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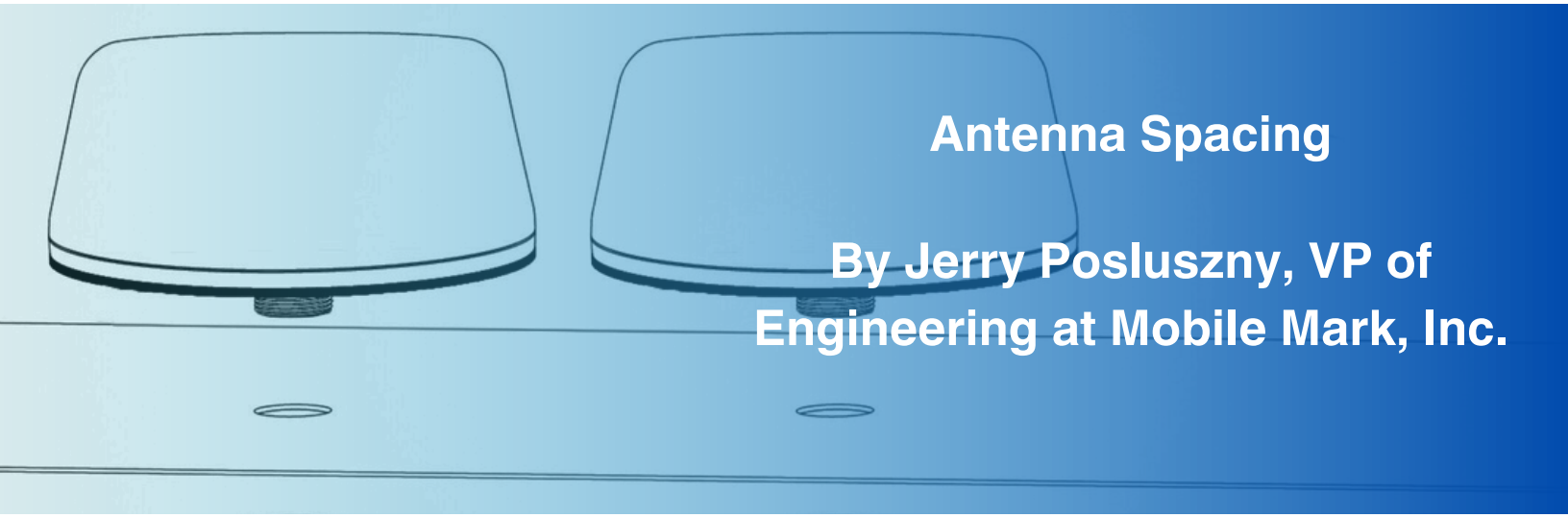

Antenna Spacing

By Jerry Posluszny, VP of Engineering at Mobile Mark, Inc.

How Close Can You Mount Two Antennas?

When two antennas working at different frequencies are mounted near each other they can affect each other's performance. To minimize the effects, we recommend using two old "Rules of Thumb" for antenna spacing.

- The recommended minimum horizontal spacing between two antennas would be one Wavelength at the lowest frequency that either antenna will work at. Of course, a wider spacing can be used without any penalty.
- The absolute minimum horizontal spacing of two antennas would be 1/4 Wavelength at the lowest frequency that either antenna will work at.

How do we calculate the Wavelength?

A Wavelength is the distance that one complete sine wave, at the desired frequency, cycle travels at the speed of light in air. The speed of Light in air is approximately 300,000,000 meters per second. Wavelength is represented by the lower-case Greek lambda, **λ**.

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Here are some simplified formulas for calculating λ in various units.

F_{MHz} = Frequency in MHz

Wavelength in meters: **$\lambda = 300/F_{MHz}$**

Wavelength in feet: **$\lambda = 984/F_{MHz}$**

Wavelength in millimeters: **$\lambda = 300{,}000/F_{MHz}$**

Wavelength in inches: **$\lambda = 11808/F_{MHz}$**

Let's look at an example. The installation requires a 700 MHz Omni-Directional for a Trunking application to be mounted next to a 2450 Omni-Direction WiFi antenna. The lowest frequency that would be used is 700 MHz and we are working in inches. We calculate one Wavelength at 700MHz.

$\lambda = 11808/F_{MHz}$

$\lambda = 11808/700$

$\lambda = 16.868$ inches

$\lambda/4 = 4.217$

Our minimum recommended spacing between these two antennas would be 16.868 inches. To get the absolute minimum spacing simply divide that answer by 4 which gives you a Quarter Wavelength, **λ /4**, of 4.217 inches.

What is the penalty of using a spacing less than one Wavelength?

As the spacing drops below one Wavelength the effects of the second antenna start to cause more distortion in the azimuth radiation patterns. Ultimately the pattern will change from Omni-Directional to more of a Bi-Directional pattern possibly creating nulls in areas that you would like covered.

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When a spacing below **λ /4** the pattern may become more directional, and the antenna tuning may be adversely affected.

The examples have been based on mast mounted Omni-Directional antennas, but the same spacing “Rule-of Thumb” also apply to mobile antennas mounted near each other on a vehicle roof, or surface mounted antennas mounted on a common mounting surface.

This paper refers to Omni-Directional antennas mounted near each other; it does not cover stacking directional antennas. This is covered in another paper.

With the given “Rules-of-Thumb” an installer or system designer can make informed decisions when designing an antenna installation or mounting system.

If you are working on a deployment and still have questions, feel free to contact Mobile Mark / Comtelco Engineering and we would be happy assist you in getting the best possible installation.

To learn more, please refer to our additional White Papers or reach out to speak with an antenna expert through info@mobilemark.com.