Welcome to AntennaSelect™ Volume 13 – August 2014

Welcome to Volume 13 of our newsletter, AntennaSelect™. Each month we will be giving you an "under the radome" look at antenna and RF technology. If there are subjects you would like to see covered, please let us know what you would like to see by emailing us at: info@micronetixx.com

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LPFM stations and water towers

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We are hearing from more future LPFM operators that have been lucky to secure free space on a water tower. We covered mounting LPFM antennas on water towers a few issues back. Let's take a closer look at getting the best performance of your LPFM antenna when mounting on one.

One customer was excited to be able to place their antenna about 50 feet above ground level on a pedestal style water tower. There were already several microwave antennas installed. The only problem with this is the pedestal was 10 feet in diameter.

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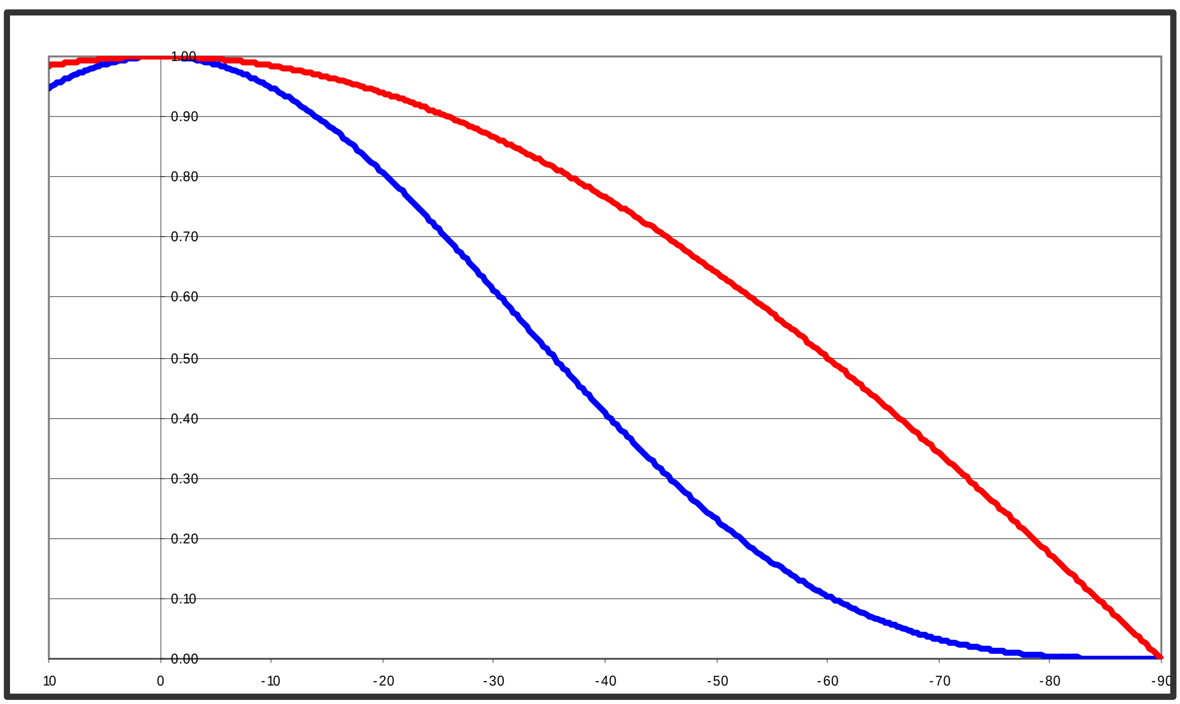
Even with an outrigged pole the large diameter of the pedestal would cause major scattering of the azimuth pattern. Scalloping to the rear of the antenna can be as much as 20 dB. That would make the station effective ERP drop down to 1 Watt at some azimuths.

If you were lucky to be able to place your LPFM above the top of a water tower here are a few things to consider. First, if possible ensure the bottom bay of the antenna is 20 feet (6 meters) above the top of the water tower. Mounting it lower will cause the top of the water tower to reflect some of your signal upward, or out of phase with the main lobe. If a majority of your population is in one direction, try to have the antenna mounted on that side of the water tower.

Another idea to reduce the interaction of the antenna to the water tower top is to use a two bay ½ wave spaced antenna. Lets look at the plot of a single FML antenna bay and two half wave spaced bays. For this exercise, the antennas center of radiation is 20 feet above the top of the water tank. 0 degrees is the horizon, -90 degrees is directly below the antenna.

RED plot is a one bay antenna BLUE plot is a two bay ½ wave spaced antenna



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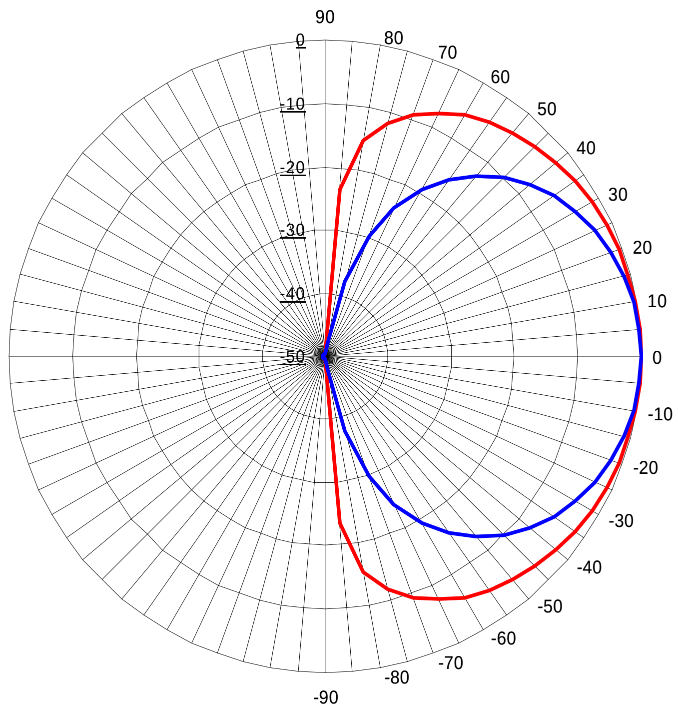
Another way to look at the two elevation patterns is via a Polar plot. The plot has a 50 dB scale, in 10 dB steps. 0 degrees is the radio horizon, -90 degrees is directly below the antenna.

Polar Plot FML 1 Bay RED plot 2 Bay half wave spaced BLUE Plot

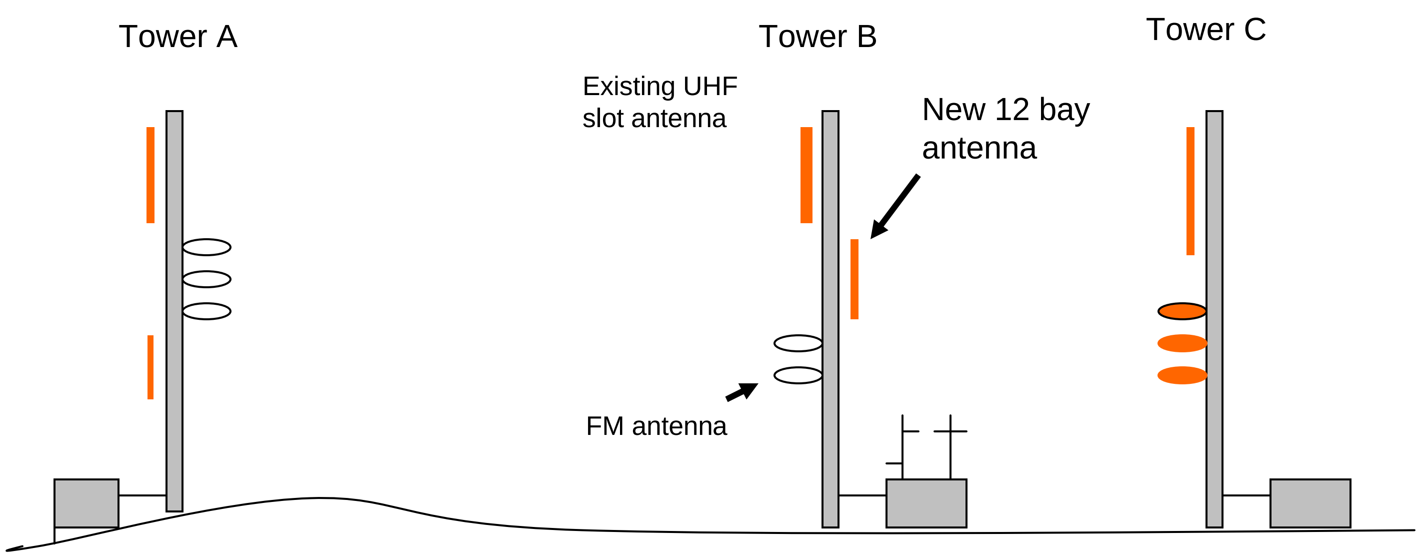


With the center of radiation being just 20 feet above the water tower tank, a -45 degree depression angle would be just 20 feet away from the antenna horizontally Using the single bay antenna pattern this point would be at half the peak ERP. Since you are running C/P, the ERP at -45 degrees would be 100 Watts. That is a lot of energy reflecting out of phase from the water tower. With the half wave spaced two bay antenna the ERP would only be 19.6 Watts at -45 degrees. At -80 degrees, which is only a few feet away from the antenna horizontally, the ERP of the one bay antenna is 34.6 Watts, versus just 3.8 mW for the two bay half wave spaced model. That is a 38 dB reduction in power hitting and reflecting off the water tower.

Passive Intermodulation (PIM) – part 3

Last month we looked at some spectral effects of PIM and how corroded junctions can act as perfect PIM generators. In multi user sites, going to more tightly controlled antenna elevation patterns can reduce radiation above and below the horizon by as much as 25 dB. Also when PIM occurs due to a new user at a site, changing the placement of the new antenna can make a big difference in PIM generation.

Let's look at how changes in transmitting antenna elevation patterns can make a big difference in reducing or eliminating generation of PIM products. In the previous article we looked at how changing antennas could greatly reduce the reflections of the mounting structure, a water tower. We will use the example of a multi user site on a mountain ridge. The towers will be a maximum height of 150 feet. We have just added a new 12 bay UHF antenna to the site. On the next page we will look at the elevation pattern and how much power density is created at steep depression angles.



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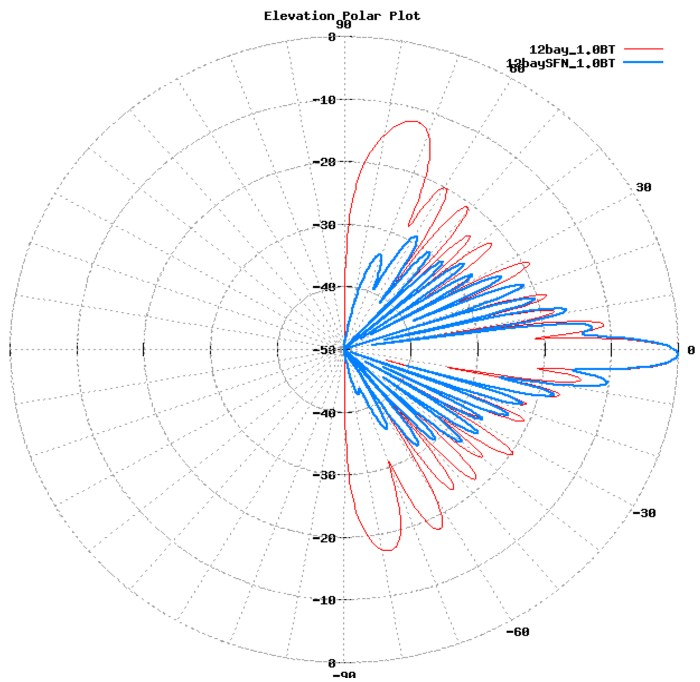
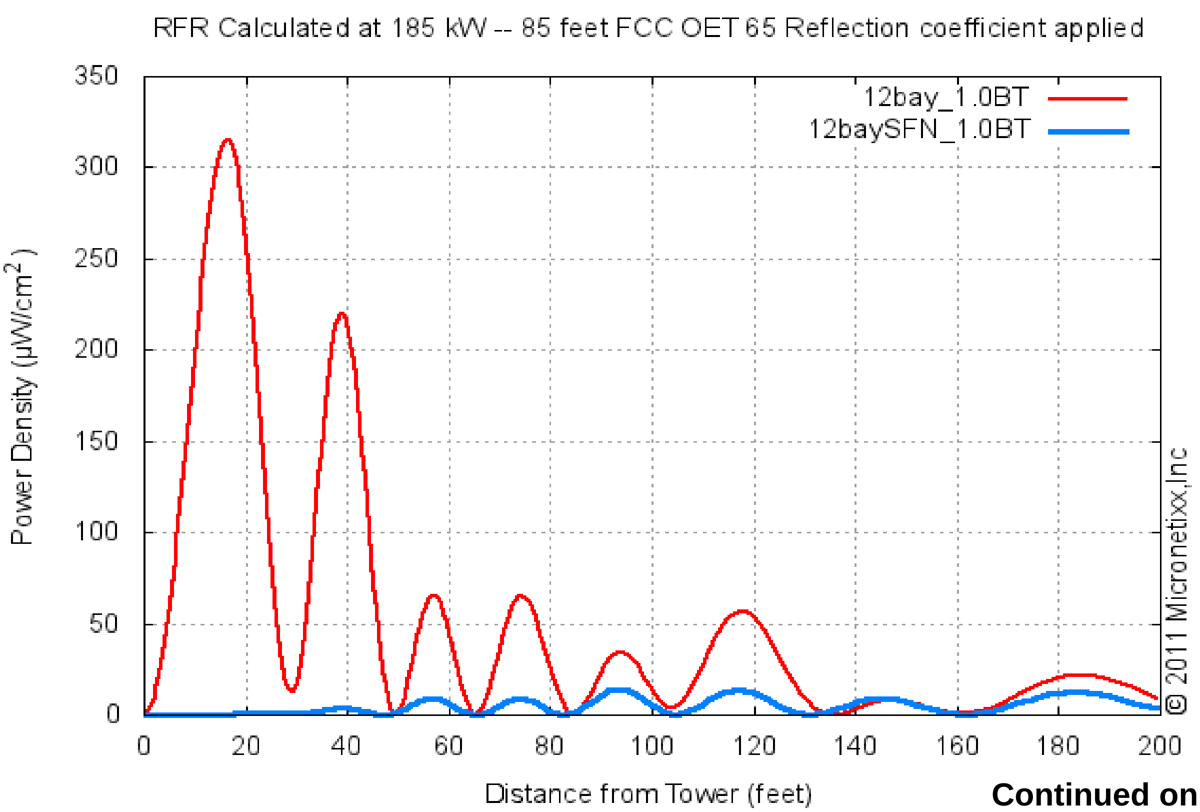


To the left is a polar plot of two 12 bay elevation patterns. The RED plot is a full wave slot antenna, while the BLUE plot is a half wave spaced antenna. The new antenna is mounted 85 feet above ground. The ERP of the station on channel 33 is 185 kW. There is 1 degree of beam tilt as demonstrated by the main beam being just below the horizon.

The 12 bay full wave spaced antenna has much higher grazing lobes at high depression angles than the half wave antenna does. Since the antenna is mounted very low to the ground, radiation between -30 and -85 degrees is just hitting the ground and increasing RFR exposure levels. The plot below shows the power density for both antennas, the full wave model is the red plot, the half wave plot is the blue plot. The lobe closest to the tower is over 100% of public exposure.



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18 feet from tower B the strongest grazing lobe hits the ground, follow by a second one 39 feet away. The half wave spaced antenna also produces lobe at the same angles, however they are 15 to 30 dB lower than the standard spaced antenna. With the half wave spaced antenna there is much less RF energy coupling to tower B and hitting connection to the UHF slot antenna above it and the FM antenna below it. The small communications antennas on the tower B transmitter building are also being hit with much lower RF levels. Lower RF levels may keep some non linear junctions from creating PIM products, or greatly reduce the products that are created. Another advantage to the half wave spaced antenna we modeled is it produces less than 5% of RF maximum public exposure anywhere on the transmitter site. In fact with the half wave spaced model we could have mounted it 10 feet lower and still been under a 5% RFR contribution.

On towers A and C the existing antennas would be hit with about the same RF levels using either the new full wave or half wave spaced antennas. The chances of new PIM products being generated are the same.

Micronetixx offers this half wave spaced technology on both it's VHF high-band (Band III) and UHF (Bands IV,V) as an option.

At multi user sites, bonding of all metallic objects becomes paramount to fighting PIM. PIM generating components can be very small or larger like tower members. On the next page is a picture of what we would call is the perfect PIM generator. The only better PIM generator would be to mount up a dipole with a diode connecting the two elements

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This is either the best PIM generator ever created or the worst mounting of 3” air flex line ever seen. Threaded rod was used for the bottom 4 supports while a wire and turn buckle was used for the top support. The grounding kit lead is held in place by one of the steel bands. The hoisting grip is wrapped around a climbing peg. Any of the supports that do not have a good electrical bond would make an excellent PIM generator. Pity the poor antenna connected to the line as it flexes in the wind.

Coming this fall – Radomes !

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This fall AntennaSelect™ will have some articles about radomes. We will look at different styles of radomes, some materials used to build radomes and the service life of radome systems

Be on the lookout for the next volume of AntennaSelect™ coming out in September

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