White Paper

Alpha Wireless Antennas helps Operator increase Sector Capacity

Abstract

Mezon (www.mezon.lt) is a wireless broadband operator based in Lithuania. It is a wholly owned subsidiary of TeleCentras, the Lithuanian TV and Radio network (www.lrtc.lt).

Mezon was experiencing unacceptable interference in parts of its network. They identified this as interference between antenna radiation patterns emanating from neighbouring cells. By replacing their existing antennas with Alpha Wireless antennas, the operator was able to significantly reduce the interference, and therefore improve network throughput by 30%, and sector capacity by 12%, in affected cells.

Alpha Wireless antennas suppress ALL upper sidelobes by >18dB. Most other antenna vendors only suppress the first upper sidelobe. Upper sidelobes cause interference across cells and it is this improved upper sidelobe suppression that helped improve overall network throughput and sector capacity as reported in this case study.

What are Upper Sidelobes?

The objective of a sector (directional) antenna is to emit radio waves in one direction. The radiation in that directional field is called the main antenna lobe. However unwanted radiation outside the main lobe is also produced. These are known as sidelobes. See figure 1. The main lobe is aimed within a specific cell, but the sidelobes, and particularly the upper sidelobes, due to their angle above the main lobe can end up in nearby cells. This can interfere with the main lobe in those cells. The physics of antenna design means that there are multiple upper sidelobes as shown on figure 1. To minimise interference it is therefore important to suppress upper sidelobes as much as possible.

Many antenna vendors only suppress the first upper sidelobe, whereas Alpha Wireless has designed its antennas to suppress all upper sidelobes. The effect of the 2nd, 3rd and subsequent upper sidelobes becomes even greater as the antennas is tilted downwards, which is often the case as an operator optimises the network.

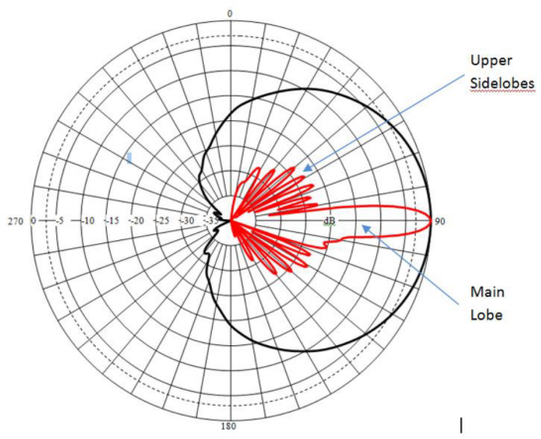

Fig 1: Upper Sidelobes

Reducing Upper Sidelobes

A sector antenna consists of an array of radiating elements. Feeding these elements with a tapered signal reduces all upper sidelobes. This means that the signal fed to each element is reduced in strength from the centre outwards. To implement this, Alpha Wireless use a low loss RF PCB, unlike many other vendors who feed the radiating elements in pairs using a cable harness. Therefore, gain and all other antenna parameters are maintained but all upper sidelobes are suppressed by >18dB.

Benefits of Reducing Upper Sidelobes

Upper sidelobes consist of unwanted radiation, and as the angle of their beam is greater than the main lobe their effect can be felt beyond the reach of the targeted main lobe, i.e. neighbouring cells.

The first upper sidelobe has the greatest effect, so most antenna vendors focus on suppressing this only, as it is assumed that the next upper sidelobes are sent more skywards due to their greater angle. However, when an antenna is tilted downwards to aim its beam more accurately then all upper sidelobes are targeted more towards the ground, therefore increasing their capacity to create interference. So, suppressing ALL upper sidelobes can help reduce interference and improve the performance of the overall network.

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Results from Lithuania

In 2010, Alpha Wireless was approached by Mezon (www.mezon.lt), a wireless broadband operator in Lithuania. The operator was experiencing greater than expected interference in its network. The network had been deployed in Vilnius, the capital of Lithuania.

The operator clearly understood the theoretical benefit of suppressing upper sidelobes, but firstly decided to run some trials. It began by feeding the radiation pattern files for its existing antennas and the Alpha Wireless equivalent into its network planning software, and the results returned showed a improved network throughput of up to 30% in high interference areas—see figure 2. A typical improvement from 4Mbps to 6Mbps was observed.

Encouraged by these results it installed a small number of Alpha Wireless antennas at a number of key sites. Again results were positive, so it decided to replace all the relevant antennas with Alpha Wireless product.

Once complete, client statistics clearly showed a 12% average sector capacity improvement on all cells that were previously most affected by interference.

Figure 2 shows a map of Vilnius. In red are cells in which no improvement was seen, in blue are cells in which the capacity improvements were measured. The blue sections on the map represent open areas of ground.

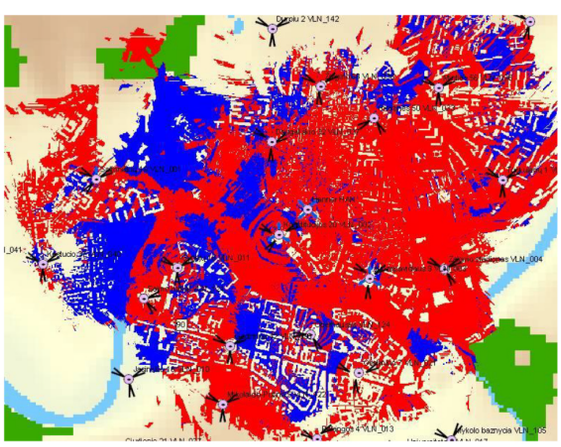

Fig 2: Network Improvements in Blue

Conclusions

All antennas radiate unwanted signals. These unwanted signals create interference. Suppressing unwanted signals reduces interference. Sector antenna upper sidelobes are examples of unwanted radiation. Most antenna vendors only suppress the first upper sidelobe. However, when an antenna is tilted, the second, third and subsequent sidelobes can also create interference. Alpha Wireless antenna suppress all upper sidelobes. A real trial in Vilnius, Lithuania has illustrated the benefit to overall network performance of suppressing all upper sidelobes.

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