IN MY OPINION

IoT Will Change Everything
By David Vye
Business Development Manager ANSYS

The Year 2015 is looking promising for several major opportunities to market and sell microwave components to non-traditional buyers. This is good news as mil/aero budgets for hardware procurement look flat or shift to cyber security spending.
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MILITARY MICROWAVE DIGEST

New Military Microwave Digest

ON THE MARKET

Band Reject Filter Series
Higher frequency band reject (notch) filters are designed to operate over the frequency range of .01 to 28 GHz. These filters are characterized by having the reverse properties of band pass filters and are offered in multiple topologies. Available in compact sizes.
RLC Electronics

SP6T RF Switch
JSW6-33DR+ is a medium power reflective SP6T RF switch, with reflective short on output ports in the off condition. Made using Silicon-on-Insulator process, it has very high IP3, a built-in CMOS driver and negative voltage generator.
Mini-Circuits

Group Delay Equalized Bandpass Filter
Part number 2903 is a group delayed equalized elliptic type bandpass filter that has a typical 1 dB bandwidth of 94 MHz and a typical 60 dB bandwidth of 171 MHz. Insertion loss is <2 dB and group delay variation from 110 to 170 MHz is <3nsec.
KR Electronics

Absorptive Low Pass Filter
Model AF9350 is a

FEATURED ARTICLE »

April 2013

Bi-Directional Amplifier Extends Range of Data, Video, and Communications Links

By Steve Barthelmes, Dean Handrinos, Triad RF Systems, Inc.

There are a large number of commercial and military data links and other communications applications in which the ability to "bolt on" additional RF output power to a low-powered transceiver while increasing its receive performance can dramatically expand the host system's range. Examples include remotely-controlled mobile robots that search disaster sites (or a building suspected of housing the enemy), small UAVs increasingly used for police surveillance and various non-law enforcement scenarios, and enterprise voice, data, and video surveillance or communications networks that need to serve a larger area than when they were installed. In general, any communications link can benefit from such a cost-effective solution. To serve these applications, Triad RF Systems has introduced the Model TTRM1010 bi-directional amplifier module (**Figure 1**) that delivers 5 W (+37 dBm) from 30 MHz to 3 GHz in a compact, rugged enclosure measuring only 3.25 x 2 x 1 in.

Figure 1: The TTRM1010 bi-directional amplifier delivers up to 5 W from 30 MHz to 3 GHz and measures only 3.25 x 2 x 1 in.

The TTRM1010 is best defined by what it is not — a consumer-grade "BDA" that many people use as a cheap way to increase the performance of wireless-enabled devices inside their homes. While many of these products are well made, they are not suitable for operating in the environmental conditions typically encountered in unmanned vehicle applications. Further, these mass-market devices are typically not available in frequency bands other than those used by commercial telecommunications operators. The TTRM1010 contains numerous features that benefit military and high-end commercial users. These features include high-performance transmit and receive sections, high-speed switching, and a power supply with a wide input voltage range of +9 to +30 VDC (**Figure 2**).

The module is constructed with the RF transmit section on the top side of a multi-layer board and the receive section on the bottom side to provide isolation between the two. The wide-input-range DC supply is housed in its own section that sits on top of the RF portion. This modular approach allows a number of solid-state power amplifier models to share a common DC supply board. The transmitter employs a GaAs MMIC-based amplifier line-up, and the receive section achieves a noise figure of 4 dB. The result is a module with performance equally suited for commercial and military applications that can be specified for indoor or outdoor use and operates over a temperature range of -20º C to +85º C and an altitude up to 30,000 ft.

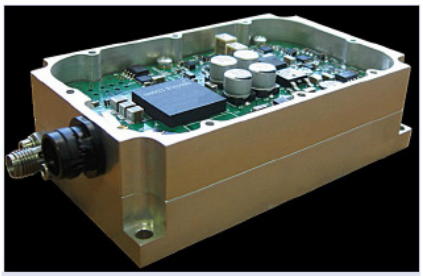

Figure 2: The DC supply board allows a wide input voltage range.

An Application Example
In a UGV application (**Figure 3**), a TTRM1010 can be integrated between the transceiver and the antenna on both the control station and on the robot's transceiver. These transceivers' radio cards often have low RF output power that limits their range and sometimes their performance within that range. The substantial increase in power provided by the TTRM1010 can significantly extend this range while the improved receiver performance helps ensure return path sensitivity matches

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FROM WHERE WE SIT

Will OpenRFM Shake Up the Microwave Industry?
By Barry Manz

Throughout the history of the RF and microwave industry there has never been a form factor standardizing the electromechanical, software, control plane, and thermal interfaces used by integrated microwave assemblies (IMAs) employed in defense systems. Rather, every system has been built to meet the requirements of a specific system, which may be but probably isn't compatible with any other system. It's simply the way the industry has always responded to requests from subcontractors that in turn must meet the physical, electrical, and RF requirements of prime contractors.
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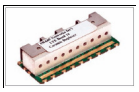
UHF, low pass filter that covers the 10 to 500 MHz band and has an average power rating of 400W CW. It incurs a rejection of 45 dB minimum at the 750 to 3000 MHz band, and power rating of 25W CW from 501 to 5000 MHz.
Werlatone



LTE Band 14 Ceramic Duplexer
This high performance LTE ceramic duplexer was designed and built for use in public safety communication and commercial cellular applications. It operates in Band 14 and offers low insertion loss and high isolation to enable clear communications in the LTE network.
Networks International

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the extended range of the transmit path.

In cases in which an amplifier cannot be utilized at both ends of the RF link, a directional antenna in conjunction with a single TTRM1010 can be used at the control site to enhance performance. Link budget gains can still be achieved in this case, as the front end of the TTRM1010's LNA section often has a lower noise figure than the transceiver's receive chain. The same scenario can be applied to unmanned sea or air-based platforms.

One of the key advantages of the TTRM1010 is its broad range of operating frequencies. Many systems operate in the Industrial, Scientific, and Medical (ISM) bands and the TTRM1010 operates on these widely-used frequencies. Other systems, especially those used by the Department of Defense, operate at other frequencies accommodated by the TTRM1010 as well, and still others operate in bands allocated for use in applications such as port surveillance, many of which the TTRM1010 also supports. The ability to operate from HF through S-band also allows a single TTRM1010 to accommodate system changes or to be used in different systems within an organization.

The transmit section of the TTRM1010 has a typical Third Order Intercept Point (OIP3) of 47 dBm, gain of 23 dB +/-1 dB, and typical harmonic and spurious signal rejection of -60 dBc, providing a very linear RF signal from the transmitter. The receive section has gain of 20 dB +/-1.5 dB. Switching time from transmit to receive is less than 2 µs, and typical return loss of both sections ranges from -14 to -16 dB. The module is switched to transmit or receive states via a TTL input, and an analog voltage output is provided for temperature monitoring.

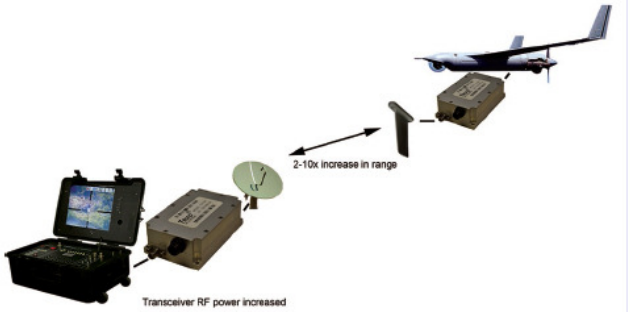

Figure 3: A typical scenario in which the TTRM1010 is employed to extend the range of an Unmanned Aerial Vehicle, (UAV) or Unmanned Ground Vehicle (UGV).

One of the most common problems faced by amplifier manufacturers is units that have been returned for repair resulting from damage by use of an out-of-range or reversed supply voltage. These kinds of returns can easily be prevented, avoiding repair costs and down time for both the customer and supplier. The TTRM1010 (and all of Triad RF Systems' amplifier products) solves this problem by using a circuit that shuts down the amplifier and protects sensitive components when the input voltage is too high, too low, or reversed This protection is active during initial turn on and when the amplifier is in operation.

Model	TTRM1010	TTRM1006	TTRM1001	TTRM1002	TTRM1003	TTRM1004	TTRM1005	TTRM1007
Frequency Range (MHz)	20 to 2500	30 to 3000	902 to 928	1650 to 1750	1930 to 1990	2400 to 2500	3300 to 3500	4800 to 4900
Power output (W, Linear/Peak)	4/20	1/5	5/20	5/20	5/20	5/20	4/20	4/20
Maximum input power (dBm)	+10	+28						
Return loss (dB)	-16	-12						
Switching speed (µs)	<2 (1 typical)							
Transmit gain (dB)	20	23	20					
Receive gain (dB)	20							
Noise figure (dB)	4	4	2.5					
Operating Temp. (°C)	-20 to +85	-30 to +80	-40 to +80					
Max. altitude (ft.)	30,000							
Supply Voltage /Current	9 to 36/600 (Tx) 200 (Rx)	+28/900 (Tx) 150 (Rx)						

While the TTRM1010 operates from a supply voltage as low as +9 VDC and as high as +30 VDC, during testing it has been exposed to a reversed input voltage as high as 50 VDC without damage. The amplifier is also protected against over-temperature conditions. The TTRM1010 is the latest member of the company's bi-directional amplifier product line, which includes the TTRM1006 (1 W or 5 W, 20 MHz to 2.5 GHz) and narrowband models designed for specific applications. Detailed specifications are shown in **Table 1**. All models can be weatherized and many parameters can be varied to meet specific customer requirements. More information is available at www.triadrf.com or 1-(855) 558-1001.

TRIAD RF SYSTEMS, INC.

www.triadrf.com
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