26th ANNIVERSARY MPD MICROWAVE PRODUCT DIGEST

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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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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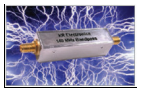
CURRENT ISSUE PRODUCTS

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

FEATURED ARTICLE »

January 2008

Considerations when Selecting COTS WLAN Products for Military Systems

By Dean Handrinos, Stealth Microwave

Commercial off-the-Shelf (COTS) Wireless Networking products and protocols have recently experienced increased usage in some military end-use RF systems. Their utilization spans a number of applications which include wireless networking and point-to-point data transmission in UAVs, UGVs, and various other products.

The SMTR2425-11B40 is an SSPA intended for systems designed for military use based on 802.11b radio systems.

System designers are finding radios based on 802.11 and similar standards good candidates for projects that require a quickly available, high performance solution for prototype and/or production radio link designs. Many factors contribute to their appeal. The widespread availability of 802.11 radio cards from a variety of vendors has promoted their low cost and a variety of available features, and many offer them at different levels of integration. Chipsets with baseband outputs enable the use of 802.11 radios at non-ISM frequency bands once the appropriate ancillary hardware is integrated, and a card with all the RF components built in facilitates getting a link up and running as quickly as possible. In addition, the data-rate performance of most 802.11 products is sufficient for most throughput-intensive applications, provides an adequate level of interference resistance (more apparent in 802.11a/g) and in some cases, is comparable in both of these categories to legacy tactical digital information links now in use.

Our aim is to provide the RF system integrator a few things to consider when it comes to COTS WLAN radio and RF SSPA selection. In particular, we will focus on what needs to be addressed when an off-the-shelf radio product with an RF output is paired with a bi-directional SSPA designed for 802.11 applications for a long range link. The information provided has been drawn from our customers' experience in this area and various projects where we've been tasked to provide a bi-directional SSPA to meet their needs.

Radio Selection

Many of the specifications outlined by a radio card's data sheet provide adequate insight as to whether or not the product is acceptable for use based on the general requirements of the system. However, when it comes to the maximum range spec of the radio some caution needs to be observed. Most commercial grade 802.11 products are designed for a maximum range of a few hundred meters. Some assume that this is a limitation of the RF output power of the card itself and that the solution is to amplify the card's output to a level that will satisfy their link budget calculations. In most instances this is not the case. A number of default timing parameter settings in commercial 802.11 hardware impose a range limit of only a few miles no matter how much amplification is present. A paper containing information concerning this topic is available at the following location: "http://c3lab.poliba.it/images/7/71/Optimization.pdf". As a result, it is important to find a radio card vendor that can carry out the specific modifications needed to make long range operation possible. As these changes deviate from how IEEE 802.11 standards have been defined, compatibility with IEEE 802.11 compliant cards may be affected. Therefore, any radios used in the system should be configured identically.

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MILITARY MICROWAVE DIGEST

New Military Microwave Digest

WHITE PAPERS

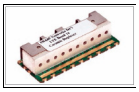
·The Design of Ultra Narrowband Amplifiers Using Small-Signal Varactor Upconverters
This paper presents a method of realizing tunable microwave amplifiers with ultra narrow bandwidths that can be less than 0.5% by the use of a varactor up-converter (UC).
Planar Monolithics

·Directivity and VSWR Measurements
Return loss and VSWR measurements are complicated by the finite performance of the directional device used to measure the reflected power. The only accurate and convenient way to make return loss measurements is with a well matched high directivity directional coupler or bridge.
Marki Microwave

·Switch Solutions for Systems with Low PIM Requirements
Dow-Key Microwave has invested in R&D for new RF switch products designed specifically to reduce intermodulation (IM) in coaxial switches.
Dow-Key Microwave

delay variation from 110 to 170 MHz is <3nsec.
KR Electronics

Absorptive Low Pass Filter
Model AF9350 is a 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

See all products in this issue

Performance Measurements - 10 Watt Bi-Directional SMTR2425-11B40 vs. competitive WLAN SSPA 10W product claimed to be suitable for military use.

Specifications	Other 10W SSPA	SMTR2425
802.11b Mean Power Out (11Mbps, Claimed / Measured)	40 dBm / 38.6 dBm	40 dBm / 40.8 dBm
Burst EVM @ Measured Power	9.6%	5.9%
Capable of CW operation if necessary?	No	Yes

SSPA Selection
Once a radio manufacturer has been selected and a link budget calculated, a minimum set of RF requirements will have been identified in terms of average power output, gain, noise figure, EVM, and spectral mask performance, among others. A bi-directional SSPA that conforms to these specs is now required. Searching Google for “802.11 amplifiers” will lead you to a large number of manufacturers that claim to design and manufacture high power WLAN amplifiers that can be used in military applications. Out of this group, only a select few can actually demonstrate the performance indicated on their spec sheets. Many manufacturers’ products fail to meet even basic power output claims, which as a result cause the systems they are used in to under-perform. It is absolutely necessary that the performance numbers of the amplifier be checked by either obtaining verifiable test data from the manufacturer or via in-house testing. Thoughtful evaluation of potential suppliers and products at this point will save a lot of difficulty in the long run.

Conclusion
Using 802.11 WLAN technology is a low cost, effective means of providing robust, relatively high bandwidth data transmission for some military applications. However, a careful evaluation of the components being considered for use is needed to mitigate system performance risks, as gray areas or falsities exist in some product specifications. In most cases, this occurs because the manufacturer serves the commercial sector and does not understand or has the means to test for certain specs. With regard to the SSPA, we have independently tested a number of bi-directional WLAN SSPA products and have found that measured performance did not match specified performance in some cases. It has prompted us, as a manufacturer of WLAN bi-directional amplifiers, to ensure that our products meet or exceed the requirements of the military wireless system designer.

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- **How to Specify RF and Microwave Filters**
Covers cavity, ceramic, LC, crystal and helical filters.
Anatech Electronics

- **Mounting Considerations for Medium Power Surface-Mount RF Devices**
Covers all factors that must be considered when mounting SMT devices.
TriQuint Semiconductor

- **Biasing MMIC Amplifiers**
How to bias MMICs along with theory and techniques.
Mini-Circuits