



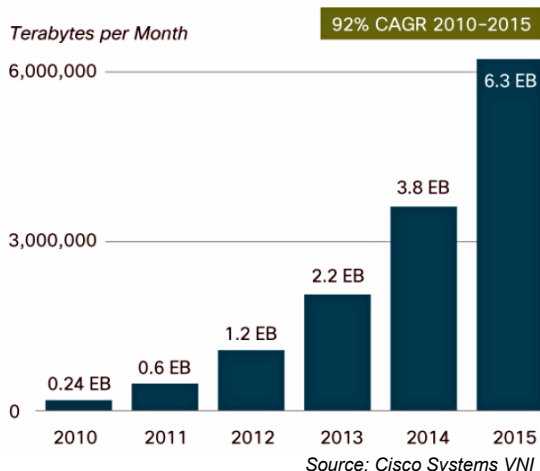
## The Importance of Filters in Point-to-Point Microwave Cellular Backhaul Networks

Backhaul is the unseen part of every wireless system, yet it is every bit as important as the "front end" portion that everyone sees. In the US, wireless backhaul has been performed using T-1 lines, as they were adequate for handling the levels of voice traffic on the network.

However, thanks to 3G and the massive upsurge in data traffic it produces they are rapidly becoming obsolete. The emergence of 4G networks is further increasing this traffic load. T1s are not only inadequate for handling this traffic volume but incompatible with IP-based transmission schemes as well. There are two basic technologies that will replace them: microwave point-to-point links and fiber optics.

Although microwave links are used in more than 70% of installations throughout Europe and 50% globally, they are rarely used in the US. However, this is projected to change rapidly as point-to-point links provide an excellent solution for backhaul, especially in the and almost 80% of cases where fiber nodes are not available at the cell site.

Filters are an essential components of every microwave link as they keep interference in check as they do and all wireless networks. They are typically bandpass filters that with sharp rejection characteristics, but other filter types are used as well.



### Backhaul: A Massive Challenge

The challenge for wireless carriers is driven home graphically by statistics kept by the Cisco Virtual Networking Index (VNI), which tracks the amount of data generated by wired and wireless devices on the Internet. The numbers are almost astronomical -- and growing fast.

Cisco's latest VNI estimates data traffic generated only from mobile devices will increase 26-fold by 2015 at a compound annual growth rate of 92%, reaching 6.3 exabytes per month by 2015. An exabyte is 1 million terabytes or 1 billion gigabytes. In 2010 the amount of worldwide data traffic exceeded global voice traffic and mobile network connection speeds are predicted to increase 10-fold by 2015 and two thirds of it will be video.





## The Importance of Filters in Point-to-Point Microwave Cellular Backhaul Networks

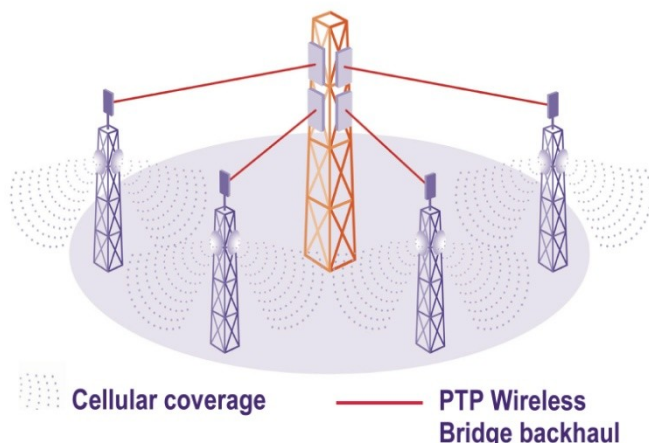
To satisfy this massive backhaul demand (and to maintain high data rates without holes in coverage), wireless carriers are adding large numbers of micro and pico cells to fill in the gaps in conjunction with traditional macro cells.

These smaller base stations have their own backhaul requirements that are different from those of macro cells as they tend to be mounted on utility poles, buildings, or other structures.

A variety of solutions are being offered ranging from the hybrid fiber coax “plant” of Multiple System Operators (MSOs) of cable systems to products that can offload traffic from these smaller sites into the wired infrastructure.

One solution even uses IEEE 802.11n (WiFi) at 5 GHz as a point-to-point or meshed point-to-multipoint solution to deliver more than 100 Mb/s of backhaul capacity over surprisingly long distances by using “smart” high-gain antennas, beamforming, and other techniques.

However, tradition point-to-point microwave links provide the most viable overall alternative. Microwave bands from 3.5 through 86 GHz are allocated for this service and while the lower-frequency allocations have narrower channel bandwidths they can achieve data rates of several gigabits per second.



Higher frequency allocations have wider channels that enable higher data rates but cover shorter distances per “hop”, are more susceptible to disruption from precipitation, and are currently more expensive.

Nevertheless, short installation times, low initial and maintenance costs, high reliability, and low maintenance make all microwave solutions very appealing.

### So How About Filters?

Filters will be required in all of these microwave systems to reduce interference to other services operating near their frequencies and the cellular systems they serve. They range from higher power cavity bandpass filters to LC lowpass and highpass filters placed before and after the system components as well as within them along with low-loss duplexers to distribute the signals.





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For example, backhaul transmit and receive bands are reversed at a hub in contrast to cellular transmit and receive bands. As cellular and backhaul antennas are located close together the potential for interference is high.

Using the interference to uplink cellular reception caused by backhaul transmission (which is similar to downlink interference to backhaul reception) as an example, backhaul signals can degrade cellular base station receiver sensitivity by generating noise in the cellular uplink channel, even though they are outside the backhaul channel, via images or intermodulation distortion.

In addition, quantization noise is created when the interfering signal level is high enough to require gain compression to prevent clipping. The resulting reduced dynamic range increases quantization noise, desensitizing the receiver front end.



*Anatech Electronics duplexers are fundamental elements in many point-to-point microwave systems.*



*Anatech Electronics bandpass filters for backhaul systems are weatherized for outdoor mounting.*

As is the case with all co-located wireless communication systems, there are two basic ways to solve these problems.

The first is to reduce the backhaul signals to levels low enough to accommodate the cellular receiver or receivers and to use bandpass filters with steep rejection characteristics to remove any signals outside of bands limits.

The second solution is to locate backhaul and cellular antennas is far from each other as possible. There are other more complex solutions that for example use separate frequency subbands for the backhaul and cellular signals and then use the backhaul radio's duplexer to provide the crew required filtering.





## **The Importance of Filters in Point-to-Point Microwave Cellular Backhaul Networks**

### **Solutions from Anatech Electronics**

Anatech Electronics has been designing and manufacturing filtering solutions for wireless communications systems for more than 20 years.

As a result we have developed a broad line of standard solutions that cover frequencies from HF well into the millimeter-wave range which is the domain of all microwave point-to-point links.

These filters have extremely steep rejection characteristics which allow separation of the backhaul and cellular frequencies and are well suited for both indoor applications as well as installation in outdoor locations where they will be subject to hostile environmental conditions.

All of these product types are available at cellular frequencies as well as the 3.5 GHz region in which most backhaul systems operate, and custom designs can cover much higher frequencies as well.

The company's cavity bandpass filters range from low-power models to those handling very high-power even at higher frequencies. Low pass filters, both standard and custom models, are available to solve specific problems and remove signals either above or below the frequency of interest. Anatech's duplexers have equally high performance, and can also be provided in highly weatherproof enclosures.

**For filters and filter-based products  
Anatech Electronics should be your supplier of choice.**

Please contact us with your technical questions and design requirements.  
Click our logo, send us an [e-mail](#), or call us today.



For standard and semi-custom products, click the logo to visit our Web store!

