Affordable High-Performance Wireless Backhaul for Bridging the Digital Divide

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In developed countries and markets, affordable 24/7 broadband access to the Internet has become the ubiquitous lifeblood of society over the past decade. It has profoundly changed peoples' lives and has even re-shaped society as a whole. Its importance is underlined by the fact that losing this connection to the world has the same impact on households as a power outage.

The Digital Divide

Unfortunately, there are still millions if not billions of people, inhabiting less affluent or more remote parts of our planet that are *not* benefiting from the "ubiquitous" Internet revolution. A revolution that has transformed most of the rest of our world, and is holding the promise of improving *their* quality of living too.

This undesirable situation is in part caused by the prohibitive cost of building fixed or mobile access networks in markets with low population densities or low per-capita incomes. Other common challenges, beyond equipment cost, that frequently pop up in developing countries are:

1. No (reliable) power supply for powering the infrastructure and end-user devices,

2. High recurring cost for obtaining licensed spectrum and/or difficulty in obtaining a suitable spectrum license,

3. Limited reach of microwave links in mainstream licensed frequency bands (6 GHz upwards, but typically 10 GHz and up) & high cost of long-haul trunk radio solutions,

4. Path obstructions necessitating the erection of costly high-rise towers.

We at DragonWave are keen on contributing towards addressing those challenges, narrowing the Digital Divide and thereby serving as a catalyst for improving the lives of the less privileged by bringing broadband Internet access to their doorstep.

DragonWave's role in Bridging the Digital Divide

DragonWave is a leading vendor of packet microwave equipment, including carrier Ethernet switches and synchronisation solutions for radio access networks. During the Mobile World Congress in Barcelona in March 2013, we have launched our latest product, the Harmony Lite – please refer to Figure 1.
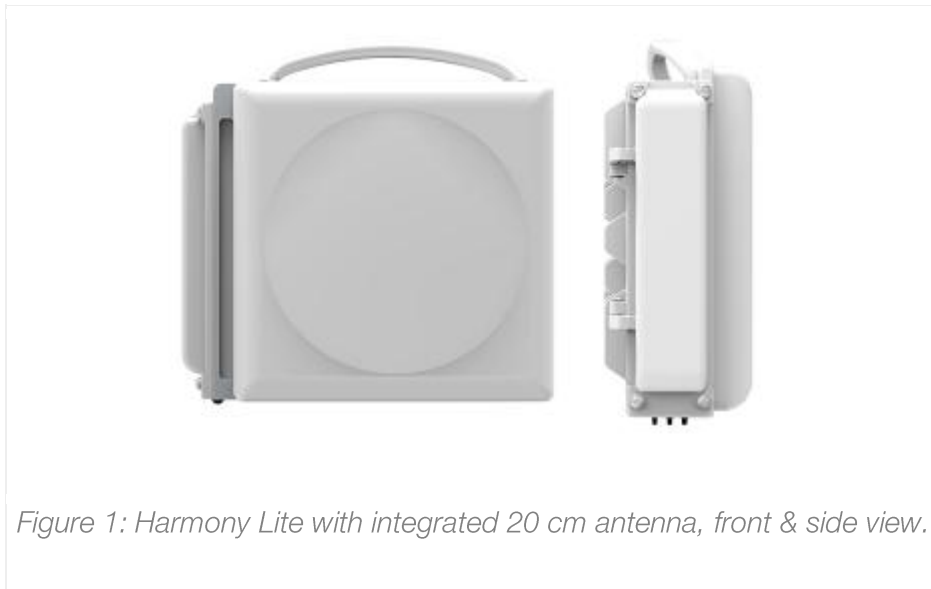

Figure 1: Harmony Lite with integrated 20 cm antenna, front & side view.

Harmony Lite is optimised for the following three use cases:

1. Low-cost mid-range wireless rural access,

2. Microcellular wireless mobile backhaul for dense urban areas, both Line of Sight and near/Non-line of Sight.

3. Low-cost access for Enterprise and SoHo[i] customers.

So what makes Harmony Lite stand out from other (low-cost) point-to-point packet microwave radio's on the market and in our own portfolio? In fact, it is many things, or rather a *unique feature mix* that make this product outstanding and the best tool for the applications listed above:

1. **Low CAPEX:** a Harmony Lite link is extremely affordable, costing just about 50% of a regular packet microwave link with a same-size antenna. This opens up new, price-sensitive applications and markets, like for example wireless rural access in the African countryside.

2. **Low power consumption (OPEX):** a Harmony Lite unit consumes about 15 W of power, which amounts to just 30% of the power consumption of a typical packet microwave unit. The low power consumption has a positive knock-on effect on other, very significant cost factors:

   a. The power supply and battery backup system in remote areas. Mains power is simply not available or unreliable at best at remote communities. Therefore, a transport solution at remote sites will have to be solar and/or wind energy powered, backed up by a battery system. The cost of such secondary systems can easily multiply the cost of the primary system; hence scaling back on power greatly reduces the Total Cost of Ownership.

   b. The power injectors: due to its low power consumption, Avenue Link Light can be powered using inexpensive off-the-shelf PoE+ power injectors or readily available PoE+-capable 3rd party switches.

3. **Extended range:** despite its modest power uptake, The Lite can link points that are as far as 38 km apart with 99,995% link availability – please refer to Figure 2 for details. This is thanks to the fact that it operates in the sub-6 GHz bands, including the unlicensed 5 GHz band and the licensed 2 and 3 GHz bands.

4. **Site synchronization:** this unique feature enables perfect synchronisation of the Tx and Rx bursts of 2 co-located Harmony Lite units, enabling 1:1 frequency (channel) re-use (efficient use of scarce resource) *without* link degradation as long as the main beam angular separation ≥90°. This feature is ideally suited for e.g. east-west (=chain) sites that are necessary if points A and B cannot be connected using a single hop because of terrain obstructions or distance.

5. **Support of 5 GHz unlicensed band:** this allows the user to deploy the Lite without incurring any license cost, lowering the Total Cost of Ownership to the absolute minimum.
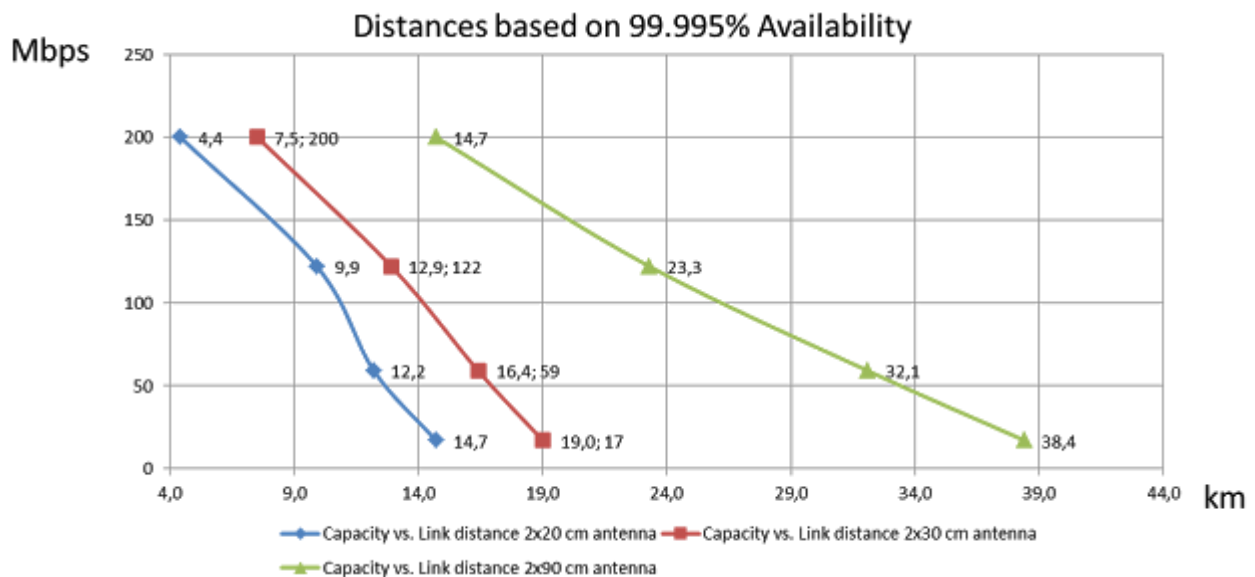

Figure 2: aggregate link capacity (Tx+Rx) versus distance and antenna size for the 5 GHz (unlicensed) Harmony Lite variant (99,995% availability in Burkina Faso). Range in lower 2.x and 3.x GHz licensed bands will be higher.

Harmony Lite boasts other merits too, although those are more relevant for microcellular backhaul and enterprise connectivity applications: integrated 20 and 30 cm antennas, lowering installation effort and cost, the near- and Non-Line-of-Sight capabilities dealing with obstructions like poles trees and even corners, the support of synchronous Ethernet and IEEE1588v2 Boundary Clock for LTE-A, the 2 ms latency (versus 6-8 ms for competition) boosting customer effective throughput and more.

So how can Harmony Lite benefit people on the wrong side of the Digital Divide? Well, simply by making Internet access to remote or less well-off spots on this Earth much more affordable and therefore feasible for the first time in history. We can knock off 50% of the primary link CAPEX, 70% of secondary CAPEX (power and Battery Back Up systems) and 100% of licensing OPEX, *and still provide communities a world-class, dependable lifeline to the outside world*. This is exactly our mission: Building Better Backhaul Everywhere!

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