Welcome to AntennaSelect™ Volume 14 – September 2014

Welcome to Volume 14 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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Mounting LPFM antenna on cell towers

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Most **LPFM** stations will be installing their transmitting antennas very close to where their listeners are. Many stations will choose to install their antennas on existing cell towers. There are two main types of structures, monopoles and lattice towers. These structures will have some effect on coverage to the rear of the transmitting antenna. If there are multiple towers at a site, try to choose the one with the smallest pole diameter or face width.

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If a majority of the population you are trying to serve is in one direction from the site, installing the antenna so there is no tower between your antenna and the population will provide the best coverage.

Let's look first at using a cell monopole to host an **LPFM** antenna. The monopole will scatter the azimuth pattern mainly to the rear of the LPFM antenna. To minimize the effect of the monopole, using an outrigged pole to mount the antenna on will give the best results. The optimum distance from the monopole to the outrigged pole is 3 feet or about 1 meter. Normally a 2 to 3 inch pole is used to mount the antenna bays. The tower company or your installer can determine the pole size and wall thickness needed for your location.

Other antennas on the monopole can effect the azimuth and elevation pattern of your antenna. For a 2 bay FM antenna 240 inches (20 feet or 6.1 meters) is needed to ensure minimum pattern distortion. There should also not be any antennas mounted at the same elevation on the monopole on the opposite side.

If you are lucky to be able to install your new **LPFM** antenna on a small monopole extension above the existing tower, the bottom of the lowest LPFM antenna bay should be at least 5 feet above any cell antennas mounted below. Also the monopole should extend a minimum of 5 feet above the mounting bracket of the top bay of the **LPFM** antenna.

A lightning rod and good bonding to the cell tower help minimize damage from lightning. Also ground the transmission line to both the monopole extension and the existing monopole with a grounding kit.

A second type of cell tower is a lattice like structure. The face of the tower will scatter the azimuth pattern to the rear of where the antenna is mounted.

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The optimal mounting location for your **LPFM** antenna is off one of the legs of the tower. If there is one general direction where most of your listeners are located, mount the antenna to the tower leg that has the closest azimuth.

If you are locating at a multi tower site try to use the tower that has the smallest face width. Also try to use a tower that has no obstructions (another tower) in front of your **LPFM** antenna.

One other item to watch out for is your antenna will be mounted close to a large cluster of transmission lines on the tower. The transmission lines will act like a reflector and cause significant scalloping of the azimuth pattern. The scallops can be deep as 20 dB, which would reduce your ERP down to just 1 Watt in places. If you are limited to mounting the antenna close to these lines, use an outrigged pole and get the antenna away from the lines as far as possible.

The optimal way to mount your **LPFM** antenna is by using an outrigged pole that is 3 feet or about 1 meter off the tower leg. 20 feet or 6.1 meters of clear vertical space on the tower will ensure the best performance of your antenna. As with the outrigged pole used in the monopole example, the diameter of the pipe should be 2 to 3 inches.

If questions come up about mounting your new **Micronetixx LPFM** antenna, please let us know. Pictures and tower drawings are very helpful to us in advising the optimal mounting configuration. **LPFM** antennas are quite different than the antennas most cell tower installers are used to. The **LPFM** antenna is omni-directional and operates at a much lower frequency (about 8.5 times) than a cell phone antenna. The cell antennas are very directional and are mounted in clusters to achieve the desired azimuth pattern.

Passive Intermodulation (PIM) – part 4

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Last month we looked at how optimizing the elevation patterns at multi user sites can lower the chances of PIM being generated. This month we are going up on the roof. Buildings that are transmitter sites can be a major source of PIM. Antennas are crowded together and there are other mechanical components of the building that can be perfect PIM generators. In many buildings the support monopole systems are less than 30 feet tall. That is just room enough for a small UHF slot antenna, a 2 Bay FM antenna or a 6 dipole business band antenna. That rooftop space is being shared with chillers, air vent heads, and even window washing equipment. Depending on the design of the building, the elevator penthouse may be at the same level or just under the roofline. There is a lot a machinery running a bank of 6 or more elevators.

Even simple things like roof flashing, or a set of rusty door hinges may cause problems. 3 foot long lightning rods with rusty bolts attached to the ground system make perfect PIM generators. The roof flashing may be glued in place with a mastic and the seams between sections held in place by pop rivets. Using an Ohmmeter the flashing seems to have no resistance between itself and the lightning rod near by. But does the bond provide a constant V to I transfer ratio at all frequencies and signal levels ?

And there is that ladder that runs from the roof line to the top of the elevator penthouse. Is it grounded to the building roof system ? Maybe or maybe not. How about the rusty bolts that attach the rails of the ladder to the mounts ? Another potential PIM generator. Do not fault the architect that designed the building, as he or she had no idea that the rooftop would become an RF hotspot one day.

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If there are any metallic components or fixtures stored on the roof together, these can be PIM generators. Unused antennas and transmission lines should be removed from the roof as soon as possible.

If there is a MATV system on the roof check the antennas for rust and corrosion. Many consumer and commercial grade antennas have pop rivets to hold the elements to the feedlines. Even the U bolts can cause problems once they age. A corroded antenna with just a single corroded pop rivet can be a first class PIM generator.

Good bonding of all metallic components on the roof lessens the probability of damage from lightning and also lessens the possibility that PIM will be generated. A well maintained site takes less work than trying to find PIM once it has started.

Radomes for pylon antennas – part 1

Slotted pylon antenna are constructed from steel or aluminum pipe and have a column or columns of slots cut into them. To keep rain or snow from getting inside the pipe, the slots are covered.

The most basic approach is to use plastic inserts that fit into the slot, sealing it up. Antennas for a number of years used this design. There are some drawbacks however. At each slot there is a lot of electrical energy. The plastic material has a very small relative permittivity (ϵ_r) or dielectric constant. With the strong fields passing through it, the slot covers will warm up. When there is rain present, the dielectric constant will increase slightly. This can affect the overall tuning of the antenna slightly. Ice can cause more problems as the tuning of the antenna will be affected more. If there are columns of slots, let say four around on the pylon, the icing may not be equal over all columns.

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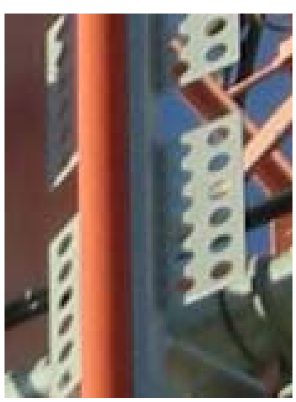
This can cause more detuning problems to the antenna and cause a significant rise in V.S.W.R. . When the antenna is new, the slot covers are clean and have a low dielectric constant. As they age, the sun can begin to break own or pit the outer surface of the slot cover. Dust in the air, or soot from industrial emissions can begin to form in these pits. Depending on the makeup of the dust or soot and where it is deposited on the slot cover, detuning can occur. The material may also increase the dielectric constant so the slot cover then heats up. If it gets hot enough it can fail by melting and falling out of the slot. This exposes the coupler structure at each slot and the inner conductor to direct contact with the elements.

A regular inspection of the antenna should be done with these type of slot covers. Since they are so small, they would not be visible from the ground – so a climb up is needed. Letting water hit the couplers could case corrosion, and the coupler could fail, causing a burn out.

The next step up in slot covers is a small formed plastic strip that runs the length of the slotted area of the antenna. The strip is a few inches wide and an inch or two high. It is held in place by screws or by hold down strips. The plastic material forming the strip is usually UV stabilized and may be pigmented. With this design there is less heating of the material and less detuning sensitivity during rain or icing periods



Typical plastic strip slot covers of competitors side mount UHF slot antennas. The square shaped white one is more prone to ice build up.

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One problem with these slot covers is if the antenna is elliptically or circular polarized. The polarizer elements over the slot will be outside the cover. Also the slot cover may not allow for optimum placement of the polarizers over the slot.

In conditions where ice can be problematic, ice build up on the polarizer changes the 90 degree electrical delay between the slot and polarizer. This affects the proper launch of the vertical signal component in quadrature with the horizontal component. What was elliptically polarized becomes dual linear polarization. Also the ice will affect the tuning as well since the frozen ice is making the polarizer element larger. The ratio of H to V signal component will change and the antenna will detune slightly.

These same effects hold true for antennas that have just the simple slot covers. In icing conditions where elliptical or circular polarization is used, the detuning and H to V ratios will degrade even faster.

Next month we will look at some larger radome systems for slotted pylon antennas. These will all be unpressurized radome systems. At **Micronetixx** we do not use slot covers or strips. All of our side mount slot VHF (Band III) and UHF (Band IV) antennas come with partial or full 360 degree radome systems. All of our radomes are formed as arcs. This approach along with the material we use ensures a long rugged life, and excellent performance during ice events. If you like great performing antennas, we will tell you how we do it.

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

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