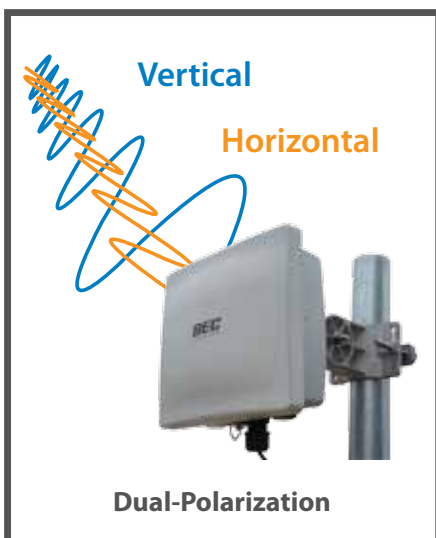


Benefits of Dual Polarized Antenna for Fixed LTE Broadband



With the increasing popularity of LTE capable mobile Internet devices and data extensive applications, bandwidth delivery becomes a challenging task for mobile operators. Not only do operators have to invest in acquiring LTE radio spectrums and expand network capacity, they must also look into providing quality UE or customer premise devices that incorporate advanced antenna technologies to generate maximum data rate from existing bandwidth. Although most antenna designs for today's 4th Generation fixed mobile broadband CPE devices are already targeting high bandwidth, high-gain and long reach applications. Many designs leverage on low cost, multi-band off-the-shelf antennas that performs poorly in high data critical applications.



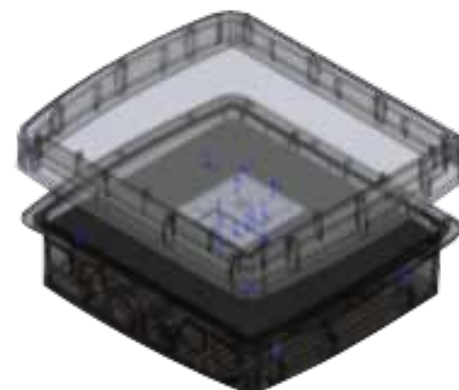
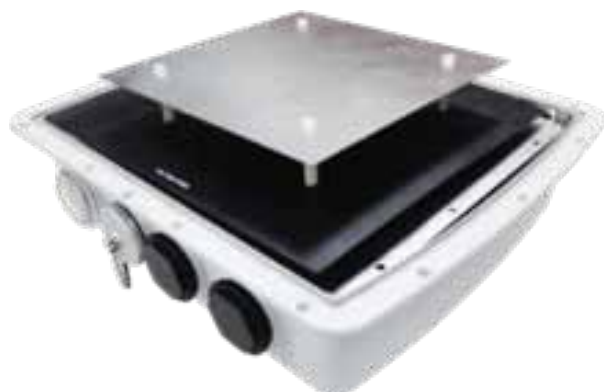
MIMO is one of the techniques used in LTE Release 8 to achieve such high data rates. In a multiple-input multiple output (MIMO) LTE wireless system, spatial multiplexing and polarized multiplexing are used to increase spectral efficiency or transmit diversity to make improvement of LTE link quality. This technique enables the so-called multiplexing gain – multiple data pipes between transmitter and receiver within the frequency band of operation.

The benefits of spatial multiplexing are significant in a non-line-of-sight environment because the spatial correlation among multiple propagation channels is low. However polarized multiplexing of MIMO with dual polarized antenna is effective in a line-of-sight environment with outdoor conditions. The dual polarization MIMO antenna uses a vertical (V) and horizontal (H) polarization.

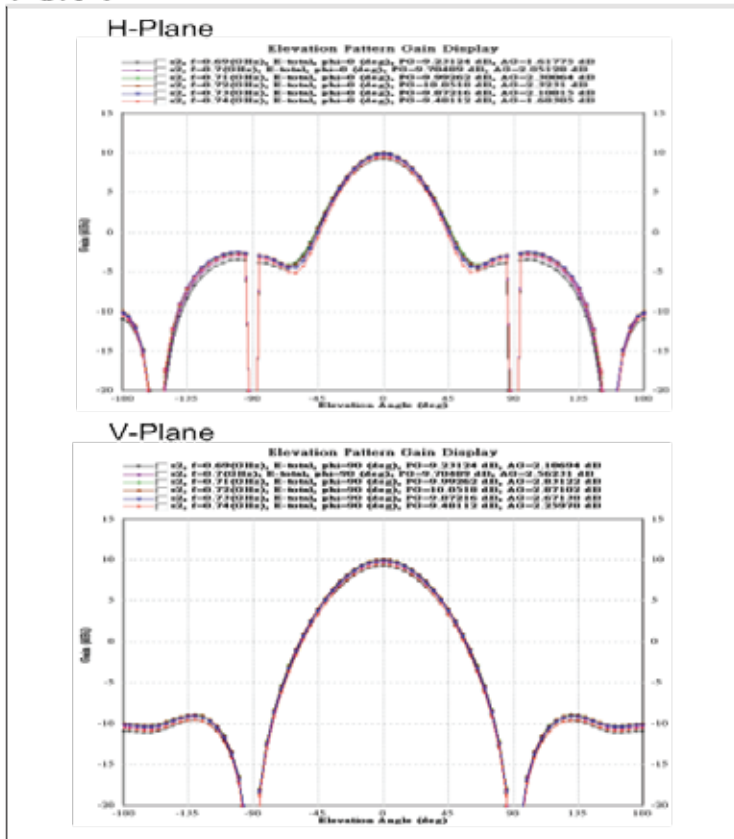
It establishes lower channel correlation than the spatial multiplexing MIMO in a Line-of-Sight environment which is credited to its V & H plane polarizations in an ideal line-of-sight environment. Dual-Polarization also offers substantial efficiency in a non-line-of-sight environment due to low

channel correlation. The performance of these signaling techniques is highly dependent on channel characteristics which in turn depend on antenna height, spacing and richness of scattering. However, when the available space is limited, the use of a dual-polarized antenna is more suitable than two separated antennas.

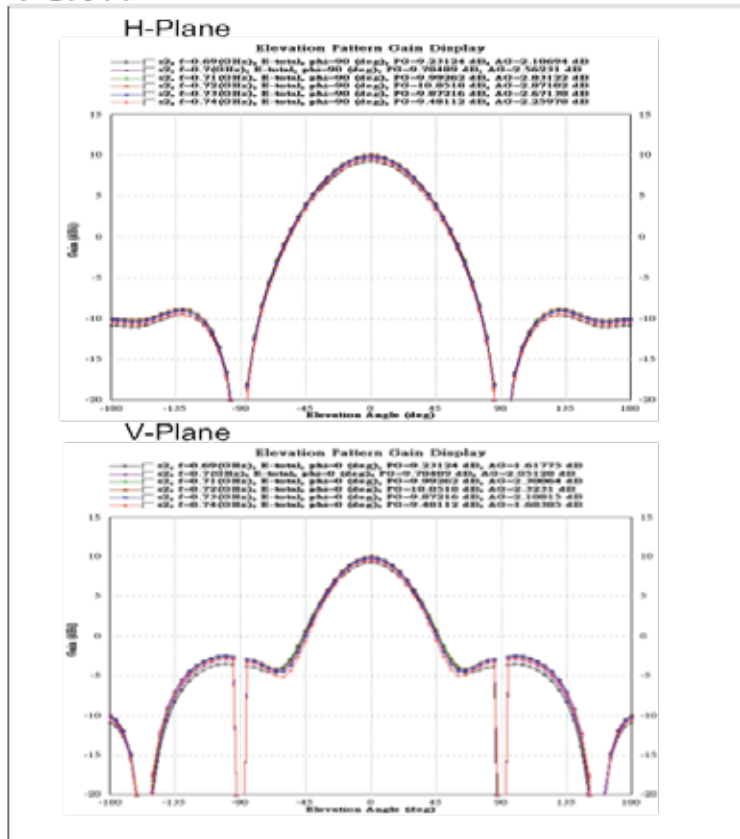
Antenna design view of BEC 6800RUL



Port V

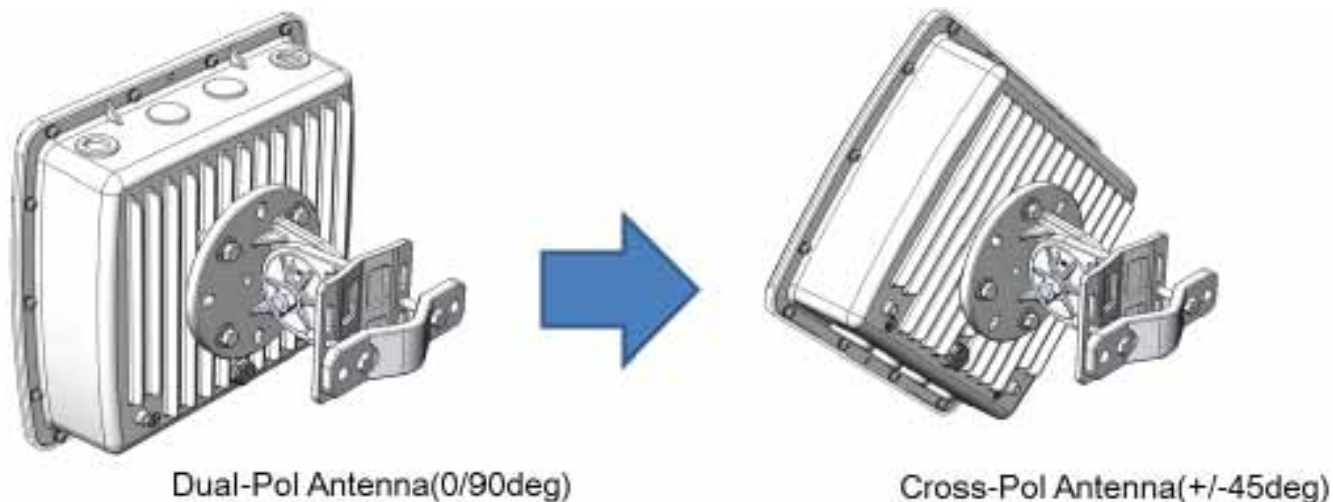


Port H



Example Radiation Pattern

Antenna polarization is a very essential consideration when choosing 4G LTE customer premise equipment for fixed wireless broadband services. The polarization modes of antennas include the polarization and dual polarization. The dual polarization antenna reduces the impact from multi-path attenuation and improves the quality of signals received by the ENB by using polarization diversity. Dual polarization antennas in LTE networks usually use a 45 degree cross polarization mode. Popular polarizations are designed based on vertical & horizontal linear patterns. Polarization of the radio wave can be determined by the electric field. A vertically polarized linear (V-plane) is when the electric field is perpendicular to the surface. Horizontal polarized linear (H-Plane) is when the electric field is parallel to the ground. The polarization of each antenna in a system should be properly aligned. Maximum signal strength between stations occurs when both stations are using identical polarization. The BEC 6800RUL outdoor LTE device is designed to provide flexible mounting options that easily can be adjusted to match the polarization of the ENB.



Based on proven results, single band fixed mobile CPE devices can achieve exceptional performance by incorporating dual-polarized antennas while at the same time reducing occupied space needed in the device. This then reduces the weight and size of the device. While a variety of dual-polarized multi-band antenna designs have been introduced for various applications, most of the multi-band dual-polarized antennas introduce harmonics frequencies or use techniques to generate additional resonances such as insertion slots. More importantly, it creates a ratio between frequency bands below or equal to 2 and implies dependence between the two different frequency bands.

BEC's outdoor 4G LTE mobile router employs a unique single-band dual-polarized wide beam width patch antenna with low cross-polarization and high isolation, specifically for fixed wireless broadband applications. Service providers offering services to weak or non-existent wireless signal areas can benefit from the extended range and reach of the BEC's 6800RUL outdoor LTE router. Dual Polarized Multiple MIMO antenna technology allows service providers to select the optimal solution for their environment or application whether LOS (Line of Sight) or NLOS (Non-Line of Sight). Compact physical size and light weight were key design and safety considerations of the BEC 6800RUL, it can be easily mounted directly on exterior walls, chimneys, lightweight poles and used for retrofitting applications such as the replacement of older generation wireless technology.