



WiMAX Delivers Performance & Value at 3.5 GHz



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Introduction

WiMAX investment decisions are predicated by access to appropriately regulated, licensed spectrum. Recognizing the advantages of WiMAX, regulators around the globe have allocated considerable portions of spectrum amenable to WiMAX and continue to allocate new spectrum channels to account for interest from multiple providers as well as to address the need for scaling these networks over time.

The global WiMAX community has successfully achieved some harmonization of the frequencies allocated for WiMAX. Almost three quarters of the spectrum allocated for WiMAX globally is focused in the 2.5 GHz and 3.5 GHz bands. Focusing development and deployment to a few, select bands offer greater design efficiencies as well as economies of scale – allowing steeper cost declines over time.

As the world moves toward wireless installations that operate in spectrum bands much higher than legacy 2G or 3G cellular networks, there has been much discussion regarding the ability to realize viable fixed and mobile networks at these frequencies. This has been especially the case when considering 3.5 GHz.

By leveraging substantial advancements in RF technologies, WiMAX systems operating at 3.5 GHz will provide all the performance opportunities of mobile WiMAX connections. At the same time, when compared to 2.5 GHz systems, WiMAX in the 3.5 GHz bands will have lower spectrum expense, increased capacity at the time of service launch, and cost of ownership parity with 2.5 GHz systems when measured over time.

The Physics of Higher Frequencies

RF propagation physics demonstrates that as the frequency of operation increases- the coverage radius offered by the wireless base stations is reduced for a given output power. This reduction in coverage area happens as we move to higher frequencies and the radio waves have a harder time bouncing off of structures, getting around corners, and seeing through walls. In fact, in geographies where reflections are less pronounced and line of sight connections are more common, such as in rural environments, 3.5 GHz has been found to perform very similarly to 2.5 GHz.

Traditional cellular networks operate at frequency bands much lower than 2.5 GHz offering advantages in network dimensioning. However, the enhanced air interface and advanced, multi-antenna techniques offered with WiMAX allows the platform to overcome many of the disadvantages of the higher frequency of operation. As a result, typical mobile WiMAX networks operate with a very similar number of base sites for a given geography as legacy 2G and 3G networks.

Frequency Impact to Network Dimensioning & Cost

WiMAX networks deployed at 3.5 GHz may require almost 30% more sites for a given coverage area than a 2.5 GHz installation. This is a directional estimation that considers similar system margins contributed from penetration loss and fade margins for 2.5 GHz and 3.5 GHz systems. In actual application, the system margins are likely to be somewhat higher for a 3.5 GHz system and would be accounted for in detailed RF propagation modeling.

However, in deploying those additional sites, the 3.5 GHz network will also have 30% additional capacity inherently built into the system. As a result, the 3.5 GHz network will be able to absorb a greater rise in data consumption on the network over time and avoid additional capacity focused build out longer than a 2.5 GHz system.

The increase in sites at 3.5 GHz results in approximately 13% increase in total cost of ownership for the system over 2.5 GHz. Fixed costs common to both a 2.5 GHz and 3.5 GHz network including such operational line items as subscriber acquisition, systems integration and network management results in the 30% increase of sites contributing only a 13% increase in cost of ownership.

3.5GHz requires almost 30% more sites than 2.5 GHz for the same coverage area

3.5GHz system delivers 30% more capacity than 2.5GHz in same coverage area.

3.5GHz system requires approximately 13% more capital outlay than 2.5GHz initially.

3.5GHz and 2.5GHz systems demonstrate parity in cost of ownership as we move from coverage to capacity focused build out.

Note that over time as we move from a coverage focused build out to address capacity increases, and the 2.5 GHz system requires investments in new build out earlier than the 3.5 GHz system – both the 2.5 GHz and 3.5 GHz system will demonstrate parity in cost of ownership.

Managing Site Density & Cost

3.5 GHz and 2.5 GHz will result in cost of ownership parity as the networks move from initial coverage focused build out to capacity focused build out; however, operators considering 3.5 GHz deployments will naturally consider technology choices that optimize their costs for service launch. These operators should pay particular attention to the capabilities and performance of their selected WiMAX products and how they contribute to reducing the number of base stations needed, site development costs, and backhaul deployment – all of which can dramatically impact the capital costs to launch.

Device Strategy

An operator's WiMAX evaluations will often begin by considering the device strategy since device selection will go hand-in-hand with meeting the end user service objectives.

While the cost of an individual WiMAX device is an important concern during the operator's investment decision, the operator should not compromise cost for capability. The operator must avoid the risk of introducing a device that is by its own measure inexpensive but contributes to a cost of network ownership that is much higher due to the device's limitations.

For example, lower performing devices may have reduced receiver sensitivity and lower effective transmit power - quickly increasing the number of additional sites required by upwards of 50%, dramatically impacting the business case. The impact of the additional sites, site acquisition costs, network maintenance and expanded backhaul planning may in some scenarios result in nearly a \$10 increase in cost of ownership for every \$1 of CPE cost savings.

Base station performance will understandably have a direct relationship to the number of sites required to service a given geographic area and the capital outlay required to launch service. Performance parameters such as the receive sensitivity of the base station to transmitted signals from WiMAX devices will significantly impact the coverage radius afforded by each base station to meet the uplink requirements of the service – a typical limiting factor in WiMAX network design.

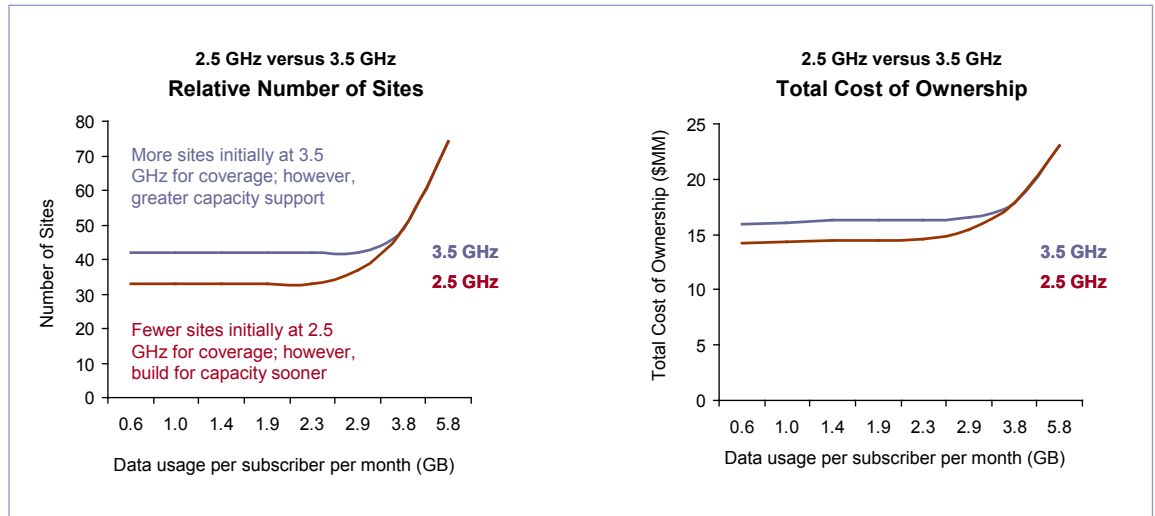
While it is imperative that the operator selects equipment that delivers high performance and quality as this will dictate the capabilities of the service, it is also very important that the infrastructure solutions offer good flexibility in deployment approaches. In many installations, site acquisition and development can grow higher than the cost of the equipment itself.

Having access to light-infrastructure solutions with flexible deployment options including outdoor and indoor, wall mounted for on-building installation, pole mounted for existing towers, base mounted for rooftop or ground based systems, and rack mounted where existing sheds are available can allow the operator strategic options for managing their site costs and reducing the overall cost of ownership.

Backhaul Planning

Backhaul planning and leasing expense plays a critical role in the design and deployment of the WiMAX system and will additionally play an important role in ensuring end-to-end service quality.

Backhaul spend can vary dramatically depending upon the technology employed to manage the aggregate bandwidth. Traditional leased line solutions may result in backhaul contributing to as much as 20% of the WiMAX spend where advanced wireless point-to-point solutions can reduce the contribution to as low as 2%.



Data usage per subscriber provides a reasonable view of the impact of increasing capacity utilization within the WiMAX system. A similar trajectory could also be drawn for an increasing base of subscribers consuming greater capacity. As a point of reference, 2GB is roughly equal to a single digital, IP movie and on average, a power business user today may utilize up to a 1GB of data in a single workday downloading and sending emails.

Conclusion

WiMAX is heralding a new generation of wireless broadband networks operating in new spectrum allocations. 3.5 GHz WiMAX spectrum has been demonstrated globally to offer a significantly lower price per Hz per population covered than 2.5 GHz spectrum. Wireless broadband investors would be well positioned with investments in 3.5 GHz spectrum, taking the savings from spectrum expense and applying it toward capital spend in the network displacing the cost of the additional sites and benefiting from the added capacity of the system.



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