

Application Note

License-Exempt Gigabit Ethernet Microwave Radio Applications

Applicable Products: EX-5r GigE, EX-5r-c GigE

Introduction

The accelerated growth of fixed and mobile wireless broadband services and applications has created unprecedented challenges for telecommunications networks worldwide. Whether broadband services are accessed via 3G cellular, campus network, point-to-multipoint, WiMAX or municipal Wi-Fi Mesh, subscriber traffic needs to be transported back to the core network so that services such as voice and Internet access can be successfully delivered to the user at an acceptable quality level. The tremendous growth in voice and data use is placing greater demands than ever on the world's backhaul infrastructure. This application note examines the need for and applications of Exalt's Gigabit Ethernet-capable license-exempt microwave radios.

Scenarios

Service provider and enterprise applications alike demand high capacity connectivity to support high speed wireless access, fiber access or both. Increasingly, organizations are looking to microwave radio to meet their backhaul and interconnect needs. The reasons for this are simple enough: microwave networks offer a lower total cost of ownership than leased lines with the advantage becoming more pronounced as capacity requirements increase. Among microwave alternatives, license-exempt radios offer a high degree of flexibility and rapid time to deployment; virtually any application demanding high throughput and Gigabit Ethernet connectivity can be well served by a license-exempt microwave radio system. Several examples are described below.

High Speed Campus and Remote Connectivity

Exalt GigE radio systems provide enterprise IT managers with an ultra-reliable, cost-effective tool for transporting between campus buildings and geographically dispersed sites the data associated with ever more bandwidth-intensive applications. Such applications include voice, LAN access, video conferencing, distributed database access and data center backup. Figure 1 depicts an example of such a campus and distributed office environment.

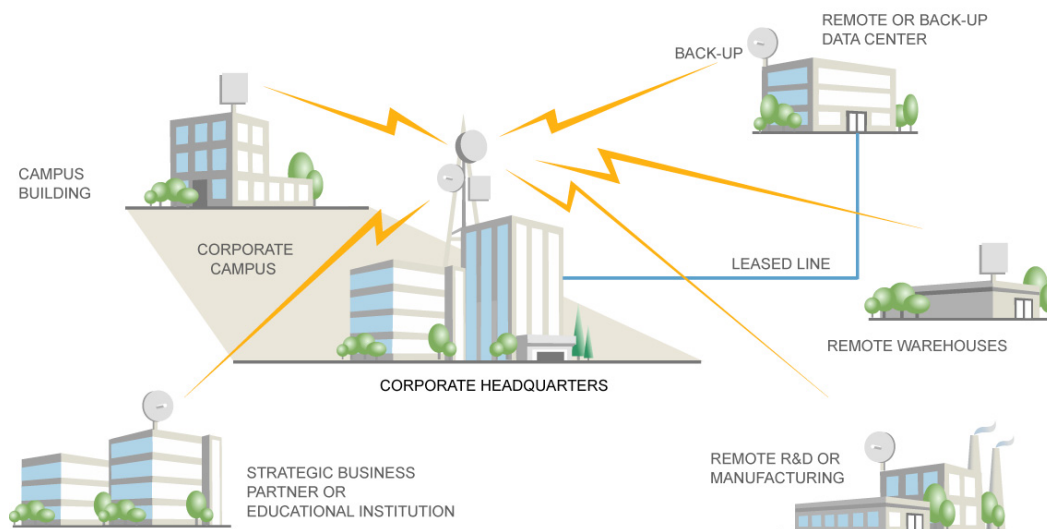


Figure 1 – Campus and distributed office environment

In addition to the high throughput available, Exalt's GigE radios allow IT managers to meet the highest security requirements by offering both AES encryption up to 256 bits, VLAN support with 802.1Q and QoS with 802.1p. By using hardware-based encryption, the GigE radio systems deliver the designed user throughput (up to 440Mbps), regardless of encryption level, ensuring that expected traffic loads can be accommodated under

any encryption scenario.

By making use of Exalt's embedded 802.1Q capability, IT departments can create or extend VLANs across the entire enterprise, thus further supporting security and performance requirements of individual departments. The embedded 802.1p QoS capability allows for the prioritization of high priority services. The GigE family also includes space diversity, providing the ability to establish high availability links over long paths.

3G Mobile Backhaul with 4G Migration

As wireless network capacity demands increase, mobile operators are seeking ways to quickly and easily upgrade base station backhaul capacity while maintaining latency performance and failover capability. Exalt's license-exempt GigE radio systems have been designed to offer the same low latency performance and five 9s availability associated with licensed band systems. These capabilities, along with space diversity and high capacity make the GigE radios ideally suited to cellular last hop and aggregation site applications, as shown in Figure 3.

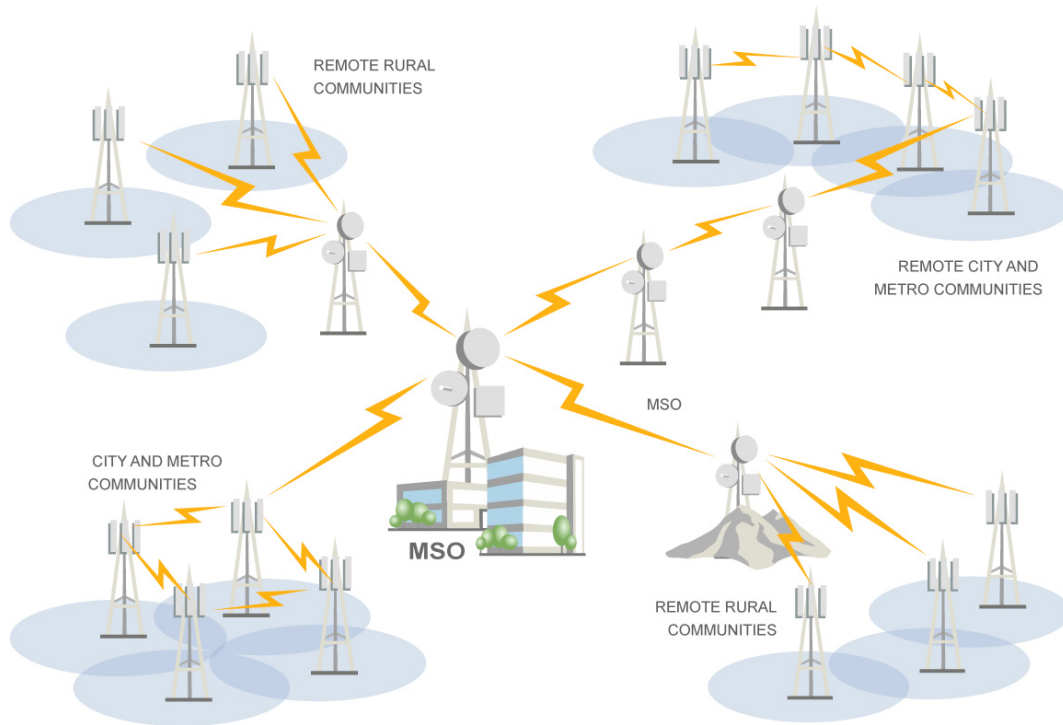


Figure 2 – 3G cellular network with 5 GHz microwave backhaul

In many cases, 3G network microwave backhaul decisions are made with an eye towards 4G requirements, notably the need to migrate from an all or mostly TDM architecture to an all-IP architecture. Though this transition may take ten years or more, Exalt GigE radio systems are designed to accommodate any combination of TDM and Ethernet traffic and both transport mechanisms are supported in their native formats. Thus, a single radio can support any current or future combination of traffic up to 440 Mbps.

By carrying TDM and Ethernet traffic in their native formats, the GigE radios ensure that all available bandwidth is dedicated to carrying user traffic, not overhead, thus eliminating the need to over-engineer the network. Similarly, native transport enables TDM throughput to be traded bit-for-bit for Ethernet throughput and vice versa, so rated throughput is always equivalent to user available throughput and bandwidth is never wasted.

As a managed solution, an Exalt radio network can be easily integrated into any SNMP managed network supporting SNMPv1, v2c, or the latest secure v3 with encryption.

Backhaul of Single or Multiple Collocated WiMAX Base Stations

Ideal for WiMAX applications, Exalt GigE radio systems leverage the flexibility and spectrum availability of license-exempt bands to provide high capacity backhaul, as shown in Figure 3a below. Exalt radios can transport traffic from multiple WiMAX base stations while leaving valuable WiMAX spectrum available for subscribers, a critical benefit given the limited bandwidth available on WiMAX licensed bands. With aggregate user throughput of up to 440Mbps and selectable throughput symmetry, Exalt radios can support commonly occurring asymmetric traffic distribution with a downstream throughput allocation of as much as 352 Mbps.

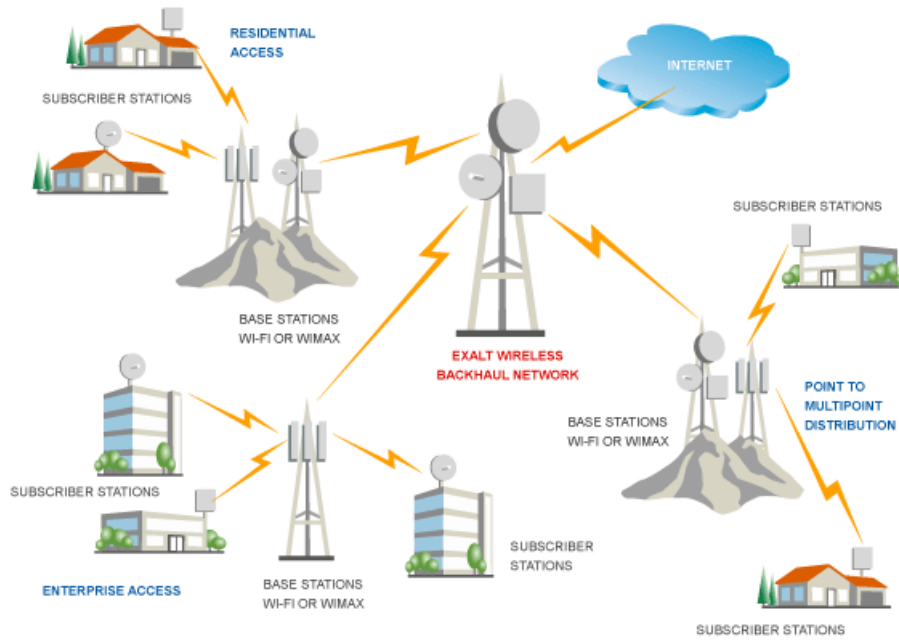


Figure 3 – WiMAX network with 5 GHz microwave backhaul

By making use of ExaltSync, Exalt GigE radio systems offer the possibility of channel reuse, allowing of multiple point-to-point (PTP) links to remote WiMAX base stations to be aggregated at a single site. With features such as VLAN and QoS, the backhaul point-to-point link can support network segmentation by customer or service class according to service level agreements and other business and operations parameters, as shown in Figure 3b.

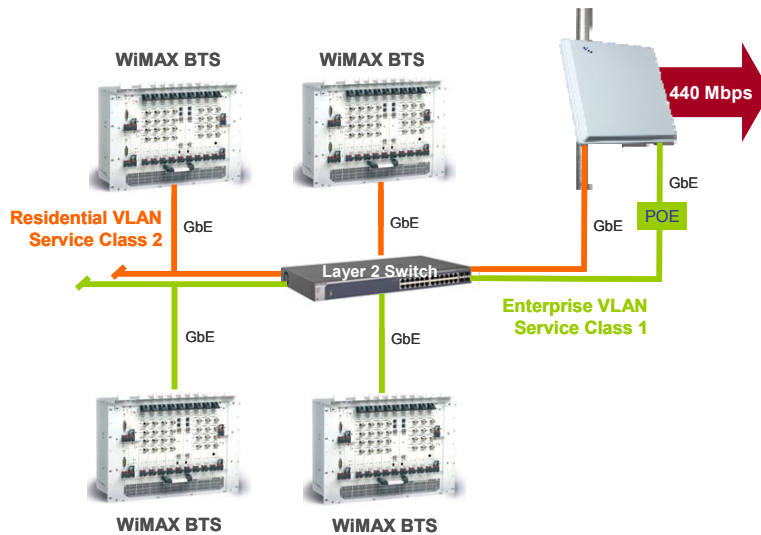


Figure 4 – WiMAX network backhaul with class of service

For mobile operators deploying WiMAX-based services in addition to cellular services, the license-exempt GigE radio family offers the ability to aggregate both cellular and WiMAX traffic over a single link. This carrier-class backhaul system with five nines availability can simultaneously provide TDM and IP capacity for 3G base stations with up to four low latency T1/E1s and scalable IP capacity for WiMAX traffic.

Wi-Fi Mesh Backhaul

Ideally suited to mesh network backhaul applications, Exalt GigE radio systems can transport traffic from aggregated mesh access points and/or point-to-multipoint (PMP) base stations to common Internet connectivity points anywhere in the network, as shown in Figure 5 below. By making use of the ExaltSync synchronization feature, operators can allow multiple point-to-point links to be collocated while utilizing the same channel. This greatly reduces spectrum contention in congested environments and reduces the tower lease costs because systems can be installed closer together without self-interference.

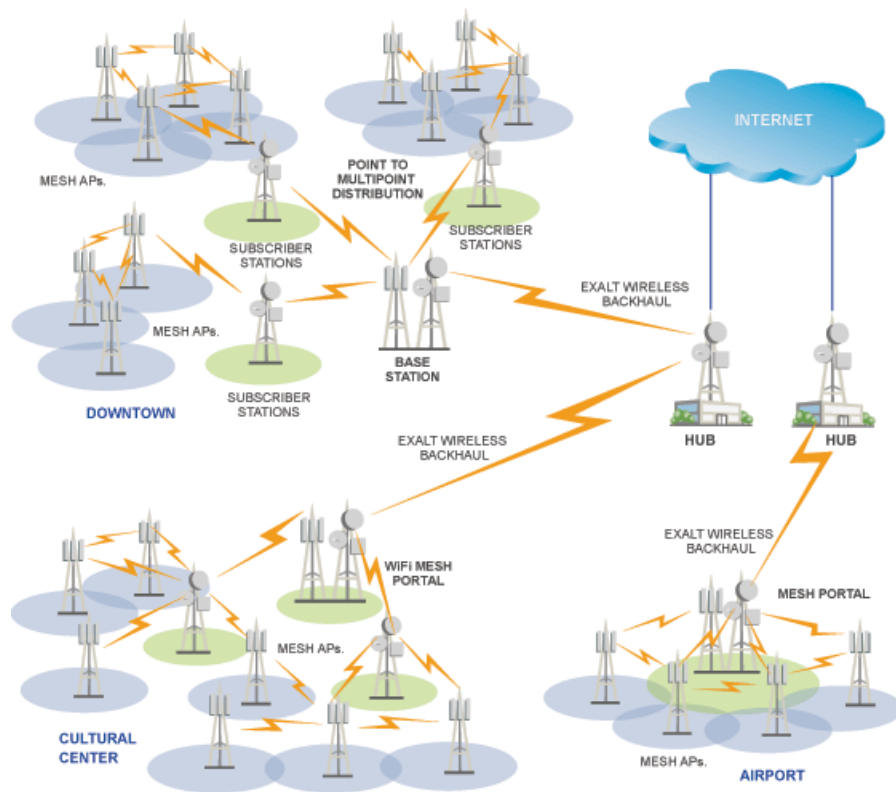


Figure 5 – Wi-Fi mesh network with 5 GHz microwave backhaul

Alternatives

There are three alternatives for providing throughput on the order of 400 Mbps and above: leased high capacity lines (fiber), licensed radios in the 11, 18 and 23 GHz bands and millimeter wave-band radios in the 60 – 80 GHz frequency bands.

Leased fiber lines at this capacity level, which is equivalent to approximately three OC3 links, will, on average, be priced well in excess of \$20,000 per month with variance depending upon distance, region and other factors. This level of expense is precisely what is causing enterprises and service providers to look to microwave radios as an alternative in the first place, as microwave radio systems can typically achieve payback in less than 12 months.

Some licensed band radios in support capacities of up to 800 Mbps while millimeter wave-band radios in the 60, 70 and 80 GHz bands offer wireline speeds of more than 1 Gbps. Obviously, such approaches may be the best fit for high capacity application requirements.

Exalt's 5 GHz GigE radio systems, though not currently capable of quite this throughput, offer a number of advantages, most notably the ability to operate at a significantly greater range than most of these alternatives – up to 15 miles with full 440 Mbps throughput at 99.999% availability – and no susceptibility to rain or fog.

Summary

A wide variety of applications across multiple industry segments demand high rate transmission of voice and data traffic. Some of those applications, as described in this note, may demand capacity in excess of 300 or 400 Mbps user throughput. No alternative approaches offer the combination of affordability, range, deployment flexibility and deployment speed as Exalt GigE series 5 GHz radio systems.

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