHz**
2.4mm	**DC-50 GHz**	**3.5mm**	**DC-34 GHz**	**SSMA**	**DC-40 GHz**

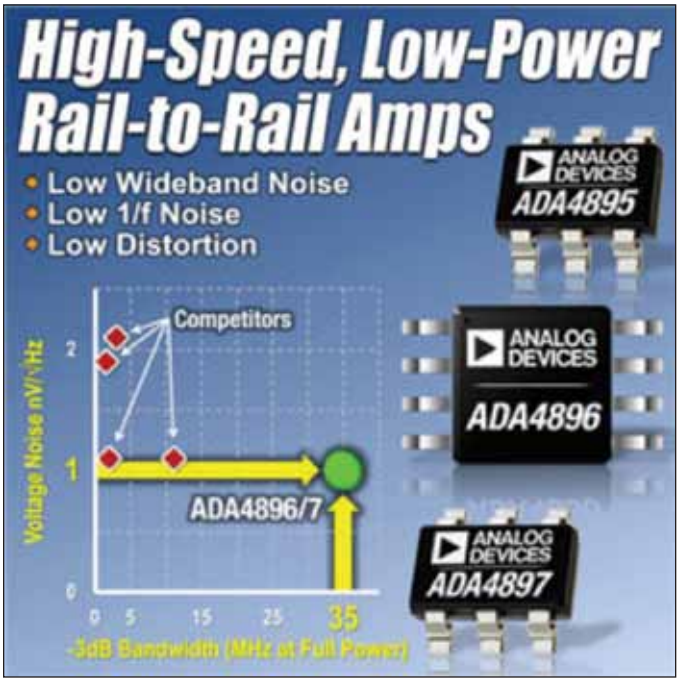
ISO 9001:2008

SGMC Microwave — The name to count on for Quality, Performance and Reliability! Please contact us today by Phone, Fax or Email.

SGMC MICROWAVE

Manufacturer of Precision Coaxial Connectors
620 Atlantis Road, Melbourne, FL 32904
Phone: 321-409-0509 Fax: 321-409-0510
sales@sgmcmicrowave.com
www.sgmcmicrowave.com

Product Highlight



Sensor

Analog Devices released the third generation iSensor® MEMS IMU (inertial measurement unit). The ADIS16488 is a tactical grade 10-degree-of-freedom (DoF) sensor and integrates a tri-axis gyroscope, tri-axis accelerometer, tri-axis magnetometer and a pressure sensor into a single package.

This new MEMS IMU provides the most stable and complete integrated sensor suite available, supporting mission critical requirements in high-performance navigation and stabilization applications. Beyond the important tactical grade (below 10°/hr) bias stability, the ADIS16488 outperforms all other contemporary gyro/IMU offerings on the often more critical specifications of g-effect, temperature coefficient, and bandwidth by up to 100X. Further, the new iSensor MEMS IMU even outperforms legacy military grade IMUs on vibration rectification and linearity. Every device undergoes unique and extensive factory calibration, resulting in unparalleled precision in the toughest environments and greatly reduces complexity, time, cost, and design risk relative to typical motion sensor development.

The ADIS16488 iSensor 10-DoF MEMS IMU is a complete inertial measurement system that combines ADI's high performance iMEMS® technology and sensor-signal processing expertise to optimize the IMU's 10-DoF dynamic performance. Operation is fully autonomous, including all embedded compensations, with valid data available from the SPI interface 500 ms after applying power. With all calibration done at the factory, and with an ADI Blackfin® processor-powered configurable interface for tuning embedded filtering and other diagnostics, a major source of design integration time and risk is virtually eliminated.

High-Speed Amplifiers

Analog Devices unveiled a series of high-speed amplifiers that establish a new performance standard with the best combination of high-speed, low noise and low power. Designed for portable, multi-channel and low power instrumentation and healthcare equipment, the ADA4896-2 (dual), ADA4897-1(single) and ADA4897-2 (dual) high-speed amplifiers provide the highest large-signal bandwidth and slew rate with the lowest noise available today in a rail-to-rail amplifier under 10 mW.

Each amplifier features low noise of 1 nV/√Hz and 120-V/µs slew rate while consuming only 3 mA of supply current. Further, the 1/f noise @10Hz is a low 2.4 nV/√Hz. Watch this video and learn more about ADI's new series of high-speed amplifiers.

Also announced as part of this high-speed amplifier series was the ADA4895-2 dual de-compensated high-speed amplifier. It delivers 1.5-GHz gain-bandwidth product at gains of +10 and greater, making it ideal as a high-speed, high-gain pre-amplifier.

The new rail-to-rail amplifiers operate across the extended industrial temperature range of -40˚C to +125˚C and offer a 3-V to 10-V supply range. The ADA4895-2 and ADA4897-1/ -2 include an output disable feature.

Analog Devices
analog.com

50 GHz

High Quality. Higher Frequency.

Our new high performance series of microwave and millimeterwave connectors can provide you with the benefit of legendary Delta quality over a broad spectrum of frequency and bandwidth requirements.

In addition to our extended-frequency 26.5-GHz SMA connectors, we now offer ultra-precision SMAs with superb performance to 27 GHz, plus 2.92 mm (SMK) connectors to meet your SMA-compatible requirements to 40 GHz, and 2.4 mm production grade connectors that will satisfy your requirements all the way to 50 GHz. For high-frequency applications requiring minimum connector size or blind mating, our SMP connectors are ideal.

Our new product lines include cable plugs and jacks, and field-replaceable receptacles for use with hermetic seals. These receptacles are available in all common mounting flange and pin size configurations.

Delta's new connectors are designed using state of-the-art optimization tools and techniques. This focus on precision produces connectors with low VSWR, minimal transmission loss, and low RF leakage.

Call or visit our website to see how Delta Quality RF, microwave, and and millimeterwave connectors can help you meet your product performance goals—from DC to 50 GHz.

DELTA
ELECTRONICS MFG. CORP.
Connect Here.

Delta Electronics Mfg. Corp.
Tel: (978) 927-1060 • Fax: (978) 922-6430
P.O. Box 53 • 416 Cabot St.
Beverly, MA 01915 USA

DELTA
MICROWAVE ELECTRONICS
Connect Here.

Delta Microwave Electronics (Nanjing) Co., Ltd.
Tel: +86 25 84195408 • Fax: +86 25 84195407
No. 9 Tianquan Road, Qilin Industrial Park (South Zone),
Tangshan Street, Jiangning District, Nanjing 211135, China

ISO 9001:2008 CERTIFIED · RoHS COMPLIANT · SOMWBA Woman-Owned CERTIFIED

DeltaRF.com

Product Highlight

Electrical-Thermal MMIC Design Flow

AWR Corp. recently authored a useful white paper, "Turn Up the Heat! AWR Connected: An Electrical-Thermal Design Flow."

Excerpt:

"Electronic circuit design typically begins with an assumption that the components are operating at ambient temperature. Monolithic Microwave Integrated Circuit (MMIC) design, in particular, violates this as the DC current flowing through the ever-shrinking devices induces heating to two, three, or even four times greater temperature (in deg C). Such a large departure from assumed room temperature behavior impacts phase, gain, efficiency, noise, and intermodulation distortion. Circuit designers need tools with integrated electrical-thermal analysis to address these performance issues."

Read the entire paper at: http://web.awrcorp.com/content/Downloads/MMIC-Flow-WP.pdf?from=771266750304385

Modelithics Latest Release for AWR Microwave Office

Modelithics, Inc. (www.modelithics.com) has released the latest version of their popular linear and non-linear system level model libraries for RF, microwave and millimeter-wave device and components. The Modelithics COMPLETE Library version 8.0 for AWR's Microwave Office™ software introduces forty-six (46) new Global Models for passive RLC's, and eighteen (18) new non-linear models for diodes, switches, amplifiers, and transistors.

Nearly all of the existing models for use with AWR's Microwave Office software have been updated with significant enhancements to enable full compatibility with AWR's APLAC® non-linear circuit simulation technology. Version 8.0 also introduces a new measurement-derived substrate library. The enhanced APLAC compatibility as well as the new Substrate Library were added in response to designer requests to improve the convenience , accuracy and flexibility of their AWR simulations with Modelithics' models.

Designers can download our free model library, Modelithics SELECT™ from www.modelithics.com and see for themselves why designers around the globe consider Modelithics libraries a necessary part of their RF design toolkit. For more information or to request a free full-version trial of the Modelithics COMPLETE Library, send an email to Sales@Modelithics.com , or click on the free trial link you'll find at: http://www.modelithics.com.

AWR
awrcorp.com

When *failure* is not an option.

Johnson's line of SMP connectors are manufactured to MIL-Spec interface standards with consistent quality and performance levels you can depend on in your designs and applications.

Key benefits of using an SMP connector are:

- Use blind-mate applications
- Micro-miniature slide-on/snap-on interconnect system
- Bullet design that provides a flexible link between shroud connections
- Available in custom configurations

Just another reason why Emerson Network Power is the global leader in enabling Business-Critical Continuity™.

EmersonConnectivity.com
800-247-8256

Johnson
Connectivity Solutions

EMERSON™
Network Power

EMERSON. CONSIDER IT SOLVED.™

Design Notes & Market Reports

Design Notes

Applied Wave Research (awrcorp.com):

Analog Office Configure

This project will help new users to Analog Office configure the software for some settings that they will be more familiar with. These include the schematic and layout colors, the hotkeys, schematic wires behavior, units, and layout face defaults. This project will also discuss a method to generate a library of elements defined by the user.

Analog Office Extends HSPICE Transient Simulations to RF

Microwave Office, the Applied Wave Research (AWR) product for RF, microwave and millimeter-wave design, offers harmonic balance simulations to obtain steady state waveforms for port voltages and currents in microwave circuits. Design of many types of circuits such as oscillators, frequency dividers, and digital circuits with memory requires the ability to perform transient simulations. AWR's Analog Office (AO) offers this capability for RF and microwave circuits through integration with HSPICE 2003 from Synopsys...

BJT Amp Complete

This example is a part of AO Getting Started Guide.

BJT Amp OpPnt

This project shows the preliminary design of a differential amplifier, in order to demonstrate the DC operating point annotation and measurement in MWOffice and Analog Office.

CustomSpirals

It is easy to create your own custom spiral inductors within the AWR environment. The following simple steps show how to create the spiral element, characterise it and then use it in your project.

HierarchyResExample

The unified database used in the AWRDE contains much more connectivity information than other IC design tools normally would. In order to make the most of the advanced features of Analog Office, hierarchical connection in layout needs to be considered a little differently.

Agilent Technologies: (agilent.com/find/powerofx)

Agilent Technologies has made available a new Application Note on Testing DigRF Interfaces. The new "Solutions for Testing DigRF Interfaces" 5990-9501EN, offers insight into how to quickly and efficiently characterize digital wireless devices. It is part of a series of Agilent Power of X application notes created to provide insight into solving tough measurement problems in a unique way for both the design and manufacturing environments. To request copies of the free application notes go to www.agilent.com/find/powerofx.

Market Reports

Test Equipment Market in Russia and the CIS

Russia and the CIS countries are emerging markets offering long-term potential for general purpose test equipment vendors. Government and private investments in infrastructure development and services are poised to generate new opportunities for test equipment vendors.

New analysis from Frost & Sullivan (http://www.testandmeasurement.frost.com), General Purpose Test Equipment Markets in Russia and CIS Countries, finds that the markets earned revenue of $194.8 million in 2010 and estimates this to reach $247.3 million in 2015. The research service covers the following products: oscilloscopes, signal generators, spectrum analysers, multimeters, network analysers, logic analysers, power meters, arbitrary waveform generators and electronic counters.

"Investments in infrastructure are rising with constant upgrades and efforts at modernisation," notes Frost & Sullivan Industry Manager Sujan Sami. "The increase in public-private partnerships (PPP) is set to boost infrastructure development, leading to greater demand for suitable test equipment."

The education as well as the aerospace and defence (A&D) sectors are major revenue-generating streams in Russia and the CIS countries. The A&D end-user sector was not as badly affected by the economic downturn as other sectors. This, in addition to the growth in the educational sector, is driving demand for oscilloscopes and other general purpose test equipment.

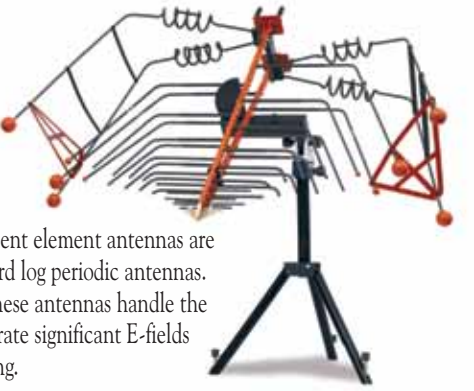
A large territory and customer base also bodes well for market prospects. "Russia is the largest country in the world and is also the 9th largest country in terms of population," explains Sami. "This implies a huge consumer base for electronic products that will attract electronic OEMs and create potential for general purpose test equipment vendors."

At the same time, growth in several industrial sectors is poised to augment demand for general purpose test equipment in the near future. In addition, with the economy recovering from the recession, the pent-up demand

What Have You Done For Me Lately? Plenty!

16,000 Watts of Pure Power

Stand back! We've exceeded our old limits with the new 16000A225 amp. It covers 10 kHz to 225 MHz and delivers 16,000 watts of power.



We've Bent The Rules

Our family of Radiant Arrow bent element antennas are up to 75% smaller than standard log periodic antennas. Covering 26 MHz to 6 GHz, these antennas handle the necessary power levels to generate significant E-fields for radiated susceptibility testing.

We've Pushed The Technology Envelope

We ripped that envelope wide open with our small, lightweight Solid State Hybrid Power Modules. They deliver high output power (up to 5 watts) across an ultra-wide instantaneous bandwidth (4 to 18 GHz).

Our New Dual Band Amplifiers Break Down Old Barriers

With two amplifiers in a single package, you can finally go all the way from 0.8 to 18 GHz with the reliability of solid state.

Our New EMI Receiver: Amazing Speed, Incredible Accuracy

The CISPR-compliant DER2018 covers 20 Hz to 18 GHz and beyond. It combines sensitivity, dynamic range and speed with a more intuitive interface.

Accuracy, Linearity & Bandwidth. Need We Say More?

Our two newest laser-powered E-Field probes, FL7040 – 2 MHz to 40 GHz and FL7060 – 2 MHz to 60 GHz; each do the work of multiple probes, with outstanding accuracy and linearity.

More Power To You

They're smaller and lighter. Yet our new "S" Series amps are available from 0.8 to 4.2 GHz, 20 to 1200 watts and everything in between.

All-In-One Fully Integrated Test Systems

Get more done in less time with everything right at your fingertips. Since it's all provided by AR, you obtain the best accuracy, lowest risk and greatest support in a fully tested system prior to shipping.

www.arworld.us/plenty

ISO 9001:2008 Certified

rf/microwave instrumentation

Other ar divisions: modular rf • receiver systems • ar europe

USA 215-723-8181. For an applications engineer, call 800-933-8181.
In Europe, call ar United Kingdom 441-908-282766 • ar France 33-1-47-91-75-30 • emv GmbH 89-614-1710 • ar Benelux 31-172-423-000

www.arworld.us

for general purpose test equipment is set to hit the market, resulting in heightened demand levels.

However, the lack of private capital expenditure threatens to restrain market growth. Poorer economies such as Tajikistan, Armenia, Uzbekistan, Kyrgyzstan and Moldova are mostly dependent on state expenditure for growth. This restricts the adoption of newer technologies, hindering market expansion.

With government policies playing a critical role in the development of countries in the CIS region and in Russia, companies also need to keep a close track of evolving government regulations.

"Focusing on total solutions, rather than just selling test instruments, is the key to achieving market success," concludes Sami. "Moreover, to compete more effectively against regional vendors, companies will need to forge alliances with local channel partners."

If you are interested in more information on this study, please send an email with your contact details to Anna Zanchi, Corporate Communications, at anna.zanchi@frost.com.

"Wireless Decade" for Latin America

Currently, the Latin American region is characterized by the coexistence of 2G, 3G and 4G wireless standards. The lack of standardization has restrained vendors in terms of product development and customer base expansion. However, the future looks bright as regulatory bodies begin playing an important role in aligning with international standards.

New analysis from Frost & Sullivan estimates the markets to expand from $ 158.5 million in 2010 to $342.0 million in 2017, growing at a compound annual growth rate (CAGR) of 11.6 percent during the forecast period.

"A key factor driving demand for wireless test equipment is the continuous development of wireless communication standards from 2 and 2.5G to 3G, 3.5G, HSPA and 4G," notes Frost & Sullivan Research Analyst Mariano Kimbara. "There are several 4G trials and deployments slated to begin by the end of 2011 and the beginning of 2012 which are expected to generate growth for this market."

The evolution from 2G to 3G wireless standards has contributed significantly to the uptake of wireless test and equipment in the Latin American region. Operators in Latin America are in the initial phase of 3G HSPA deployments and very few are introducing HSPA +. The new HSPA technologies allow increased data transmission in the region without the need for massive investment.

Imminent LTE deployments also augur well for market prospects.

"The major reason for deploying LTE in the region is the promise of reduced operating costs and savings in terms of frequency spectrums over the long term," explains Kimbara. "As a result, operators are favoring the implementation of LTE, instead of blindly following the parameters of developed markets such as those in North America and Europe."

A key challenge is the lack of emphasis on quality, which has had a ripple effect on investment levels. Latin American operators are cost conscious, exhibiting an 'essentials only' attitude towards test equipment. Consequently, vendors are experiencing difficulties in penetrating the market with high-end sophisticated testing tools.

"Regulatory bodies have not been very proactive in auditing network quality," elaborates Kimbara.

"They have shirked from applying penalties in cases where operators have failed to meet the contractually agreed performance in terms of efficiency and quality."

However, things are changing. The explosion of wireless data usage brought about by smartphones has put immense strain on networks in the Latin American region in terms of quality. Regulatory bodies are starting to push for higher quality standards in some countries.

"The rising number of smartphones and tablets sales, combined with high mobile penetration rates, has intensified the need to deploy HSPA+ in large cities," concludes Kimbara. "This will highlight the need for more robust and reliable wireless test and equipment."

C.W. Swift & Associates is proud to feature SGMC Microwave Precision Coaxial Connectors and Adapters

ADAPTERS · CABLE CONNECTORS · RECEPTACLES · CUSTOM DESIGNS

Including These Connector Series					
1.85mm	DC-65 GHz	2.92mm	DC-40 GHz	7mm	DC-18 GHz
2.4mm	DC-50 GHz	3.5mm	DC-34 GHz	SSMA	DC-40 GHz

SGMC MICROWAVE

C.W. Swift & Associates stocks RF, Microwave and Millimeter wave adapters, connectors, components and tooling from SGMC Microwave and other fine manufacturers.

C.W. SWIFT & Associates, Inc.

15216 Burbank Blvd.
Van Nuys, CA 91411
Tel: 800-642-7692 or 818-989-1133
Fax: 818-989-4784
sales@cwswift.com
www.cwswift.com

Product Highlight

30 GHz Drop-In Isolator

Renaissance Electronics has designed a new drop-in isolator for Satcom applications covering the 30-33 GHz frequency range (Model No. 2L9NEU-RoHS).

The unit has less than 1 dB Insertion Loss and more than 16 dB Isolation and Return Loss over the temperature range -20 to +60°C.

It is capable of handling 40 watts of forward and 10 watts of reflected power.

Comprehensive information about various Renaissance/HXI products is available at our websites www.rec-usa.com / www.hxi.com.

Low-Noise Amp

The HLNAV-360 is a low noise amplifier with integrated isolators at the input and output ports. It operates over the 57 to 64 frequency band with 27 dB gain, noise figure of 6.0 dB, and a P1dB of + 12 dBm.

RF interfaces are via WR-15 waveguide with standard UG-385/U flanges. A single MCX connector provides the bias input for the + 15 VDC operating voltage. The amplifier bias is internally regulated and sequenced for reliability and user convenience.

Renaissance Electronics
rec-usa.com

W.FL Cable Assemblies

VidaRF Inc. announces the availability of Cable Assemblies featuring the popular W.FL series of connectors from Hirose. W.FL is popular due to its small size as it can make connections when space is extremely limited.

Tactile click sensation confirms fully mated condition assuring complete electrical and mechanical contact.

1.5 mm max mated height, 3.4 mm mounting for receptacle

Light weight (5.6 mg)

Operating Frequency: DC – 6 GHz

VSWR: 1.35 max at 3 – 6 GHz

Temp Range: - 40 to + 85 deg C

SMA Connectors

VidaRF's wide ranging line of SMA connectors and phase matched adaptors can be configured to your specifications in ranges from DC to 18 GHz. Both male and female SMA connectors are available in crimp or solder versions, making them compatible with a wide range of cables. SMA receptacles can be ordered in a bulkhead, panel-mount, or press-fit configuration, and all panel-mount receptacles are available with 2 or 4 hole flanges. The panel-mount receptacles offer solder cup, post, or tab contact terminations. Reverse polarity SMAs are also available.

VidaRF
vidarf.com

IMS2012 MONTRÉAL

MICROWAVES WITHOUT BORDERS
MICRO-ONDES SANS FRONTIÈRES

International Microwave Symposium
IEEE 17-22 June 2012, Montréal, Canada MTT-S
http://ims2012.mtt.org/

MTT IMS
NEW YORK 1952 MONTRÉAL 2012
60 YEARS 60

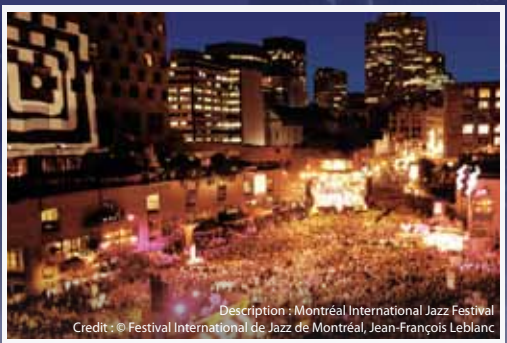
IMS2012: Microwaves without Borders

Description : Chinese Garden at the Montréal Botanical Garden
Credit : © Montréal Botanical Garden, Michel Tremblay

Botanical Garden

Description : Biosphère, Environment Museum
Credit : © Tourisme Montréal

Biosphère, Environment Museum



Description : Montréal International Jazz Festival
Credit : © Festival International de Jazz de Montréal, Jean-François Leblanc

Montréal International Jazz Festival

About the conference:

The IEEE Microwave Theory and Techniques Society's 2012 International Microwave Symposium (IMS2012) will be held on 17-22 June in Montréal, Canada as the centerpiece of Microwave Week. IMS2012 offers technical sessions, interactive forums, plenary and panel sessions, workshops, short courses, industrial exhibits, application seminars, historical exhibits, and a wide array of other technical and social activities including a guest program. Colocated with IMS2012 are the RFIC symposium (www.rfic2012.org) and the ARFTG conference (www.arftg.org), which comprise the Microwave Week 2012 technical program. With over 9,000 attendees and over 800 industrial exhibits of the latest state-of-the-art microwave products, Microwave Week is the world's largest gathering of Radio Frequency (RF) and microwave professionals and the most important forum for the latest and most advanced research in the area.

For more information visit **http://ims2012.mtt.org**

IMS2012 exhibit space is available for reservation.

To book a space or for information contact:

Richard D. Knight, Sales Manager
Telephone: 303-530-4562 ext. 130
Email: Rich@mpassociates.com

MTT-S®

http://ims2012.mtt.org

IEEE®

HIGH FREQUENCY
ELECTRONICS

www.highfrequencyelectronics.com

High Frequency Electronics magazine

An effective advertising medium to reach design engineers

- Respected technical content
- Professionally edited and presented material
- Business and technology news
- Conference and short course calendar
- New product announcements
- Online Edition (PDF) identical to print edition

www.highfrequencyelectronics.com

Use online ads for a combined online-print presence

- Subscriber services — subscriptions & renewals
- Complete archives of all past technical articles, reports, tutorials, editorials
- Advertiser information and ad material specifications
- HFeLink™ quick access to industry web sites
- Ready to add new capabilities

Special Services

Use our expertise in print and electronic media

- Article reprints, catalogs, brochures
- Mail list rental
- Trade show promotions & literature distribution
- Newsletter and promotional e-mails
- Other needs? Just ask!

ADVERTISING SALES — EAST COAST
Gary Rhodes
Tel: 631-274-9530, Fax: 631-667-2871
grhodes@highfrequencyelectronics.com

ADVERTISING SALES — WEST
Tim Burkhard
Tel: 707-544-9977, Fax: 707-544-9375
tim@highfrequencyelectronics.com

ADVERTISING SALES — CENTRAL
Keith Neighbour
Tel: 773-275-4020, Fax: 773-275-3438
keith@highfrequencyelectronics.com

PUBLISHER — OTHER REGIONS & INTERNATIONAL
Scott Spencer
Tel: 603-472-8261, Fax: 603-471-0716
scott@highfrequencyelectronics.com

Learn RF Anywhere.

Besser Associates
Web ClassroomSM

Enjoy the benefits of RF training via web conferencing:

- No travel expenses
- Shorter sessions - only 90 minutes each day
- Keep up with your projects, meetings, etc.
- Live sessions - interact with instructor
- Instructor can adapt presentation based on student feedback

Here's how it works:

- Log-in to the web conference at the start of each session - ***you can even use your smartphone or tablet!***
- Follow along and take notes - PDF manual included
- Live Demos - the instructor can share simulations and other applications from their computer
- Ask questions via the chat window at any time, or email between sessions

Enjoy the benefits of live, classroom training - with no travel expense and minimal disruption to your schedule.

Upcoming Web Classroom Courses:

- Impedance Matching - New! 2 hours - February 9
- GaN Power Amplifier Design March 12-16,2012
- RF Fundamentals June 25-29,2012

GaN Power Amplifier Design - New Course!

March 12-16, 2012 - Just 90 minutes per day!

Outline:

GaN Semiconductor and GaN HEMT PA Capabilities:

• GaN semiconductor properties • GaN HEMT transistors • geometries • semiconductor processes • breakdown voltages • thermal resistance • power capability • reliability • thermal management techniques • gain • efficiency • frequency performance

GaN FET PA Devices and Models:

• Existing discrete GaN HEMT vendors • devices • MMIC sources • comparison of MMIC devices and performance • MMIC matching and biasing elements • nonlinear GaN HEMT models

GaN FET PA Design Considerations:

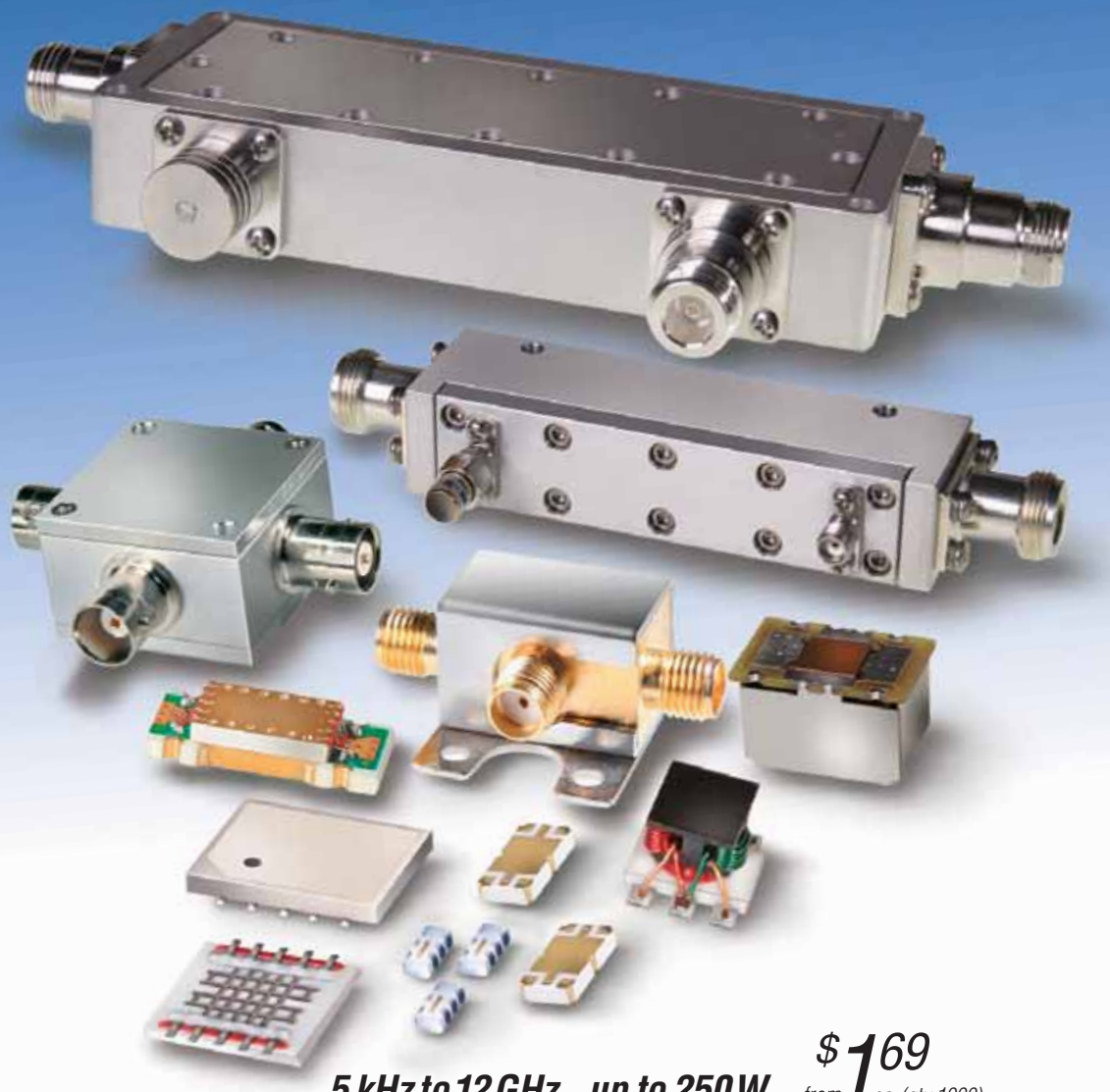
• Constant amplitude envelope design (GSM) considerations • non-constant amplitude envelop (EDGE, CDMA, WCDMS, WIMAX, LTE) design considerations and solutions

GaN FET PA Design Examples:

• Step-by-step PA design for various classes of operation as well as the popular Doherty amplifier using the latest nonlinear CAD circuit programs

Besser Associates
The Worldwide Leader in RF and Wireless Training
Phone: 1-650-949-3300 Fax: 1-650-949-4400 www.besserassociates.com

Directional / Bi-Directional
COUPLERS



5 kHz to 12 GHz **up to 250 W** from $1.69 ea. (qty. 1000)

Looking for couplers or power taps? Mini-Circuits has 236 models in stock, and we're adding even more! Our versatile, low-cost solutions include surface-mount models down to 1 MHz, and highly evolved LTCC designs as small as 0.12 x 0.06", with minimal insertion loss and high directivity. Other SMT models are designed for up to 100W RF power, and selected core-and-wire models feature our exclusive Top Hat™, for faster pick-and-place throughput.

At the other end of the scale, our new connectorized air-line couplers can handle up to 250W and frequencies as high as 12 GHz, with low insertion loss (0.2 dB @ 9 GHz, 1 dB @ 12 GHz) and exceptional coupling flatness! All of our couplers are RoHS compliant. So if you need a 50 or 75 Ω, directional or bi-directional, DC pass or DC block coupler, for military, industrial, or commercial applications, you can probably find it at minicircuits.com, and have it shipped today!

See minicircuits.com for specifications, performance data, and surprisingly low prices!
Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

SUPER ULTRA WIDEBAND

AMPLIFIERS

+24 dBm output... 0.7 to 21 GHz from $845 ea.

Calling these amplifiers "**wideband**" doesn't begin to describe them. Consider that both the ZVA-183X and ZVA-213X amplifiers are unconditionally stable and deliver typical +24 dBm output power at 1dB compression, 26 dB gain with +/- 1 dB flatness, noise figure of 3 dB and IP3 +33 dBm. What's more, they are so rugged they can even withstand full reflective output power when the output load is open or short. In addition to broadband military and commercial applications, these super wideband amplifiers are ideal as workhorses for a wide number of narrow band applications in your lab or in a production environment.

Visit our website for comprehensive performance data and specifications for our ZVAs or any of our over 10,000 catalog items. You can even order on-line for next day shipment.

Mini-Circuits…we're redefining what VALUE is all about!

TYPICAL SPECIFICATIONS

MODEL	FREQ. (GHz)	GAIN (dB)	POUT (dBm) @ 1 dB Comp.	NOISE FIG. (dB)	PRICE (1-9)
ZVA-183X+	0.7-18	26	+24	3.0	845.00
ZVA-213X+	0.8-21	26	+24	3.0	945.00
Note: Alternative heat-sink must be provided to limit maximum base plate temperature.					
ZVA-183+	0.7-18	26	+24	3.0	895.00
ZVA-213+	0.8-21	26	+24	3.0	995.00

All models IN STOCK! *RoHS compliant*

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Advertiser Index

■ **Find Our Advertisers' Web Sites using *HFeLink™***

1. Go to our company information Web site: www.HFeLink.com, or
2. From www.highfrequencyelectronics.com, click on the *HFeLink* reminder on the home page
3. Companies in our current issue are listed, or you can choose one of our recent issues
4. Find the company you want ... and just click!
5. Or ... view our Online Edition and simply click on any ad!

High Frequency Electronics

PUBLISHER
Scott Spencer
Tel: 603-472-8261
Fax: 603-471-0716
scott@highfrequencyelectronics.com

ADVERTISING SALES — EAST
Gary Rhodes
Vice President, Sales
Tel: 631-274-9530
Fax: 631-667-2871
grhodes@highfrequencyelectronics.com

ADVERTISING SALES — WEST
Tim Burkhard
Associate Publisher
Tel: 707-544-9977
Fax: 707-544-9375
tim@highfrequencyelectronics.com

ADVERTISING SALES — CENTRAL
Keith Neighbour
Tel: 773-275-4020
Fax: 773-275-3438
keith@highfrequencyelectronics.com

U.K and Europe
Sam Baird
Tel: +44 1883 715 697
Fax: +44 1883 715 697
sam@highfrequencyelectronics.com

U.K and Europe
Zena Coupé
Tel: +44 1923 852 537
Fax: +44 1923 852 261
zena@highfrequencyelectronics.com

PRODUCT SHOWCASE
Joanne Frangides
Tel: 201-666-6698
Fax: 201-666-6698
joanne@highfrequencyelectronics.com

High Frequency Electronics (USPS 024-316) is published monthly by Summit Technical Media, LLC, 3 Hawk Dr., Bedford, NH 03110. Vol. 11 No. 1 January 2012. 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.

The choice is clear
for all your RF needs.

Custom solutions and standard products from a single source.

With decades of experience in the interconnect industry, we know what's important to engineers. That's why Molex manufactures the world's broadest line of radio frequency connectors, cable assemblies and custom products. Our RF solutions can be optimized to minimize signal loss over a wide range of frequencies in a broad spectrum of sizes and styles of connectors. Plus, our service-oriented team can turn around drawings in 48 hours and deliver custom products in less than eight weeks — so you can get your products to market faster.

For the industry's largest array of product options backed by reliable service, turn to Molex — your clear choice for RF interconnect products and solutions.

molex®
one company › a world of innovation

www.molex.com/product/rf.html

IF CABLE INTEGRITY IS CRITICAL AND YOU
NEED PRODUCTS TO WITHSTAND HARSH ENVIRONMENTS...
FAILURE IS NOT AN OPTION.

THAT'S
MISSION CRITICAL CONTINUITY.

Emerson Connectivity Solutions
RF connectors and cable assemblies are designed to offer reliable connectivity solutions for RF & Microwave, Military and Security/Defense applications.

EmersonConnectivity.com
Toll free: 800-247-8256
Phone: 507-833-8822

Connectivity Solutions

EMERSON™
Network Power

EMERSON. CONSIDER IT SOLVED.™

ULTRA·REL®

CERAMIC MIXERS

300 MHz to 12 GHz

The Most Reliable Mixers In Today's Marketplace

3-YEAR GUARANTEE

Mini-Circuits...we're redefining what VALUE is all about!

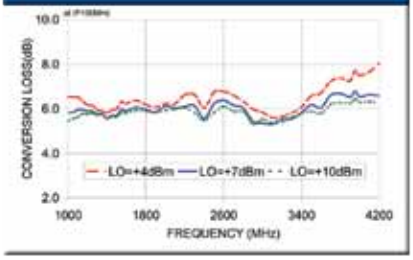
Mini-Circuits®

ULTRA-REL® Ceramic Mixers

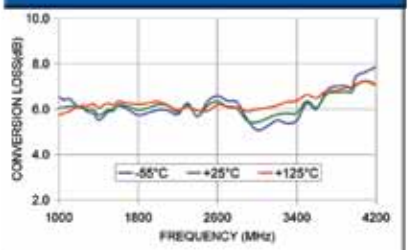
Excellent Electrical Performance for **CRITICAL APPLICATIONS**

Typical Performance Curves (*MAC 42+ shown, see minicircuits.com for other models*)

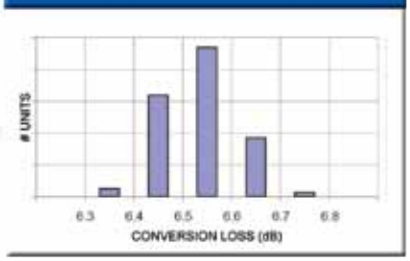
CONVERSION LOSS



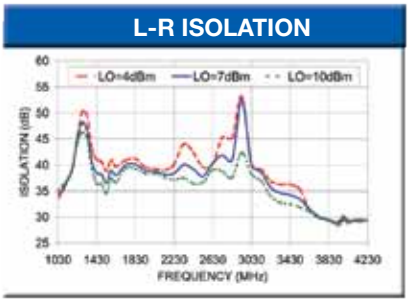
CONVERSION LOSS @ TEMP



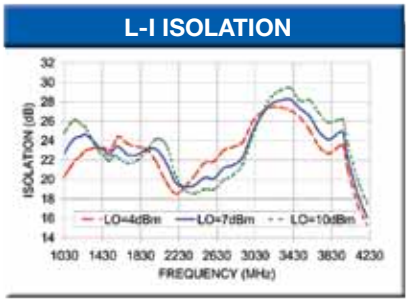
REPEATABILITY HISTOGRAM



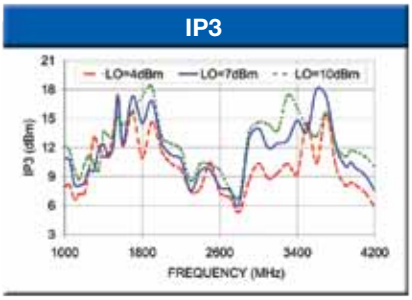
L-R ISOLATION



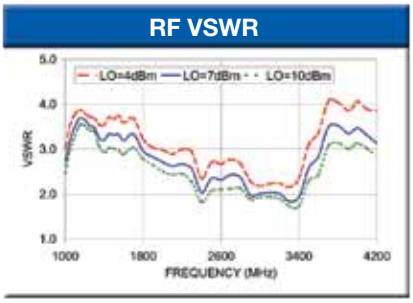
L-I ISOLATION



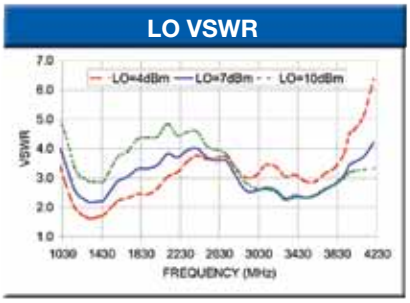
IP3



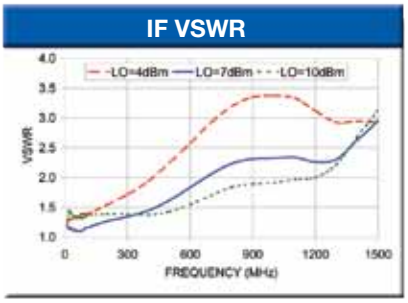
RF VSWR



LO VSWR



IF VSWR



There's much more to Mini-Circuits Ultra-Rel® Ceramic Mixers than just a rugged case—designed and built not only to survive, they deliver ***excellent electrical performance in a consistent manner*** throughout a product's life cycle: across the entire frequency range, at temperatures from -55 to +100°C, and from unit to unit and lot to lot.

It's what makes these mixers ideal, not only for military use, but anywhere long-term reliability adds bottom-line value: high moisture areas, busy production lines, high-speed distribution centers, heavy industry, outdoor settings, and unmanned facilities, to name just a few. For more information, from technical specifications to performance data, environmental ratings, export info, application notes, pricing, real-time availability, and more, just go to **minicircuits.com** and make your selection today!

Mini-Circuits® P.O. BOX 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
ISO 9001 ISO 14001 AS 9100 CERTIFIED

Designed and Built for Long-Term Reliability in **HOSTILE ENVIRONMENTS**

Mini-Circuits MAC mixers meet or exceed the following qualifications:

Gross Leak	MIL-STD-202 Method 112, Condition D (100% of all MAC Mixers we ship)
Fine Leak	MIL-STD-202 Method 112, Condition C, Procedure IIIa
Thermal Shock	MIL-STD-202 Method 107 (-55/+100C°, 1000 cycles, 15 minutes) (-55/+150C°, 1000 cycles, 15 minutes)
Vibration	MIL-STD-202 Method 204, Condition D (10-2000Hz sine, 20g, 3 axis, 12 c.y.ea.)
Acceleration	MIL- STD-883 Method 2001, Condition E
Mechanical Shock	MIL-STD-202 Method 213, Condition A
HTOL	MIL-STD-202 Method 108, Condition D (1000 hours, 125°C, at rated LO level)
Multiple Reflow	JESD22-B102
Bend Test	JESD22-B113
Adhesion Strength	Push test >10lb

All Photos courtesy of U.S. Military and NASA

ULTRA·REL® Ceramic Mixers

Meet the demands of *Your* HOSTILE ENVIRONMENT

Photo courtesy of U.S. Military and NASA

Aerospace • Military • Outdoor • Industrial • Instrumentation

Model	LO Level (dBm)	Frequency (GHz)	Conv. Loss (dB)	Isolation L-R (dB)	Price $ ea. (qty. 10)
MAC-24+ MAC-24LH+ MAC-24MH+	7 10 13	0.3-2.4	6.1	40	**5.95**
MAC-42+ MAC-42LH+ MAC-42MH+	7 10 13	1.0-4.2	6.1	35	**6.95**
MAC-60+ MAC-60LH+ MAC-60MH+	7 10 13	1.6-6.0	6.5	35	**7.45**
MAC-80LH+ MAC-80MH+ MAC-80H+	10 13 17	2.8-8.0	5.8 5.8 6.5	29	**7.95** **7.95** **8.95**
MAC-85L+ MAC-85+	4 7	2.8-8.5	7.0 6.1	31	**7.95**
MAC-113H+	17	3.8-11	6.5	28	**11.95**
MAC-12GL+ MAC-12G+	4 7	3.8-12	6.6 6.3	26	**8.95**

Go to minicircuits.com for technical specifications, performance data, pricing, and real-time, in-stock availability!

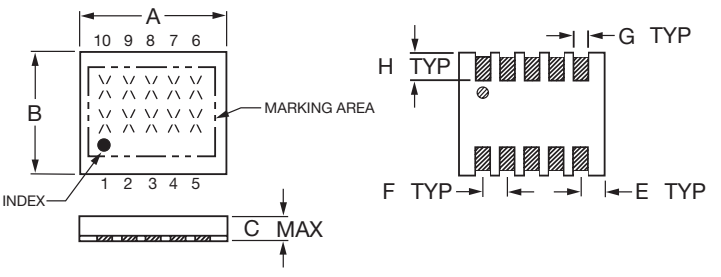
Outline Dimensions (inch / mm)

A	B	C	E	F	G	H
.30	.250	.060	.050	050	.030	056
7.62	6.35	1.52	1.27	1.27	0.76	1.42

Weight 0.23 grams

Pin Connections

LO	10
RF	5
IF	3
GROUND	1,2,4,6,7,8,9



Mini-Circuits...we're redefining what VALUE is all about!

Mini-Circuits®
ISO 9001 ISO 14001 AS9100
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661