White Paper

ANDREW
A CommScope Company

Antenna Comparison

Version 1.0

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This paper provides analysis results based on four types of antenna comparisons, which include the following:

- Standard gain antenna vs. high gain antenna
- 900 MHz antenna vs. 1800 MHz antenna
- 65° horizontal beamwidth antenna vs. 90° horizontal beamwidth antenna
- Two single band antennas vs. one dual band antenna

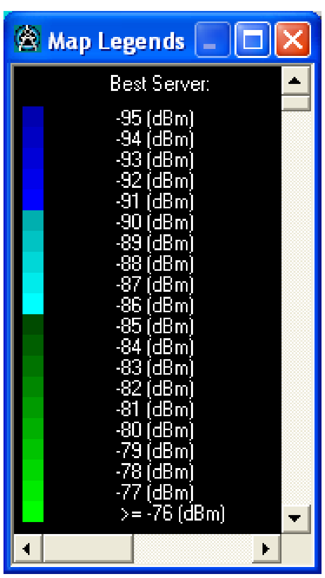
I. Settings

In order to see the influence of high gain, dual band and beamwidth, the coverage areas of these antennas are compared. While one parameter has been modified, all other stayed the same, so that we could focus on this one influence.

The following settings have been used:

- One site
- Three sectors (0°, 120°, 240°)
- TX power = 40 dBm
- Antenna height = 100 feet
- Free space (no terrain or clutter has been considered during the calculation)
- Standard 900 MHz propagation model of type COST231 has been used
- Standard 1800 MHz propagation model of type COST231 has been used

The map legend shown below describes the signal level shown in the figure below.

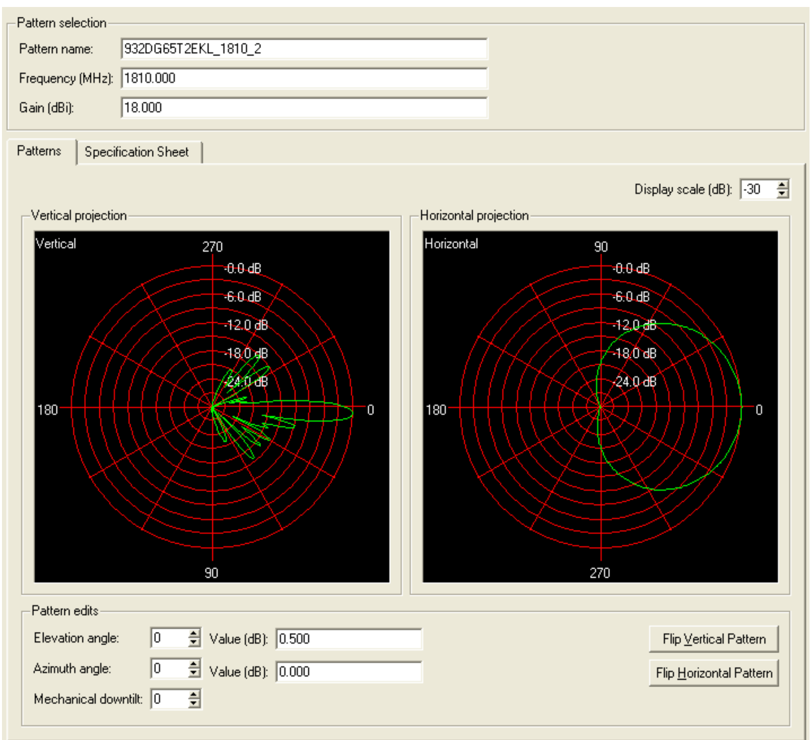


II. Antennas

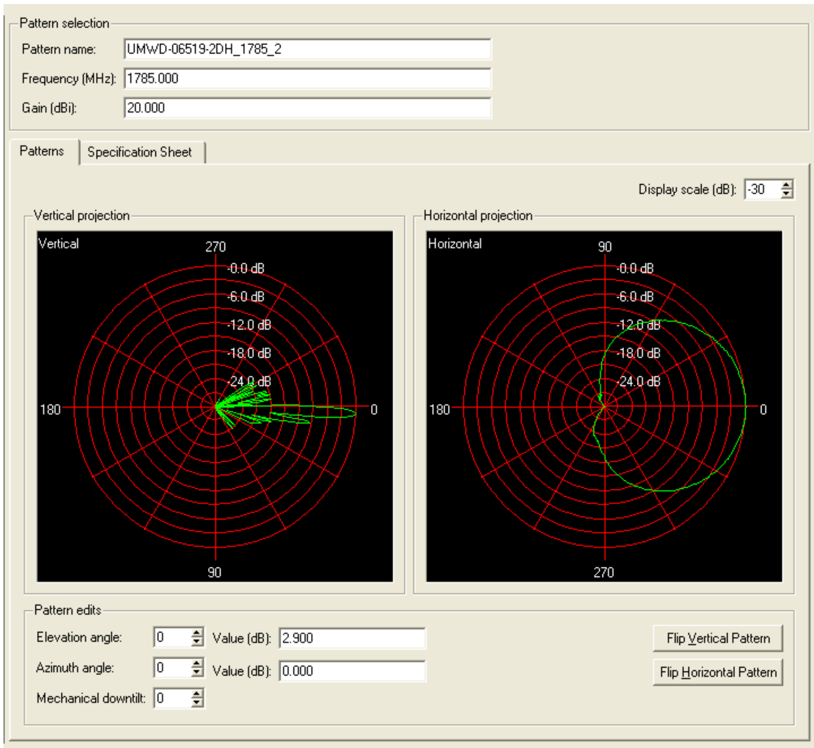
The following antennas were compared:

932DG65T2EKL	2° Downtilt at 1810 MHz	18.0 dBi
DB858DG65ESY	0° Downtilt at 940 MHz	18.1 dBi
DB858DG90ESY	0° Downtilt at 950 MHz	16.8 dBi
DB932DG65EKL	0° Downtilt at 1830 MHz	18.1 dBi
DBXLH-6565C-VTM	0° Downtilt at 940 MHz	17.0 dBi
DBXLH-6565C-VTM	2° Downtilt at 1785 MHz	18.2 dBi
UMWD-06519-2DH	2° Downtilt at 1785 MHz	20.0 dBi

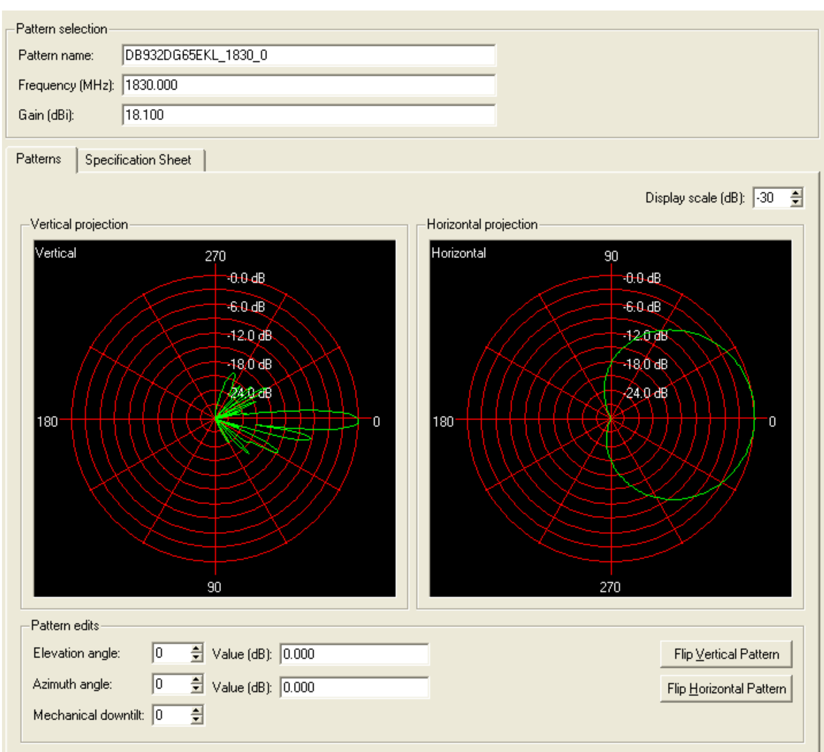
932DG65T2EKL



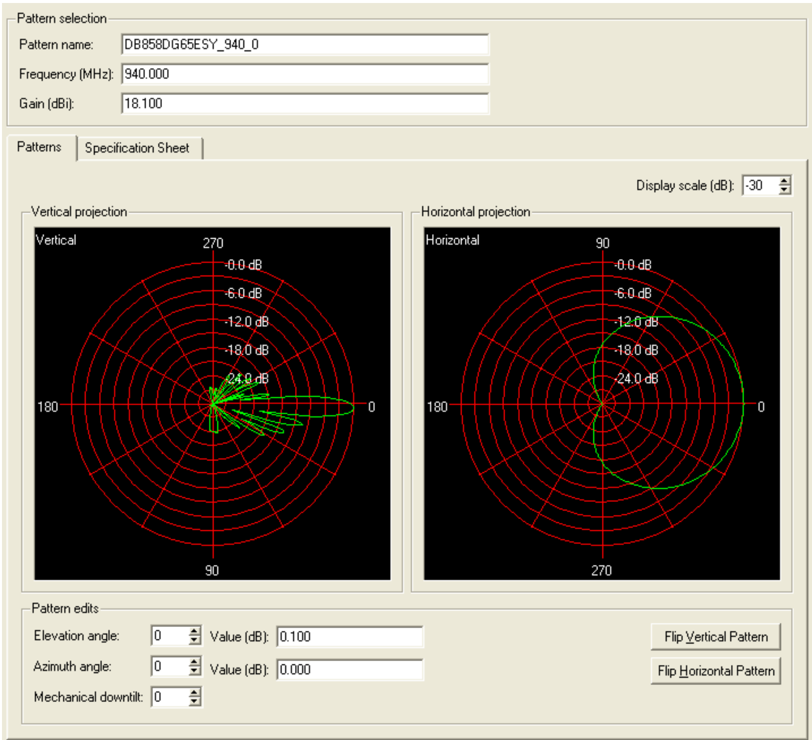
UMWD-06519-2DH



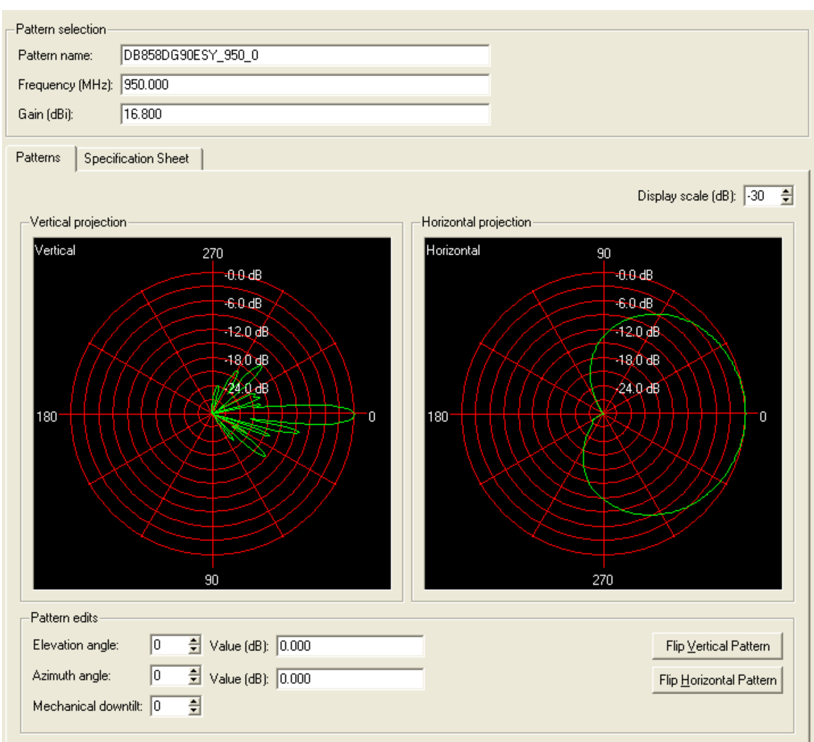
DB932DG65EKL



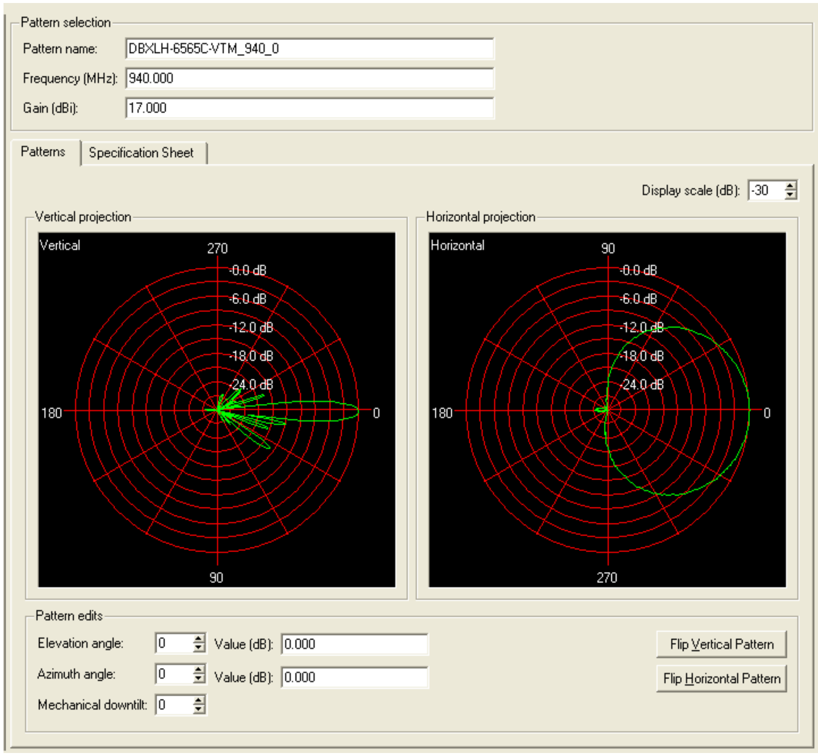
DB858DG65ESY



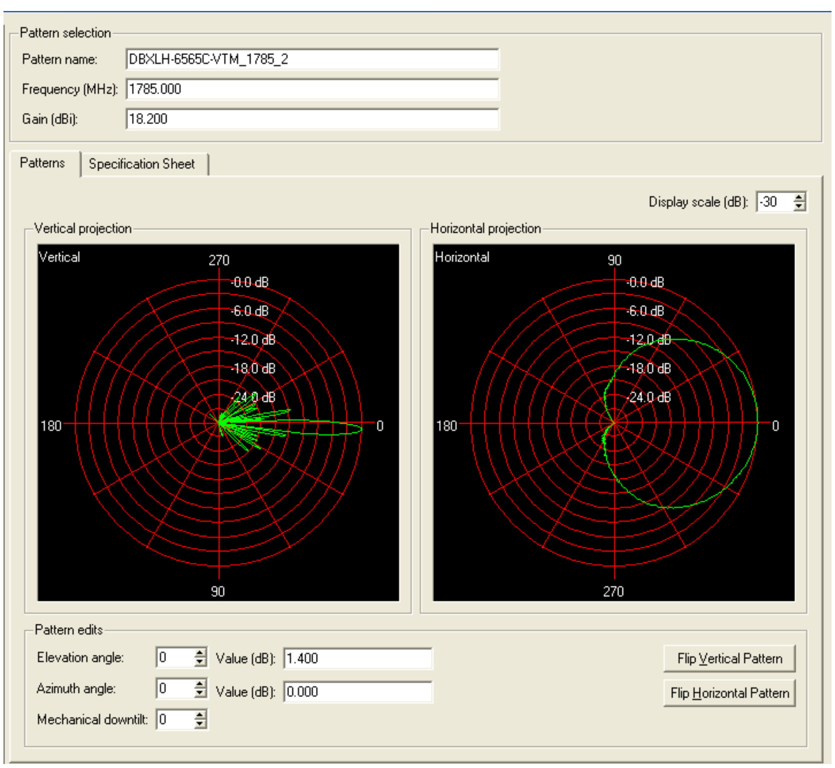
DB858DG90ESY



DBXLH-6565C-VTM at 0° Tilt and 940 MHz



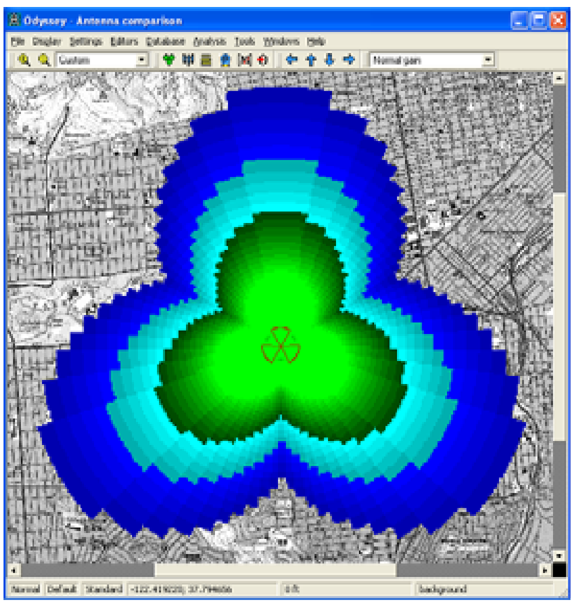
DBXLH-6565C-VTM at 2° Tilt and 1785 MHz



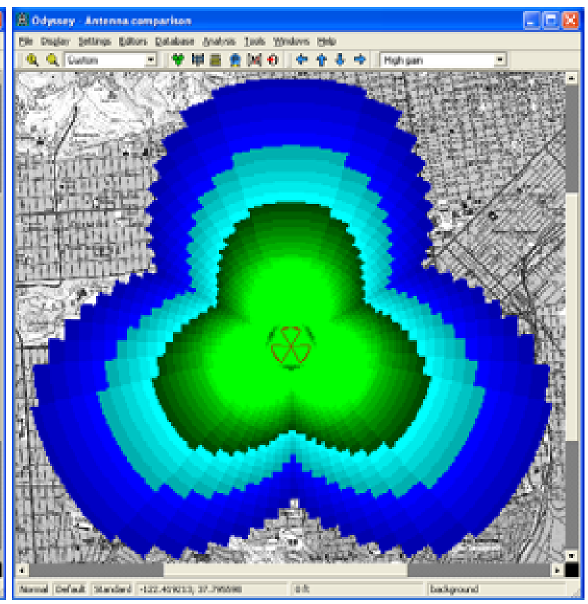
III. Standard Gain Antenna vs. High Gain Antenna Comparison

This analysis compares the 932DG65T2EKL antenna (18 dBi gain) with the UMWD-06519-2DH antenna (20 dBi gain). Both models have 2° electrical downtilt and are using the same frequency band (1800 MHz).

We see that the UMWD-06519-2DH provides better coverage. Because this antenna has a 2 dB higher gain, the average difference in coverage signal level is around 2 dB. In the figure shown on the left, we see the coverage of the standard gain antenna. In the figure shown on the right, we can see the better coverage of the higher gain antenna. There is a significantly bigger area covered by the higher gain antenna, and the border area between the sectors is also much better filled by the higher gain antenna. That can give a significant advantage for the 1800 MHz band, which has lower signal levels than the 900 MHz band. Therefore, it is very important to get as much signal strength out of the 1800 MHz antennas, and the high gain antennas are able to do that.



Standard Gain Antenna

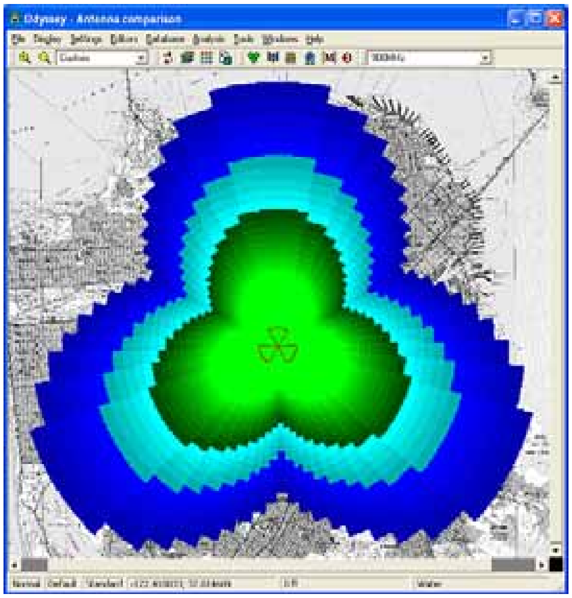


High Gain Antenna

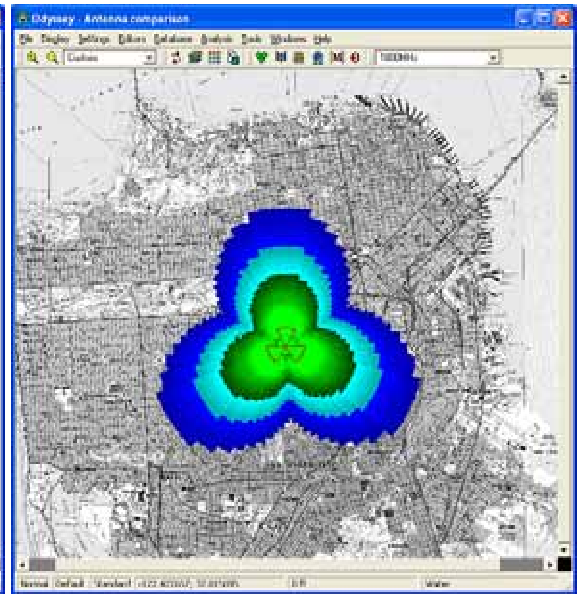
IV. 900 MHz Antenna vs. 1800 MHz Antenna Frequency Band Comparison

This analysis compares the DB932DG65EKL antenna (18.1 dBi gain at 1800 MHz) with the DB858DG65ESY antenna (18.1 dBi gain at 900 MHz). This comparison shows the influence of the frequency band on the coverage because the antenna's patterns and gains are very similar.

7 miles



900 MHz Coverage



1800 MHz Coverage

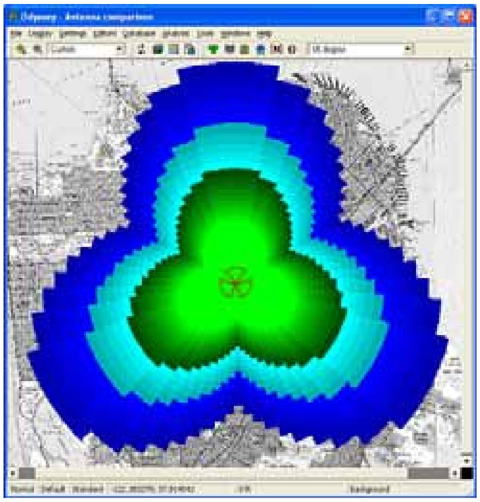
We can clearly see that the coverage area at 900 MHz is much bigger and better than the 1800 MHz coverage. In average the difference in signal strength between these two antennas (and between 900 MHz and 1800 MHz) is between 8–10 dB at any location in that area.

This clearly shows that the 1800 MHz signal levels are of much bigger concern compared with the 900 MHz signal levels. Different tilt levels between 900 MHz and 1800 MHz antennas are common in order to negate that influence.

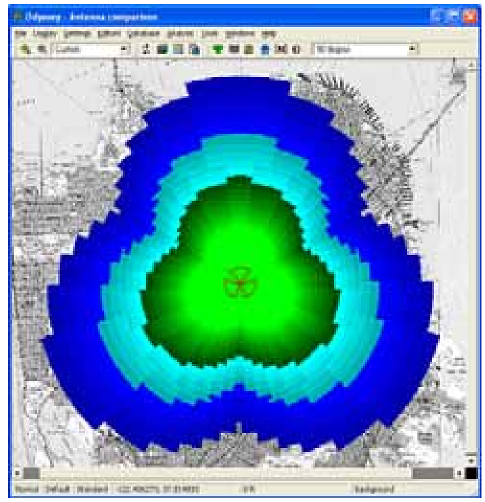
NOTE: In order to calculate these signal level values, standard 900 MHz and standard 1800 MHz model parameters have been used.

V. **65° HBW Antenna vs. 90° HBW Antenna Comparison**

This analysis compares the DB858DG65ESY antenna (18 dBi gain and 65° HBW) with the DB858DG90ESY antenna (16.8 dBi gain and 90° HBW); in order to see how the coverage is influenced by the horizontal beamwidth (HBW) and to see how the different gain affects the coverage area.



65° HBW



90° HBW

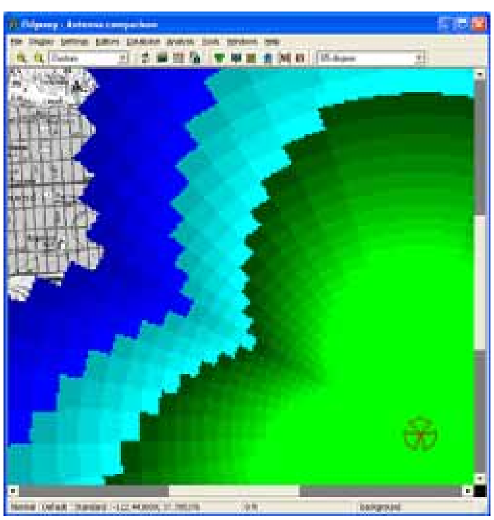
We can see three effects:

(a) The signal strength in the area of the main lobe of the three sectors (0°, 120° and 240°) is slightly better with the 65° antenna (around 1 dB) because of the higher gain of the 65° antenna.

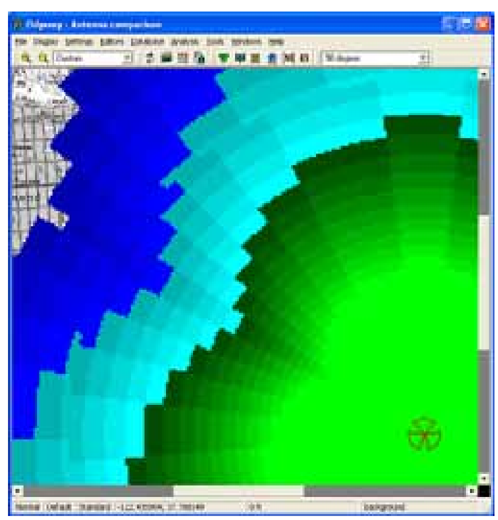
(b) For the area between the sectors (in this case 60°, 180°, and 300°) we can see a significantly better signal level from the 90° antenna of around 2–3 dB because the wider horizontal beamwidth of that antenna fills that area better.

(c) The areas between the main lobe and the sector borders (at around 30°, 90°, 150°, 210°, 270° and 330°) show almost identical coverage. Although the 65° antenna has 1.2 dB more gain, that is offset by the wider horizontal beamwidth of the 90° antenna.

These effects can be seen even more clearly when we look at the zoomed in views shown below.



65° HBW

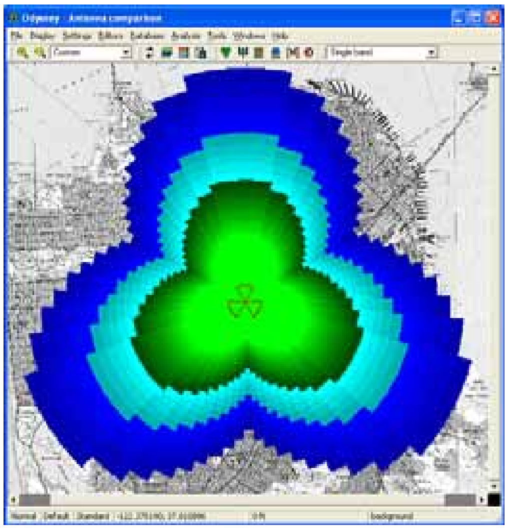


90° HBW

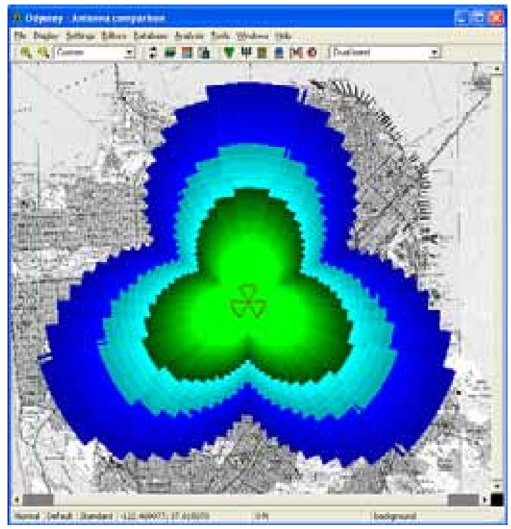
VI. **Two Single Band Antennas vs. One Dual Band Antenna Comparison**

This analysis compares the DBXLH-6565C-VTM dual band antenna (17 dBi gain at 940 MHz and 18.2 dBi gain at 1800 MHz) with two single band antennas 932DG65T2EKL (18 dBi gain at 1800 MHz) and DB858DG65ESY (18.1 dBi gain at 900 MHz), in order to see what the difference is when using two single band antennas in comparison with using one dual band antenna.

We can see that the coverage is very similar at 900 MHz, and the single band antenna is around 1 dB stronger for most of the area because it has a 1 dB greater gain (18.1 dBi compared with 17 dBi), but that does not make a big difference.

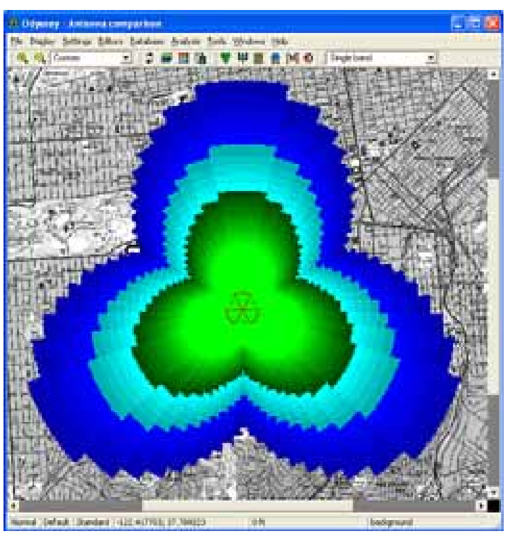


Single Band 900 MHz

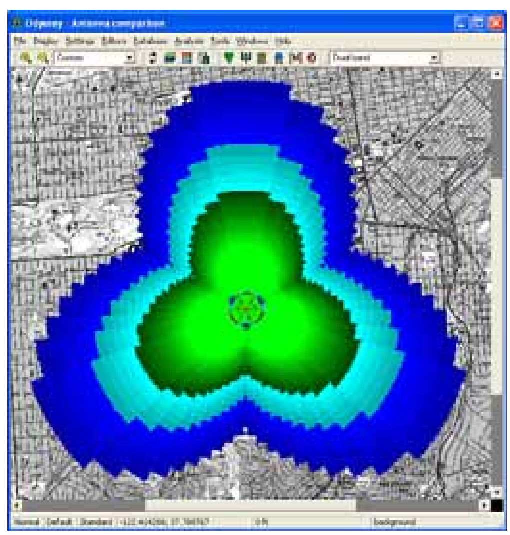


Dual Band 900 MHz

At 1800 MHz, the coverage area is almost identical—very few areas show any difference at all. Please note that the area zoomed in compared with the 900 MHz.



Single Band 1800 MHz



Dual Band 1800 MHz