

# EXECUTIVE SPOTLIGHT: GREG HENDERSON



## Microwave Product Digest: View from the Top

**MPD: If your company serves the defense market, which application or applications do you believe will be the most lucrative from an RF and microwave standpoint in the coming year?**

**HENDERSON:** We anticipate the overall defense market to have moderate growth next year—in the range of a few percentage points—but the electronics content within that market segment will be growing faster, and the RF and microwave components within that electronics content will grow even faster still. One of the major applications driving this growth is phased arrays for both radar and communications applications, which are enabling higher resolution, range, and throughput at reduced power consumption and size.

Compared to more traditional architectures, phased arrays have significantly higher RF and microwave content, and Analog Devices has a broad portfolio of solutions to meet these needs. This is true at the individual component level, where we provide a complete phased array signal chain from the data converter all the way up to the antenna. In addition, the market is moving to more highly integrated solutions and Analog Devices is developing monolithically integrated phased array chips that will significantly reduce the system complexity for our customers. These integrated solutions in particular are pretty exciting, because they are allowing for phased arrays with much smaller footprints—due to a measurable reduction in size, weight, and power (SWaP).

**MPD: What emerging commercial application or applications of RF and microwave technology do you believe will begin to deliver a respectable amount of revenue for the industry in 2016?**

**HENDERSON:** The rollout out of 4G and advanced 4G LTE standards is still a growth area worldwide. Today 4G networks only cover about 10% of the cellular population. Continued 4G rollout will drive volume in the RF market over the next year. In addition, as the existing networks pursue densification and capacity expansion, there is a trend toward high antenna count MIMO systems—which results in expanded RF content.



*Greg Henderson*

The related LTE backhaul requirements are another opportunity for microwave market growth. One of the emerging markets that we expect to grow significantly in the next year is E-band backhaul. As operators roll out higher speed networks in regions without fiber access, E-band (operating from 70 GHz to 80 GHz) is the only licensed band that can provide greater than 1 Gbps wireless backhaul. We have been seeing a significant ramp in E-band volume over the last few quarters and expect that to continue in 2016.

Another area of growth for RF and microwave is in the instrumentation and test and measurement market. The emergence of high frequency applications like phased array, E-band backhaul, and emerging 5G technology development is driving a robust market for high frequency, high performance test equipment. Analog Devices has a strong partnership with a number of test and measurement companies to develop new products that are enabling the next generation of high performance test equipment, and we expect to continue to see positive growth in this area over the next few years.

## MPD: Referring to the defense market again, is your company experiencing any effects from DoD's Better Buying Power 3.0 and open RF architecture initiatives?

**HENDERSON:** Analog Devices has a 50 year history of providing innovation and technology as a trusted partner to the U.S. government through its research labs and prime contractors. The DoD's Better Buying Power 3.0 initiative will further strengthen this collaborative bond of technology invention. Analog Devices sees the open RF architecture initiative as a benefit to the industry—as it is providing more commonality and leverage in the defense market. This will benefit the government by speeding product time to market, reducing NRE development costs, and lower recurring costs through competition. Analog Devices is seeing opportunity to provide solutions for sockets and subsystems that we may not have had access to before.

## MPD: Is the recent downturn in China's economic activity affecting your business, and/or do you think it will in 2016?

**HENDERSON:** China has driven a large amount of the LTE rollout, and there was a slowdown in that market in the summer time frame, but we've started to see improvement in those market conditions and in our business to equipment providers that serve that market. The LTE rollout in China is still only at about 25%, so there's still a large opportunity over the next few years. The other thing to note is that many of the equipment providers in China are building product to export to other regions, like India, Africa, Europe, and the Americas. So although we have some caution, because of the fundamentals of the LTE rollout, we expect we will continue to see positive growth in China over the next few years.

## MPD: Do you believe that emerging machine-to-machine communications (that is, IoT) will have a major positive impact on the RF and microwave industry in 2016?

**HENDERSON:** We believe the explosive growth forecast for “connected things” will have a major positive impact on the RF and microwave industry in the coming years, significantly increasing the demand for RF and microwave devices and bringing many opportunities to innovate on communication network technologies. Forecasts for connected objects vary from \$30 billion to \$50 billion in the next decade, the vast majority of which will connect back to the cloud using RF and microwave frequencies.

These devices will have widely diverging operation modes spanning extremely high data rate, short ranges where the devices are in a constant communication modes, to very low data rate, long range, “sleepy” devices that may go months or years without communicating. Many of these sensor nodes will also be self-powered through batteries or energy harvesters, so making the node electronics and network as efficient as possible will be critical.

There will also be a need for many IoT use cases to have as much intelligence and processing at the sensor node as possible; for example, in applications where very high latency is needed. All of these diverging requirements will place major importance on the communication networks needed to transport the intelligence from the sensor to the cloud and hence the technology and volume requirements on the RF and microwave industry will increase significantly.

## About the Author

Dr. Greg Henderson is Vice President of the RF and Microwave business unit of Analog Devices. In this role, Dr. Henderson is responsible for the creation and execution of Analog Devices' strategy for the full suite of RF and microwave products and solutions.

Dr. Henderson has served in leadership roles in the microwave, semiconductor, and wireless communications industry for more than 20 years. Most recently, Dr. Henderson served as Vice President of the RF and Microwave business unit of Hittite Microwave Corporation—prior to the acquisition by Analog Devices. From 2009 to 2013, Dr. Henderson served as the director of broadband products and later as the director of product management, for the Public Safety and Professional Communications Division of Harris Corporation. Prior to Harris Corporation, Dr. Henderson held various management and R&D/product development positions at TriQuint Semiconductor, IBM, and M/A-COM.

Dr. Henderson earned a B.S. in electrical engineering from Texas Tech University and was granted a Ph.D. in electrical engineering from the Georgia Institute of Technology. He holds seven patents in wireless communications and semiconductor technologies and has published over 20 conference and journal papers.

### Analog Devices, Inc. Worldwide Headquarters

Analog Devices, Inc.  
One Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
U.S.A.  
Tel: 781.329.4700  
(800.262.5643, U.S.A. only)  
Fax: 781.461.3113

### Analog Devices, Inc. Europe Headquarters

Analog Devices, Inc.  
Wilhelm-Wagenfeld-Str. 6  
80807 Munich  
Germany  
Tel: 49.89.76903.0  
Fax: 49.89.76903.157

### Analog Devices, Inc. Japan Headquarters

Analog Devices, KK  
New Pier Takeshiba  
South Tower Building  
1-16-1 Kaigan, Minato-ku,  
Tokyo, 105-6891  
Japan  
Tel: 813.5402.8200  
Fax: 813.5402.1064

### Analog Devices, Inc. Asia Pacific Headquarters

Analog Devices  
5F, Sandhill Plaza  
2290 Zuchongzhi Road  
Zhangjiang Hi-Tech Park  
Pudong New District  
Shanghai, China 201203  
Tel: 86.21.2320.8000  
Fax: 86.21.2320.8222

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