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X2Y Attenuators Co-Founder Anthony Dies.

Anthony (Tony) A. Anthony, age 77, of Erie, Pennsylvania, passed away at his home on October 13. Tony was born on June 2, 1935 in Erie, a son of the late Anthony and Mary Louise (Paris) Anthony.

A 1953 graduate of Erie Cathedral Prep where he excelled in sports, he went on to graduate from the U.S. Naval Academy in Annapolis, Maryland, Class of 1958. While attending the Academy, Tony started both ways at left tackle for Navy's nationally ranked football team. In his senior year, the 5th ranked Naval Academy went on to dominate the 8th ranked Rice University Owls with a 20-7 win in the 1958 Cotton Bowl. In June 1958, Tony was commissioned a 2nd Lieutenant in the U.S. Marine Corp and five years later left the service at the rank of Captain in the Marine Corp Reserves.

From the mid-1960's until early 1996, Tony enjoyed a long career in the electronics industry working for companies such as Erie Technological Products, Murata Manufacturing Co. Ltd., and later Spectrum Control Inc.

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New Interactive PDF EMI Shielding Catalog

PDF of shielding product catalog lets the user jump from page-to-page with a click of the mouse and even download interactive sales drawings of over 100 finger stock gaskets, metalized gaskets, fan vents and board level shields. Download a copy at www.tech-etech.com/shield and see just how useful this interactive functionality can be.



Tech-Etch

In 1996, Tony co-founded X2Y Attenuators LLC with his Naval Academy classmate and longtime friend Don Harris of Santa Monica, California. Tony was a prolific inventor. During his life he was granted over 140 issued U.S. and international patents on X2Y Technology, which is applied in electronic components that are used in products including satellite radios, automobile braking systems, commercial and military aircraft, portable heart defibrillators and computer microprocessors. In 2003, Tony was recognized by the IEEE EMC Society with a Technical Achievement Award for X2Y Technology.

Tony is survived by his loving wife of 16 years, the former Pamela Kay Keith whom he married on October 19, 1996, as well as her son Colin Keith and wife Mary-Kay Keith of Erie. He is also survived by five children, William Anthony and wife Julie of Erie, Dr. Richard Anthony and wife Svetlana of Glendale, California, David Anthony and wife Lori of Erie, Mary Anthony of San Mateo, California, and Kathryn Anthony of Austin, Texas; and his eight grandchildren. In addition, Tony is survived by his brother Richard Anthony and wife Marsha of Erie; and many beloved nieces and nephews.

Leader Tech Receives MIL-SPEC Certification

Leader Tech's newly expanded line of TechSIL Conductive Elastomer compounds received QPL certification by the Defense Logistics Agency. This unrivaled commitment to excellence distinguishes Leader Tech as the only MIL-SPEC approved and certified manufacturer of all 12 conductive elastomer formulations.



This prestigious designation authorizes the company to formulate, extrude and mold conductive elastomers to stringent MIL-DTL-83528D specifications. Leader Tech's high-performance TechSIL gaskets are manufactured at its recently expanded Global EMI Shielding Technology Center using proprietary base formulations of silicone, fluorosilicone and EPDM rubber that are embedded with highly conductive fillers including: Silver, Silver/Copper, Silver/Aluminum, Silver/Nickel, Silver/Glass, and Nickel Coated Graphite. The company offers numerous standard gasket profiles as well as unlimited variations of extruded, molded, sheet stock, and

die-cut finishes.

Leader Tech's new TechSIL 5000 Conductive Elastomers provide engineers with a highly customizable gasketing solution that delivers a shielding effectiveness of up to 110dB across wide temperature variations and environmental conditions. An onsite applications engineer is also available to help formulate materials to meet your custom requirements.

Boeing Tests Electromagnetic Pulse Missile

Electronic warfare may have gone a notch higher with the successful testing of a new missile that fires an electromagnetic pulse to disable electronic devices without causing damage to buildings and other structures. A Boeing Phantom Works team tested the Counter-electronics High-powered Advanced Missile Project (CHAMP) on October 16 in the U.S.



"This technology marks a new era in modern-day warfare. In the near future, this technology may be used to render an enemy's electronic and data systems useless even before the first troops or aircraft arrive," said Keith Coleman, CHAMP program manager for Boeing Phantom Works. Coleman, who led the Boeing team in the historic test flight, said the team is now analyzing data and telemetry from the test.

Observing the test were members from the U.S. Air Force Research Laboratory (AFRL) Directed Energy Directorate team, and Raytheon Ktech, suppliers of the High Power Microwave source, from a conference room at Hill Air Force Base.

ETS-Lindgren Refocuses Manufacturing Locations

ETS-Lindgren, a global leader in test and measurement as well as medical solutions, is refocusing its U.S. manufacturing facilities to increase vertical integration, provide greater control of in-house processes, and improve logistics efficiency.



The company currently has manufacturing facilities in Cedar Park, Texas; Durant, Oklahoma; Glendale Heights, Illinois; and Minocqua, Wisconsin. With the new focus, medical production will be centered in Minocqua, while test and measurement production will be centered in Cedar Park with support from the Durant facility. ETS-Lindgren will maintain an operation in the Chicago, Illinois, area for sales, engineering, design, project planning, installation, and customer support.

As part of this consolidation, the separate legal entities of ETS-Lindgren L.P. and Lindgren R.F. Enclosures Inc. have been merged to form a new entity, ETS-Lindgren Inc. Customers and suppliers will not see a change in the company's business policies or practices, but will benefit from this organizational streamlining.

Murata Opens Plant in the Philippines

In October, Murata Manufacturing Co. Ltd. celebrated the completion of its newest plant in Southeast Asia. The factory, Philippine Manufacturing Co. of Murata Inc. (PMM), is located in Tanauan City in Batangas Province, Philippines. A ceremony celebrating its completion was attended by many representatives of Tanauan, as well as President Tsuneo Murata, Executive Vice President Yukio Hamaji, and PMM President Takashi Masuda, of Murata.



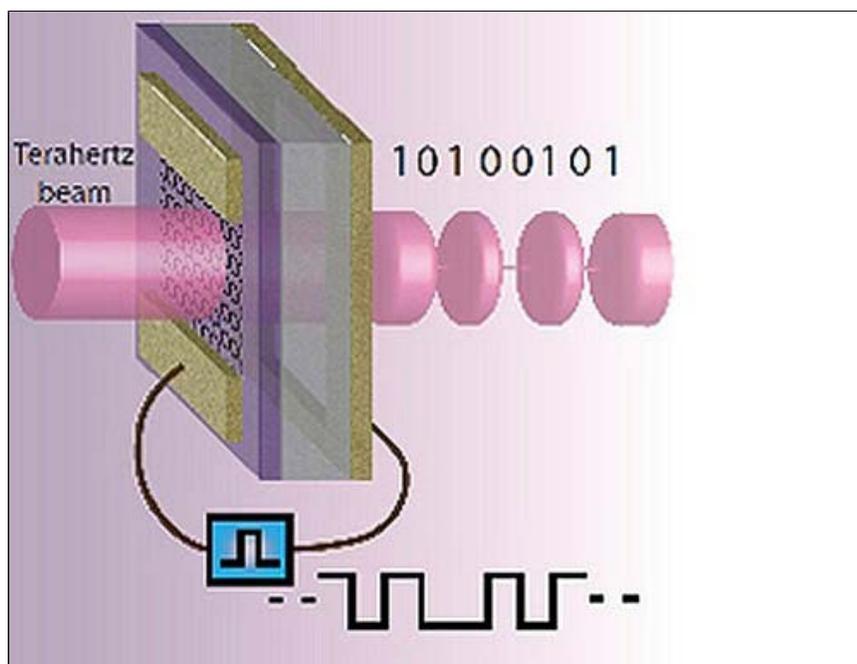
Murata Manufacturing Co., Ltd.
President/Statutory Representative
Director Tsuneo Murata celebrates
completion of its newest plant.

"We were able to hold this ceremony today thanks to the tremendous support we received from many people. This Murata Philippine factory is our largest site in Asia. When fully operational, it will be capable of producing a variety of models in representative production scales, enabling us to greatly increase our scope of production." said President Murata.

Production at PMM will begin in January 2013 with Multilayer Ceramic Capacitors; it is anticipated that other products will also be manufactured at PMM in the future.

Closing the THz Gap with Graphene-Based Devices

A research group led by Huili (Grace) Xing at the University of Notre Dame, with support from the National Science Foundation, has been actively developing graphene-based devices capable of efficiently manipulating THz waves. Graphene, an atom-thick sheet of bonded carbon atoms, can modulate or vary the properties of THz waves, making it an ideal choice for THz-based devices and systems.



Artistic rendering of a graphene-based device that modulates terahertz electromagnetic waves into low and high intensity, thus representing information transmission.

Xing, her colleagues and students at the University of Notre Dame aim to develop cheap, compact and high-performance graphene-based THz systems such as cameras and high speed communication chips. "Understanding the interaction of graphene with THz waves is the key for developing these THz devices," Xing says. Her group relies on numerical simulations to engineer their devices before fabricating them in the laboratory.

The graphene-based THz devices proposed and developed by the group so far consist of a layer of graphene and another two-dimensional layer of electrons separated by a thin insulator. This layer affects the properties of the waves passing through the material, while the insulating layer serves to create a nonconductive space between the graphene and second electron layer. By applying a voltage between these layers, the absorption of THz waves can be tuned from close to zero to almost 100%.

Electromagnetic Oil Extraction Technique

Mark Trautman, a senior scientist for Florida-based Harris Corp., is participating in a project to extract precious bitumen – a hydrocarbon mixture in oil sands – without using water. No steam. No liquid water. Just electromagnetic waves.



A crew installs a casing into oil sands at a test site in this photo. The casing surrounds an antenna that is inserted into the sand

That could be significant for development of tar sands. It's a cheaper method than what is used now, and would save on water. Critics dislike tapping the sands, saying it requires huge amounts of energy and water, increases greenhouse gas emissions and threatens rivers and forests.

The technique broadcasts electromagnetic waves into the sands. The waves heat water molecules surrounding the bitumen. Crews then inject solvents into the formation. The process reduces the resource's viscosity, allowing it to be more easily extracted.

Widely-used techniques like fuel-assisted gravity drainage – in which steam is injected into the sands to free up bitumen – rely heavily on water. Trautman said the extraction process he is working on – Enhanced Solvent Extraction Incorporating Electromagnetic Heating, or ESEIEH – could remedy that need, which can be a problem.

Lab Name Honors Roger Pollard

Agilent Technologies Inc. of Santa Clara, California, has opened the first Agilent-equipped terahertz measurement laboratory in Europe at the U.K.'s University of Leeds. The new laboratory will enable research on devices, components, circuits and systems at much higher frequencies than any other institution in the region has been able to perform previously.

The lab is set up in memory of professor Roger Pollard, former dean of engineering at the University of Leeds and a long-time friend of Agilent, who passed away at the end of last year. The Agilent 1.1THz PNA network analyzer is the centrepiece of the new lab.

Peter Jimack, dean of engineering at the university, and Greg Peters, general manager of Agilent's component test division, formally opened the laboratory. Featured guest speaker professor Giles Davies delivered a keynote presentation on terahertz technology.

Rogers Corporation Appoints New Executive

Rogers Corp. of Rogers, Connecticut, reports the appointment of Helen Zhang as President of Asia Region to oversee the company's growing business in greater China and throughout the Asia-Pacific region. Zhang will be responsible for driving Rogers' growth strategy in Asia across the company's three core businesses of printed circuit materials, power electronics solutions and high performance foams.

Zhang joins Rogers from Dow Chemical where she served most recently as global general manager for the Interconnect Technology business of Dow Electronic Materials. Zhang holds an Executive MBA from the GuangHua Business School of Beijing University and a BS degree in Environmental Chemistry from Beijing Polytechnic University.

In the newly created executive role, Zhang will be responsible for business growth in the Asia Pacific region overseeing the company's manufacturing and sales operations, as well as building relationships with the government, industry and the community. She will be based in Rogers' Beijing office.

National Instruments Acquires NMDG

National Instruments of Austin, Texas, a leading supplier of test, measurement and development systems, has acquired NMDG, a company with more than 20 years of experience and technology in high-frequency stimulus-response and large-scale network analysis measurements, effective October 15.

The team serves as the foundation to establish a Network Analysis Center of Excellence located in Brussels, Belgium to work worldwide with NI partners, lead user programs and develop measurement and modeling architectures on NI's platform, influencing the future product roadmaps of NI. The NMDG acquisition is part of a continued NI vision to provide RF and microwave design engineers with access to NI technology from initial design through production test.

Sommer Named CFO of SMA Solar Technology AG

The Supervisory Board of Germany-based SMA Solar Technology AG has appointed Lydia Sommer to the company's managing board. Sommer comes from the Siemens Group, where she has held various management positions in the field of finance and controlling both in Germany and abroad.

In order to systematically grasp the emerging opportunities in foreign photovoltaic markets within a difficult market environment, the supervisory board has decided to increase the SMA managing board from four to five members.



Sommer

"With Lydia Sommer we now have – in addition to our proven executive team – another experienced international manager who will take over finance and legal," explains Günther Cramer, chairman of the supervisory board of SMA Solar Technology AG.

The SMA Group generated sales of €1.7 billion in 2011 and is the global market leader for solar inverters, a key component of all PV plants and, as an energy management group, offers innovative key technologies for future power supply structures.

Anritsu Corp. Opens India Subsidiary

Anritsu Corp., a global provider of innovative communications test and measurement solutions for more than 110 years, reports the opening of an India subsidiary in Bangalore. The new office brings together marketing, sales, engineering, services, and support. By co-locating all the departments, the company expects to accelerate the rate of delivery of new products and provide better and broader support to its growing customer base in India. Anritsu also plans to start a branch office operation in Noida within this fiscal year.

The Indian test and measurement market has been driven by global and domestic demands. Frost & Sullivan research on Indian test & measurement shows that the domestic demands have risen over the years, to make the market realize the opportunities from every sector in India. There has been an increasing integration of Internet connectivity, wireless communications (3G/4G/WiFi/Bluetooth), high-fidelity audio, and HD video in consumer electronics devices. This has been accelerating the demand for new technology testing solutions.

Semigen Acquires 50GHz Network Analyzer

SemiGen Inc. of Manchester, New Hampshire, an ISO and ITAR certified RF/Microwave assembly and automated PCB manufacturing company, have purchased a new Agilent 50GHz PNA network analyzer to augment their RF/Microwave test lab.

SemiGen's facility will now have the ability to provide higher frequency testing for internal designs and customer requirements. The machine will have the ability to measure S-parameters, insertion loss, gain, return loss, balanced parameters, differential measurements, compression, distortion, and noise figure.

"This is the next step in our testing evolution to provide customers testing services with up-to-date equipment for precision measurements approaching the millimeter-wave range." said Jim Morgan, president of SemiGen.

Wireless Charging w/o HF Electromagnetic Fields

University of British Columbia Canadian researchers have invented a safe, efficient technology to wirelessly charge electric vehicles without potentially dangerous radio waves. The design instead employs remote magnetic gears to rotate a base magnet driven by electricity from the grid, and a second located within the car. The base gear remotely spins the in-car gear, which in turns generates power to charge the battery. Researchers say this charging method operates at a frequency 100 times lower than traditional wireless EV chargers and with negligible exposed electric fields.

Four wireless charging stations have been installed at UBC's Building Operations parking lot and service vehicles retrofitted with the new technology. Tests show the system is more than 90% efficient

compared to a cable charge. A full charge takes four hours and enables the vehicle to run throughout an eight-hour shift.

“One of the major challenges of electric vehicles is the need to connect cords and sockets in often cramped conditions and in bad weather,” says David Woodson, Managing Director of UBC Building Operations. “Since we began testing the system, the feedback from drivers has been overwhelmingly positive – all they have to do is park the car and the charging begins automatically.”

SenarioTek Appoints Pettis A/D Business Manager

SenarioTek of Santa Rosa, California, a leading designer and manufacturer of RF and microwave products, has named Stephen Pettis as its new Aerospace/Defense Business Development manager. This is a new position which focuses on expanding SenarioTek's growing defense ATE business. Prior to joining SenarioTek, Pettis spent over thirty years working with Hewlett-Packard and Agilent Technologies. He was both a technical and sales lead, helping Aerospace/Defense customers meet their test needs and improve their productivity.



SenarioTek designs and manufactures RF and microwave products and integrated systems for the wireless, telecom, ATE, aerospace and defense industries. They offer the market's most competitive alternative for the creation of RF and microwave measurement products such as switch matrices, frequency converters, and calibration solutions with frequencies up to 60GHz.

Wireless Spectrum Driving New Design Approaches

Consumer demand and the coming spectrum crunch are driving a new era of innovative engineering and spectrum-sharing strategies in wireless because the low-hanging fruit in spectrum allocation has all been picked, an industry expert said.

“The easy stuff (in spectrum) has been cleared. Now it gets hard,”

said Mark Gorenberg, a managing director at Hummer Winblad venture capital and a member of the President's Council of Advisors on Science and Technology.

The council's report, issued in July of this year, recommended a variety of steps in the coming years to move spectrum from scarcity to abundance. Over the years, the government has freed unused or underused federal spectrum for commercial uses, and while more spectrum has been examined with this in mind, the time and cost to clear the frequencies is now too onerous.

Clinical Trials Validate Electromagnetic Therapy

Recent clinical studies of designed Pulsed Electromagnetic Field (PEMF) therapy device, called Depth-Empulse, in selected Nigerian hospitals, have shown that it is a useful and very efficacious form of non-pharmacological therapy and adjunct in rapid healing and pain relief in many conditions faced by man.

The studies noted that Depth-Empulse reduces recovery time of subjects by 50 to 60% and therefore reduces cost of drugs, consumables, bed-space, feeding and morbidity and shortens return to healed state.

Depth-Empulse has been probed by the NASA, researched by the World Health Organisation (WHO), and approved by the United States Food and Drug Administration as efficacious and without side effect.

A recent study by scientists from Yonsei University in South Korea published in Nature Materials concluded: "Magnets that guide the behaviour of tiny metal beads can be used to flip on a cell's death switch, kick-starting the cell's demolition. The approach might one day be used to kill cancer cells or orchestrate other cellular events without drugs or incisions."

RFMD Wins DARPA GaN Contract

RF Micro Devices, Inc. of Greensboro, North Carolina, a global leader in the design and manufacture of high-performance radio frequency components and compound semiconductor technologies, has been awarded a \$2.1 million contract from the Defense Advanced Research Projects Agency (DARPA) to enhance the thermal efficiency of gallium nitride (GaN) circuits used in high power radar and other military systems.

The award is in association with the Near Junction Thermal Transport (NJTT) effort of DARPA's Thermal Management Technologies (TMT) program. The goal of the DARPA NJTT initiative is to achieve a 3x or greater improvement in power handling from GaN power amplifiers through improved thermal management of the near junction region. By combining thermally-enhanced diamond substrates with RFMD's industry-leading GaN-on-SiC high power technology, RFMD expects to significantly improve power density and power handling capability.

IEEE Presents Drexel, with an IEEE Milestone

On October 22, IEEE commemorated the 60th anniversary of the

invention of the barcode by dedicating an IEEE Milestone in Electrical Engineering and Computing at the Bossone Research Enterprise Center at Drexel University. Moshe Kam, 2011 IEEE President and department head of Electrical and Computer Engineering at Drexel, took part in the dedication ceremony.

In 1952, a pair of graduate students from a school then called the Drexel Institute of Technology patented a system for instant electronic recall of product information using patterns of lines of varying widths. The barcode was first used in grocery stores in 1966 and saw widespread use after the Universal Grocery Products Identification Code was created in 1970 to standardize common grocery items. Today the system is used around the world and has also become important to the medical field, where it is used to retrieve patient information.

The IEEE Milestones in Electrical Engineering and Computing program honors significant technical achievements that occurred at least 25 years ago in technology areas associated with IEEE. To date, more than 100 Milestones have been approved and dedicated around the world.

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New EMI Receiver Reduces Test Time

AR Receiver Systems has introduced a DSP-based emissions receiver that has the speed and accuracy to reduce test time from days to minutes.

The new Model DER2018 Digital Emissions Receiver offers continuous coverage from 20Hz to 18GHz with 140MHz instantaneous bandwidth. It performs over 30,000 simultaneous CISPR detections, allowing the user to scan 4GHz/sec with the peak detector; sweep 30-1000MHz in seven seconds with all CISPR detectors; identify disturbances using fast time-base 3D display; and catch short-duration transient disturbances.

The receiver complies with CISPR-16-1-1 edition 3.1. Combining state-of-the-art sensitivity, dynamic range, and accuracy: the receiver is extremely easy to use with all functions menu-driven. Emission testing can be performed to MIL-STD-461 D, E, & F; DO160D, E, & F; CISPR 11/EN 55011; CISPR 22/EN 55022; CISPR 14/EN 55014; and FCC Part 15 standards.

The EMI receiver system includes a built-in computer and interfaces with standard data storage and high resolution video devices. A 23" widescreen flat LED monitor, keyboard and mouse are also included.

For more information, contact AR RF/Microwave Instrumentation, 160 School House Rd., Souderton, PA 18964, phone: 1-215-723-8181 or visit www.arworld.us. For an applications engineer, phone: 1-800-933-8181.

Versatile Low Hardness Sarcon Thin Film

Sarcon® 30QR from Fujipoly is a low hardness thermal interface material that exhibits a thermal conductivity of 1.10 W/m²K and a thermal resistance of .57 °Cin²/W. This material is available in roll or sheet form and can easily be die-cut, molded or extruded to accommodate your unique application specifications.

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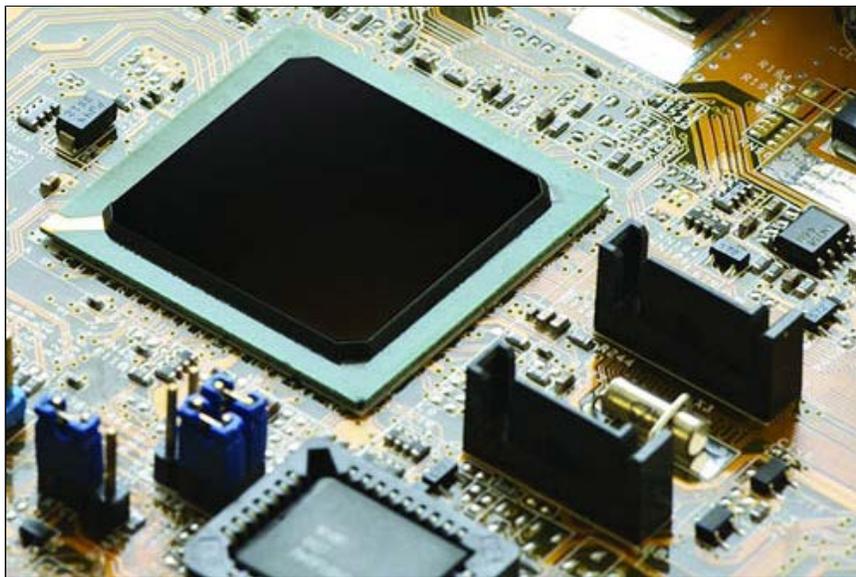
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The versatility of Sarcon® 30QR is evident in its use as a conductive insulator for semiconductors, compression joining material for thermistors and temperature sensors, as well as a gap filler material for all types of heaters. This is V-0 flame-retardant thin film as recommended for applications with operational temperatures that range from -60°C to +180°C.

For more information contact Fujipoly America Corp., phone: (732) 969-0100 or visit www.fujipoly.com.

New RFI/EMI Spring Contacts from Harwin

Harwin, the leading hi-rel connector and SMT board hardware manufacturer, has expanded its EZ-BoardWare range of PCB hardware products with nine new EZ-Spring Contacts.



Also known as Spring Fingers or Grounding Contacts, these devices are designed for easy assembly onto PCBs, and are used as grounding or shielding contacts, in contact with metal frames or shields. Suitable for both wiping and sliding action, the individual

clips are supplied in tape and reel packaging for automated placement, and reduce manufacturing costs by eliminating time-consuming secondary assembly operations.

A significant addition to Harwin's existing range RFI/EMI spring contacts, the new devices are available in a variety of different styles. Uncompressed heights of between 1.7mm and 7.0mm provide excellent design flexibility, and good spring properties provide excellent electrical connection/grounding to be made between a PCB and various other electronic components – other PCBs, speakers, fans, aerials, shields etc – even if the equipment is subject to vibration. A variety of plating finishes, including gold and tin are offered.

For more information, visit www.harwin.co.uk.

New RF Preamp for EMC Testing

The Model S5200 from Baytems is a general-purpose RF preamplifier having a 3dB bandwidth of 1kHz up to 1.2GHz. Typical gain flatness is +/- 0.75dB from 9kHz to 1GHz, with a gain of 20dB.



The broadband amplifier can be used to improve the sensitivity of spectrum analyzers and other RF measuring instruments, or to increase the power level of a signal source. The Baytems Model S5200 is invaluable for low signal measurement applications with its wide bandwidth, high gain and low noise figures. The device is essential for radiated field strength measurements where spectrum analyzers are used together with broadband antennas as these have relatively high loss factors.

The Model S5200 is very compact, measuring only 105x65x185 mm. It can be operated from 115 or 230 VAC. The Model S5200 is available from Baytems' webstore for \$995.

For more information, visit www.baytems.com.

The World's Fastest EMI Test Receiver

Rohde & Schwarz's new R&S ESR EMI test receiver offers broadband

architecture that allows standard-compliant EMI measurements up to 6000 times faster than other solutions.



Comprehensive diagnostic tools such as spectrogram display, realtime spectrum analysis and IF analysis help developers to detect and eliminate EMI. The R&S ESR also offers an intuitive touchscreen interface.

The new R&S ESR test receiver is available in two different models for frequencies ranging from 10Hz to 3GHz or 7GHz to meet the requirements of all users who perform EMC certification on commercial equipment. The R&S ESR covers all commercial standards relevant for test houses and EMC labs used by electrical equipment manufacturers and their suppliers.

The test receiver features time domain scan, an FFT-based receiver technology that allows it to perform measurements up to 6000 times faster than other EMI test receivers. Standard-compliant EMC measurements which took hours in the past can now be completed in just seconds, saving users valuable time on the way to obtaining results.

For information, visit www.-rohde-schwarz.com.

Matrix® AP Harmonic Filter Product Line Extension

MTE Corp. reports the extension of the Matrix AP Harmonic Filter product line. Adding to the current 83A-1200A offerings, 6A-66A units are now available. All 6A-103A units utilize a new, single three-phase capacitor.

Capacitor Contactor Option 002 is also available as a standard option on all 6A-1200A filters. To accommodate specific application requirements, this option disconnects the capacitor bank, essentially eliminating leading power factor under light or no-load conditions. This option is also available as an upgrade to existing installed Matrix AP Filters.

For more information, visit www.mtecorp.com.

Amplifier for Portable Medicine

Analog Devices, Inc. is offering the AD8237 micro-power, zero-drift precision instrumentation amplifier,

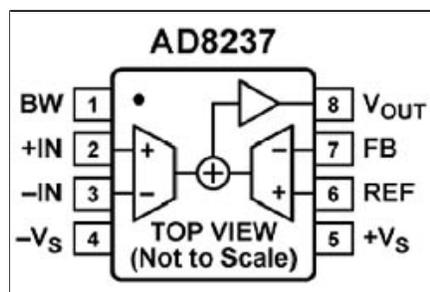
The AD8237 features a low input offset drift ($<0.3\mu\text{V}/^\circ\text{C}$) and an industry leading input signal range that extends 300 mV beyond the supply rails. Combined with a maximum gain error and drift of 0.005% and $0.5\text{ppm}/^\circ\text{C}$ respectively, and common-mode rejection ratio of 114dB, the device offers precision measurement, even at low gain.

With a low quiescent supply current of just over $100\mu\text{A}$, the amplifier is well suited for signal conditioning bridge, temperature and other similar sensors used in low-power designs. Target applications for the AD8237 include portable and battery-powered healthcare, consumer and precision instrumentation equipment such as infusion pumps, mobile blood pressure monitors, 4- to 20-mA sensors, gaming peripherals and consumer weigh scales.

For more information, visit www.analog.com.

National Instruments Debuts Integrated RF Testing

National Instruments has condensed a new multi-functional RF vector signal transceiver in size and made it easier for engineers and scientists to use its graphical system design language Labview to tailor FPGA-based hardware for specific applications.



The product covers up to 6.0GHz and 80MHz instantaneous RF bandwidth, which allows it to be used to test the latest wireless standards such as 802.11ac and LTE and can be expanded to support multiple input, multiple output (MIMO) configurations or parallel testing in a single PXI chassis.

For more information, visit www.ni.com.

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E. Thomas Chesworth



Most of the world is rough - leaves in the forests, lightning, mountains, bark on a tree, seashores and noise as displayed on an oscilloscope are rough . It is interesting that most of our mathematical representations of the world are smooth - sign waves are smooth, planes and lines are smooth circles and conic sections (orbits of planets) all are smooth. Could it be that we are doing something wrong, that we are missing something?

Smooth things are differentiable, velocity on a curve is an example. In general, rough things are not differentiable. And a lot of things we take for granted in engineering analysis require uniform-continuity. If you don't have it, the rules don't work. One of the rules is that if you make a small change in a system, the system changes a small amount. If that isn't true, then you have to assume that the system cannot be described by all the rules - at least you can't depend on the rules working. And there are systems that don't follow this rule of small changes.

Suppose we build a sandpile. Take a small round table and set a funnel above the center of it - a funnel so small that only one grain of sand at a time comes out. Start dropping grains on to the table. A conical pile of sand forms and eventually the edge of the base of the cone reaches the edge of the table. At this point each time you add a grain of sand to the apex of the cone, a single grain falls off the table. Right? Sorry, wrong.

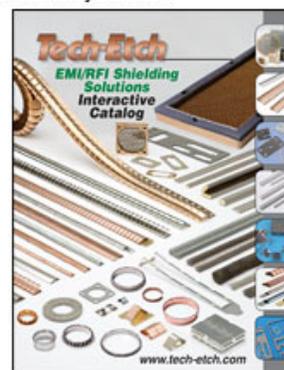
Sooner or later you add a single grain and it starts an avalanche down the side of the cone and a thimble full, a fist full or a bucket full of sand falls off the table. And worse, there is no way to calculate where, when or how much sand will fall. The stock market is like that. Everything is going along smoothly when suddenly and unexpectedly the Dow Jones average drops a few thousand points. Believe me if there was a way to use mathematics to predict this happening, it would be used.

There is a branch of mathematics that describes this behavior (although not in a way that we can yet use to solve real problems the way we would like to solve them). It is called Chaos theory and is characterized by fractals. Although not restricted to geometry (i.e., the stock market) fractals are most easily described and understood in geometry. Take a look at a fractal geometry in a plane. Google "fractal zoom." You will probably come up with a Mandelbrot fractal

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New Interactive PDF EMI Shielding Catalog

PDF of shielding product catalog lets the user jump from page-to-page with a click of the mouse and even download interactive sales drawings of over 100 finger stock gaskets, metalized gaskets, fan vents and board level shields. Download a copy at www.tech-etech.com/shield and see just how useful this interactive functionality can be.



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which is named for Benoit Mandelbrot, a mathematician who worked on fractal geometries.

The fractal geometries have several weird properties. First they tend to be self-similar (as you look at smaller parts of them finer features emerge that resemble the original. They are nowhere differentiable and they nearly fill up space. That is, they have fractional dimensions. For example, a fractal line nearly fills up a plane. Points have 0 dimension, lines have 1 dimension, planes have 2 dimensions and so on. A line that nearly fills up a plane has, say 1.732 dimensions. If you can't visualize that, go back and have another look at the fractal zoom you found.

Why should we care? Well, at present the realistic terrain in video games are fractal geometries. If we can make realistic looking mountains in a game, why not describe real mountains - say the Alps - with fractals. We can't do that yet, but when Newton was born we couldn't mathematically relate the force of gravity with the orbits of planets. If we could make a fractal mathematically, we should be able to describe the stock market and predict its future values. No one would go broke anymore. If you think going broke is fun, you ought to try it sometime.

Perhaps we could even predict the next values of white noise and therefore generate a set of voltage values that would cancel it out. How would that be as a low noise - no noise - amplifier?

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Shielding With Conductively Coated Plastics

by William D. Kimmel, PE
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In previous articles, we have noted that high frequency shielding effectiveness is primarily limited by the openings and penetrations: the conductivity and thickness of the shielding material plays a less important role. You have to do a very good job of closing these openings and penetrations before the conductivity of the shielding material even becomes a limiting factor.

As such, thin conductive coatings on plastic is becoming increasingly popular for EMI shielding, even showing up in military applications, where shielding demands are quite demanding.

Vacuum Technologies Inc. of Reedsburg, Wisconsin, tasked us to do some comparative shielding effectiveness (SE) tests on coated plastics and to assess the impact of small openings in the coating. So we welcomed the opportunity to get some real test data to validate our position.

Let's take a look at the test results, then discuss methodology of making the shield work – that is, handling the openings and penetrations.

Test Set-up

Common SE testing uses a window in a shield room, with the radiating source on one side of the shield room and the receiving antenna on the other side. The hole is plugged with various shielding samples for comparison.

We tested 12-inch square- coated panels and compared with a solid aluminum panel. The SE of all coated panels are shown relative to the aluminum panel. The panels were bonded to the shield room at the perimeter using good quality EMI gasketing.

The tests show that the SE of the coated panel was almost as good as that of the aluminum sheet. Further, the tests show that small openings had little adverse effect on SE, but that larger holes showed some shielding degradation especially at higher frequencies.

This validates our position that SE is primarily driven by larger openings created by seams and by wires (data and power) penetrating the shield.

We'll start with a comparison of three samples, then continue with a wrap-up.

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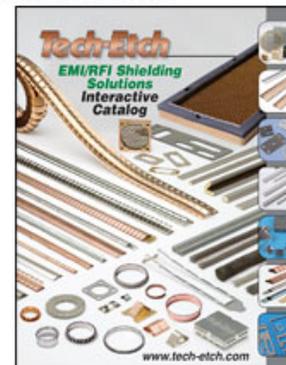
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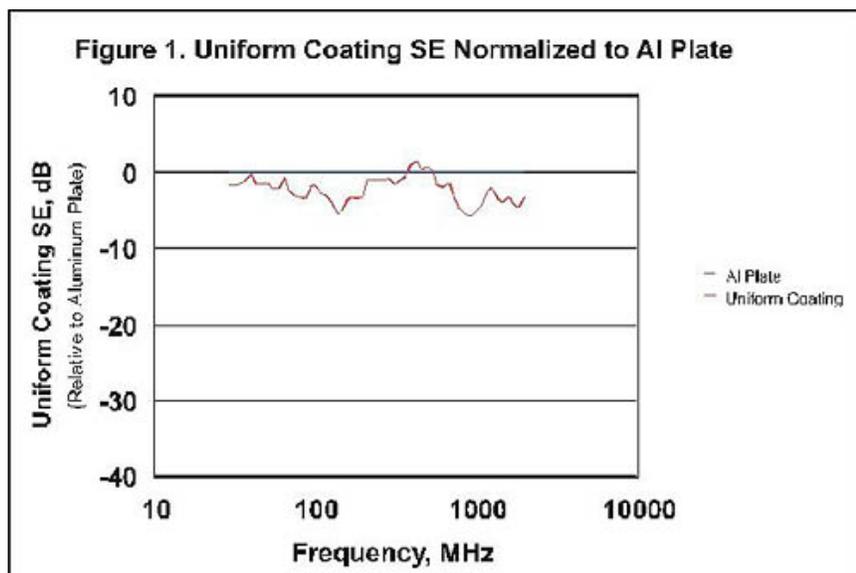
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Tests

The first test compares the SE of a fully coated screen (with no openings) with the aluminum plate (figure 1). The SE of the coated screen is normalized to the aluminum plate (SE of Al plate is shown as "0dB") and the coated screen is shown relative to 0dB. As can be seen, SE of the coated screen nearly as good as that of the Al plate. Since aluminum plate is a very good shield, we can safely say that an aluminum coating will be a very good shield.



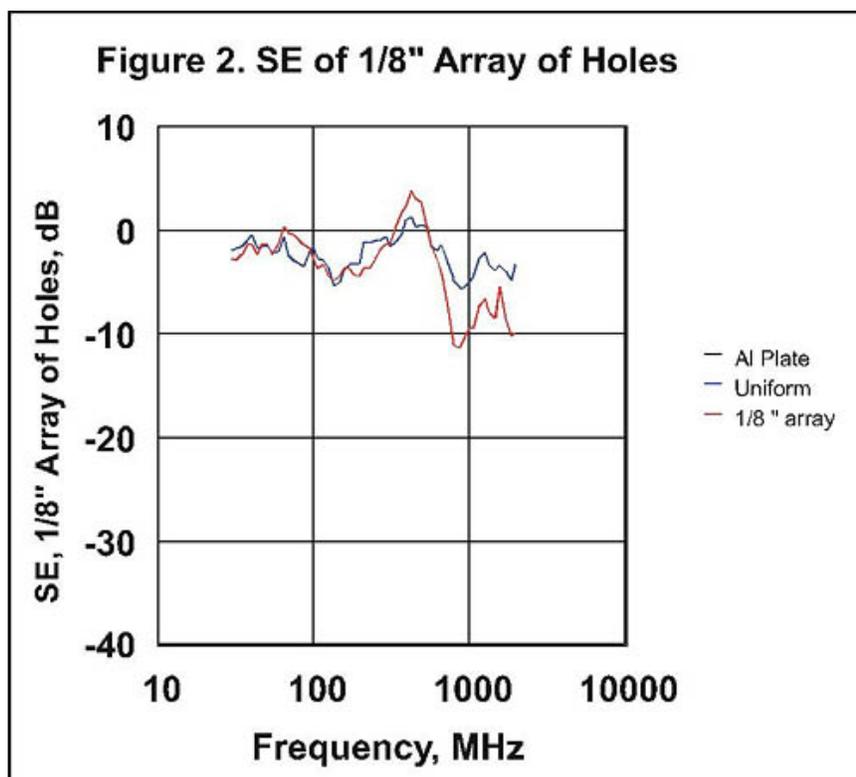
(Note that SE variations with frequency occur to test variations, and are not to be taken as real variations – you need to look at the overall picture.)

The second test places a 10x10 array of 1/8-inch holes and compares with the fully coated sample (figure 2). Such a condition might exist if there were a need for ventilation holes. As can be seen, the SE of the array is not significantly less than that of the uniform panel.

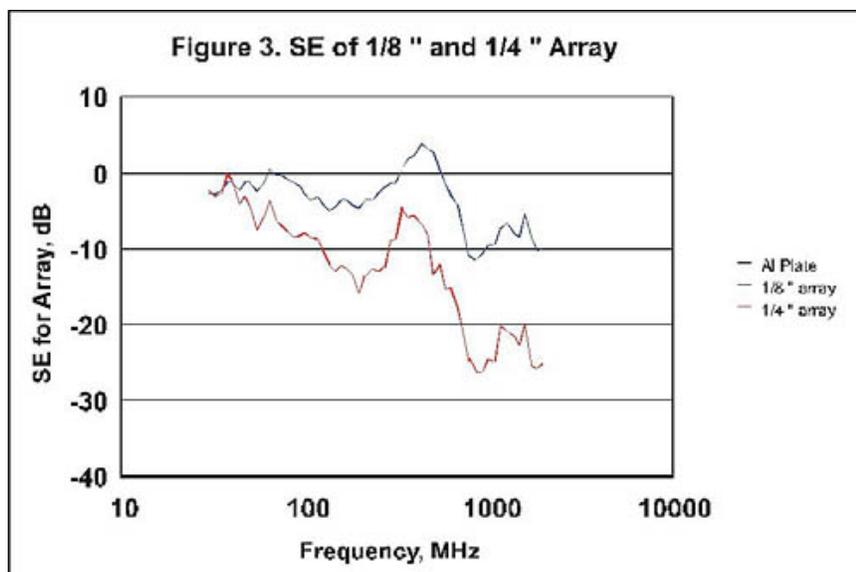
The third test (figure 3) places a 10x10 array of 1/4-inch voids and compares with the similar array of 1/8-inch voids. This shows the SE degrading with larger holes, especially at higher frequencies. Even at lower frequencies, there is some degradation due to the more significant reduction of effective conductivity.

Assessment of Results

Shielding effectiveness of the coatings are very good for all samples other than the one with large holes. While this test doesn't test for absolute SE, we note that SE for aluminum sample is very good, so we are comfortable in saying the Al coating SE should be at least 60dB even at the highest frequency tested, 2GHz. As a general guideline, SE of 30dB is reasonably adequate for most commercial applications, and 60dB or more is generally adequate for harsh military environments. Thus, vacuum plating can be considered for most shielding needs.



Small holes do not tangibly degrade SE at frequencies (we tested up to 2GHz). Thus, there is no reason to be concerned about small openings that may be needed for ventilation or seams or even that may occur during the plating process. Larger holes do result in shielding degradation, especially at the higher frequencies.



Design Guides

In most cases, SE of conductive coating is adequate for even fairly demanding shielding needs. As with metal enclosures, the principle reason for inadequate SE is the wire penetrations and the openings – without full attention to these factors, the shield will be ineffective.

One of the problems with effective shielding using coated plastic is that it has been difficult to effectively close the holes and the penetrations. We have had numerous cases where the mating

surfaces are not conductive – the designer often masked off the coating well back from the seam to make sure none of the coating peaked through to the outside.

This situation has changed, largely driven by the cell phones and other handheld wireless devices, where EMI gasketing is needed. This can be accomplished in several ways, the most common is form-in-place gasketing. In this process, a conductive bead (like a bead of toothpaste) is laid down onto the coated plastic using numerical control, then cured to form a flexible conductive bead.

In order for this to work, the mating surfaces must be rigid enough to withstand the closure forces presented by the gasketing, while still providing continuous closure.

But the biggest problem is the wire penetrations, namely the power entry and data entry. Where high speed data lines require shielded cable, mating the cable shield to the enclosure shield is absolutely critical. Fully circumferential closure is mandatory for demanding shielding requirements – no pigtail terminations allowed. Similarly, where filtering is used, as for power or low speed data, filter mounting must be directly to the enclosure, again, no pigtails allowed. This places special constraints on the mating surfaces.

Summary

Conductively coated plastics have stepped into the shielding mainstream. Shielding effectiveness of even a thin conductive coating of aluminum provides nearly as good a high frequency shield as solid aluminum.

Small holes, as may be needed for ventilation are permitted, but these need to be kept as small a diameter as feasible. Even ¼ inch holes start to leak, especially at higher frequencies.

The big problem with shielding is the openings and penetrations. These problems have been successfully addressed using form-in-place gasketing, good for closing seams and for mating connectors to the shield.

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