

# Microwave and fiber drive future of wireless backhaul

*Technologies required for 4G wireless networks that will generate massive amounts of traffic*

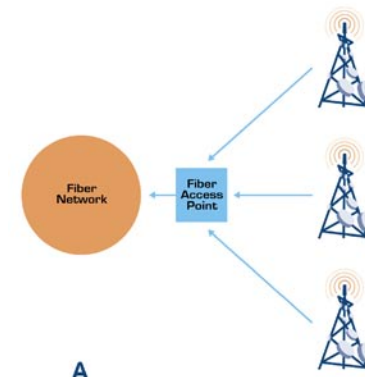
BY MARK W. ANDREWS  
TriQuint Semiconductor  
Orlando, FL  
www.triquint.com

The “wireless revolution,” which began in the U.S. around 1984, has indeed lived up to its name. Generally speaking, the first wireless generation created the industry, the second replaced analog with digital transmission, and the third made broadband wireless data communications a reality.

The fourth-generation will make it possible for anyone who can afford a \$200 smart phone and a monthly service tab to have the same speed and bandwidth of wired services — anywhere. It will be great for consumers, and wireless carriers — and advertisers too. That is, it will be great if carriers can solve two of the most vexing challenges they have ever faced: handling massively expanding network traffic and ensuring it can be sent to and from their cell sites to their network hubs via “backhaul.” To meet the challenge will rely on fiber-optic networks, microwave, and millimeter-wave links.

In the U.S., backhaul is often implemented via T1 lines using TDM, which is wholly inadequate to handle the truly massive amounts of data that “4G” networks will generate. In addition, WiMAX and LTE networks are the first to be based on the Internet Protocol (IP), for which T1 lines are ill suited.

Optical and microwave/millimeter-wave links are two most viable solutions to replace them. Fiber-optic networks offer extraordinary traffic-carrying capacity, but only about 15% of cell sites in the U.S. have access to a fiber-optic node. In rural areas, fiber networks may not be available for many years, which



makes microwave point-to-point and point-to-multipoint links extremely appealing.

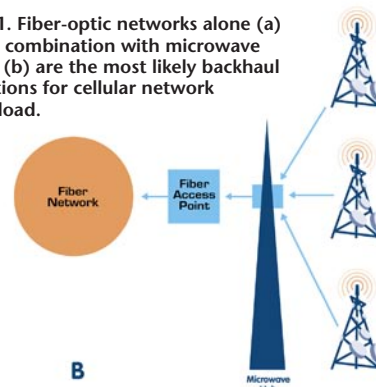
## Microwave backhaul

Microwave systems may not have the “sky’s the limit” bandwidth of fiber, but they can deliver very high throughput, are easy to install, cost-effective to maintain, are extremely reliable, and their performance is continuously improving. Where a cell site can access a fiber node, it will most certainly use it. When this is not possible, microwave and millimeter-wave radios will get the signals from the tower to the nearest point where fiber is available. In other situations, microwave or millimeter-wave links may provide the entire solution. The two most likely scenarios are shown in Fig. 1.

The backhaul technology candidates both require microwave technology as one of their fundamental components. Fiber-based systems employ optical modulator drivers that are in fact high-performance microwave amplifiers. Microwave and millimeter-wave alternatives require the full gamut of RF-based technologies, from discrete devices to multifunction MMICs.

Semiconductor companies are de-

Fig. 1. Fiber-optic networks alone (a) or in combination with microwave links (b) are the most likely backhaul solutions for cellular network overload.



veloping a complete range of backhaul radio components supporting all licensed bands to at least 42 GHz with high output power and efficient linearity. Industry-standard SMT packages for these devices facilitate easier handling and automated assembly.

Two examples of RF power amplifiers are TriQuint’s devices built on a power GaAs pHEMT process (see Fig. 2). The TGA2533-SM operates from 12.5 to 15.5 GHz with P1dB output power of 33 dBm (2 W), has 27 dB of gain, and a third-order intercept point of 43 dBm. The device is packaged in a 5 x 5 x 0.85-mm 24-lead QFN. The TGA4532-SM operates from 17.7 to 19.7 GHz with P1dB output power of 31 dBm (1.3 W), and has gain of 23 dB and a third-order intercept

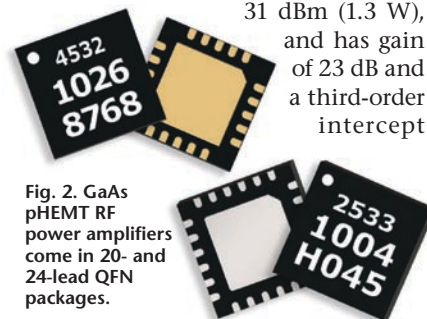


Fig. 2. GaAs pHEMT RF power amplifiers come in 20- and 24-lead QFN packages.

point of 41 dBm. It is housed in a 20-lead 4 x 4-mm QFN package. Both devices have an integrated power detector for monitoring.