Application Note – Remote RF Antenna Extension

Nowadays, cell phones are a girl's (and boy's) best friend -- that is, until that all-important call gets dropped. Increasing coverage and capacity, without breaking the bank, has become an almost intractable problem for mobile service providers. But where RF technology falls short, Free-Space Optics comes through – loud and clear.

The Problem

The growing demand for mobile wireless service is driving service providers to expand networks at an unprecedented pace. Unfortunately, that's a lot easier said than done. In rural areas, the problem is how to extend coverage to users spread out over a large area, especially if there are obstacles such as mountains or foliage in the way. In Urban areas, the problem is particularly acute. There are many places in which a wireless network cannot reach (e.g. tunnels, indoor stadiums, elevators, underground parking lots…). It is precisely urban areas that hold the largest number of potential subscribers, making it crucial not only to increase coverage but capacity as well. Simply adding cell sites to an existing network is neither practical nor economical. Each new cell site requires a significant amount of time and money to set up. Real estate issues and zoning laws make it difficult, and sometimes impossible, to put a cell site in the desired location. The capital expenditures involved can easily be on the order of US$400,000, and operating expenditures can add up to similar numbers after only a few years.

The Traditional Solution

Rather than building new cell sites, service providers sometimes extend their coverage (at the expense of capacity) by using remote antennas or "microcells." These are RF antennas that have a backhaul connection to a central cell site, known as a base transceiver station (BTS). In this way, the remote antenna extends the capacity of the BTS without all the real estate requirements and costs of a complete cell site. There have traditionally been two types of backhaul connections used for this application, each with its own limitations…

Optical Fiber

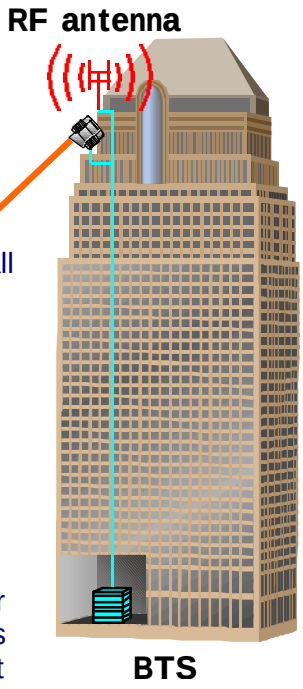
This has the required bandwidth capability, but involves a lot of time and physical disruption with regard to laying the fiber itself. This translates into added capital expense, as well as added operating expenses in the form of license fees. Also, there is little flexibility to react to changing demographics and zoning laws.

Microwave

While this is generally more flexible and less time-consuming than a fiber connection, it has much lower bandwidth, which limits the number of radio channels per transmission. Also, EMI and spectrum licensing limitations can prevent deployment in certain areas.

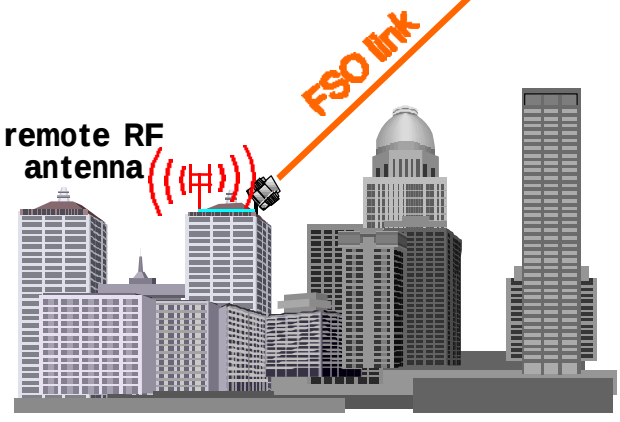
The SONAbeam™ Solution

The ideal backhaul connection between a remote antenna and a BTS is achieved by using fSONA's free-space optics (FSO) SONAbeam™ technology. This technology offers all of the advantages of both fiber and microwave, with none of their disadvantages.



- ✓ ***High Bandwidth:*** FSO is capable of the same capacity and performance as optical fiber – up to 1.482 Gbps and beyond of true throughput.
- ✓ ***Minimal Real Estate Requirements:*** An FSO link involves only two transceivers with their associated power and interface cabling.
- ✓ ***Flexibility:*** Quick, simple, and portable installation gives FSO the ability to respond to changing market demands and network requirements.
- ✓ ***No EMI:*** Unlike microwave, there are no interference issues, and the small footprint of an FSO terminal allows it to be mounted almost anywhere.
- ✓ ***Cost Effectiveness:*** Unlike fiber, there is no physical disruption involved in setting up an FSO link. Municipal and zoning approvals are not required, and neither are the lengthy waiting periods. Capital expenditures are therefore kept to a minimum. Because FSO works in an unlicensed part of the spectrum, there are no licensing fees. The FSO system itself requires little maintenance and uses few building resources. Consequently, operating expenditures are kept to a minimum as well.

By using an FSO backhaul connection to a remote antenna, a service provider can see as much as 80% total savings over installing a separate cell site. This does not even include the added revenue that is acquired by virtue of the fact that the added coverage is up and running so quickly. Taking this into account, a SONAbeam™ link can effectively pay for itself in as little as one month.



The fSONA/ADC Solution

The SONAbeam™ 1250-M and 1250-S models are ideally suited for this application. Both are capable of operating at bandwidths up to 1.5 Gbps, and the SONAbeam's exceptionally high link margin allows for longer ranges and higher availability than any other FSO system. The ADC Digivance™ is used to convert 25 MHz of RF spectrum into 1.482 Gbps of digital bandwidth. ADC has fully qualified the SONAbeam for interoperability with its product line. Together, these two technologies offer the only truly economically feasible solution for remote antenna extension.

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