

White Paper

60GHz Metro Cell and Small Cell Backhauling for Service Providers

Backhaul traffic in dense city areas, extend service to previously inaccessible locations with small, low power, environmentally friendly backhauling equipment, remove bottlenecks, replace existing but end of life infrastructure such as the Nokia MetroHopper microwave radios.

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1. Introduction

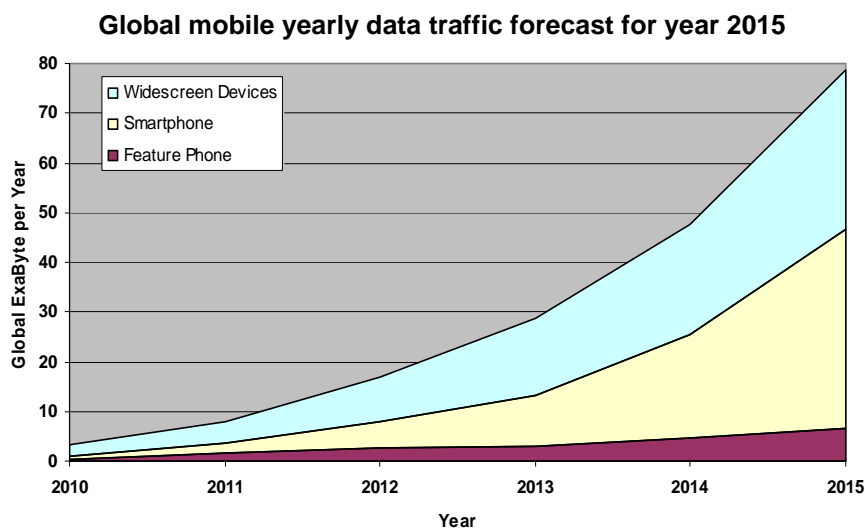
In the highly competitive telecommunications arena with heavily growing bandwidth demand for mobile data applications, Service Providers and telecom companies have to continually expand the data capacity of their networks, especially in dense city areas. Owing to existing cellular Base Transceiving Stations (BTS) reaching their capacity limits, new network design approaches are required. One of the main challenges of these new network designs is how to backhaul traffic from Metro-Cell BTS.

This paper provides:

- An overview of the current network architecture trends of some mobile operators
- Challenges of those approaches, especially relating to backhaul design
- Solutions to ensure a cost effective, adequate and reliable backhaul solution that will avoid the creation of bottlenecks within the network while reducing CapEX and OpEX

2. Trends & Aspects of Metro-Cell Deployments

Increasing mobile data demand and the opportunity to generate higher Average Revenue Per User (ARPU), by offering increased mobile bandwidth, is currently requiring Service Providers to make significant increases in their network capacities.



Source: Alcatel-Lucent; (ECC Report; Oct 2011)

Most operators are currently combining three different approaches to ensure a higher data capacity at street level:

- Replace existing BTS with higher capacity BTS by a shift of technology from 3G to 4G
- Significantly increasing the number of traditional BTS per km²
- Improving and expanding coverage, by installing “Small Cells” in dense areas at street level, thus relieving the demand on the capacity of the traditional BTS

New Cellular Network Design



Source: ECC Report; Oct 2011

This new access layer network design has an incremental impact on backhaul design:

Higher Bandwidth Capacity of BTS

- New 3G & 4G Technologies provide higher bandwidth over the air
- Ethernet & IP begin to dominate
- Legacy TDM & ATM no longer meet backhaul capacity requirements

Much higher Base Station Density especially in dense areas

- More 3G/4G BTS are required to meet bandwidth demand
- Traditional licensed microwave frequency spectrum limited and usually licensed

Small Cells installed on City street furniture like e.g. Light Poles

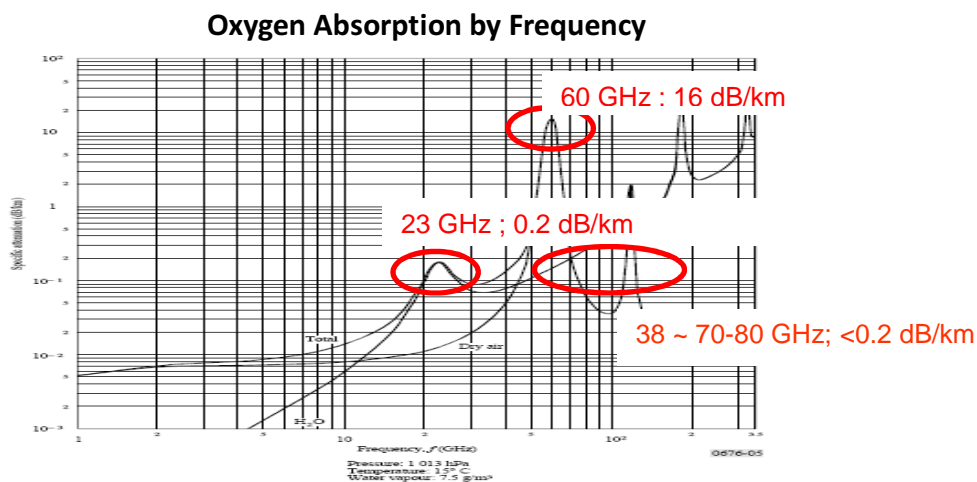
- Backhauling via fibre/cable in many cases not possible & expensive
- Traditional Microwave not suitable due to size of hardware + frequency availability

3. 60 GHz – A Frequency for Wireless Backhauling with many advantages

60 GHz was always seen as a less favourable frequency, due to the sharp oxygen absorption peak of 16 dB/km across the band. This means that in addition to the Free Space Loss (FSL) oxygen absorption loss must be taken into account and a margin allowed for rain fade. As a result, under perfect conditions, a maximum link distance of up to 1500 metres is possible.

This could be considered a disadvantage in traditional network design, where a Microwave link would mostly be used for distances beyond 1500 metres. However, for Metro Cell deployments, high oxygen absorption and the associated reduced range, becomes a real benefit compared to traditional microwave or other wireless backhauling solutions:

- Hundreds of links can be installed in a dense area
- Very low interference between the PTP links or other 60 GHz devices in the field
- High bandwidth of up to 1 Gigabit/s (full duplex) per link
- Carrier Class availability within the given distance recommendations



The official regulatory view on the use of 60 GHz

Because of the characteristics of 60 GHz, CEPT and ETSI recommend that a “light licensing regime” shall be used in the band 57-63 GHz. As a result, in many countries, this band is “license exempt”.

ECC/REC/(09)01 summarises a ‘light licensing regime’ as follows: “Light licensing regime, where the position of and characteristics of the stations are recorded on a data base on a first-come-first-served basis, with responsibility for subsequent users to ensure the compatibility with previously notified stations”.

4. Small Form Factor and Unobtrusive Infrastructure Becomes Critical

Until recently, the design and form factor of wireless backhauling solutions were not of great importance to Service Providers, since they were typically mounted on high masts and unlikely to be seen from ground level.

This concept is currently changing with the new Metro Cell and Small Cell network designs being rolled-out. Cellular BTS are being moved much closer to the ground, sometimes almost down to street level, e.g. on top of low buildings or light poles/lamp standards. Moving communications equipment this close to the public means that installing a large traditional microwave to backhaul these BTS would simply not be an option.

With the Liberator-V320 and V1000, Sub10 Systems offers an all-outdoor solution benefiting from the advantages of 60 GHz as well as offering a small, energy efficient and highly robust design.

The Liberator-V320 Solution

The Liberator-V320 is ideally suited for the backhauling of Small Cells in dense inner city areas delivering up to 320 Mbps Full-Duplex Net throughput in QPSK and up to 160 Mbps Full-Duplex in BPSK mode.

Weighing just 2.5 kg and measuring a compact 182x182x68mm, the Outdoor Unit (ODU) is easy and quick to deploy. Moreover, the ODU can be easily hidden and/or camouflaged, making identification as a PTP link unlikely.



The Liberator-V1000 Solution



The Liberator-V1000 has been developed to solve bandwidth bottlenecks in Metro Cell Networks and to be used as a last-mile fibre/leased line replacement for business customers in city environments.

The V1000 supports up to 1 Gbps Full-Duplex Net throughput, at an availability level of up to 99.999%. The form factor of the ODU is identical to that of the Liberator-V320.

Sub10 is delivering both systems as a “Link-in-a-Box”, with all required accessories, which helps to reduce the logistical challenge of a large scale roll-out. Additionally, both products come with a 24 month standard warranty and are easily installed and managed.

5. Case Study: Replacing Nokia MetroHopper Installations

The Nokia MetroHopper is a 58GHz TDD PTP Radio Link that supports up to 4 x E1, delivering a total of 8Mbps over a single radio hop. The MetroHopper has been installed by many Service Providers to backhaul BTS traffic, generally in dense city deployments, worldwide, during GSM roll-outs.

Due to bandwidth limitations, Nokia Siemens Networks decided to inform the market, in 2010, that the MetroHopper product was reaching 'End of Life', leaving Service Providers without an equivalent alternative in the same frequency band. One of the affected customers was a large Austrian Service Provider who, at very short notice, had to find a cost effective solution to replace more than 100 MetroHopper Links in Vienna.

To have replaced the MetroHopper with traditional licensed microwave would have caused high additional CapEx and increasing OpEx, since most of the MetroHopper sites were not suitable for the bigger microwave antennas & ODUs. Moreover, 60 GHz is lightly licensed in Austria, unlike 38GHz for example where a significant annual fee has to be paid.

After an intense technology and business evaluation the decision was made to replace all MetroHopper Links in Austria with the Liberator-V320 from Sub10 Systems owing to the following advantages:

- Removal all indoor equipment other than a small Power over Ethernet (PoE) injector
- The only 60 GHz system in the market meeting their Carrier Class requirements and conforming with spectrum regulations, size, product quality and link availability
- Bandwidth increased from 8 Mbps to 320 Mbps
- No additional civil works required due to small size and low power consumption

