Welcome to AntennaSelect™ Volume 33 – August 2017

Welcome to Volume 33 of our newsletter, AntennaSelect™. Every two months 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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Micronetixx has moved into a larger facility

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We have moved to a larger facility just down the road from our current location. The new location is larger in size and will let us add more machining lines and provide more space for products that we test indoors. The layout of the building even makes it easy for us to build 100 foot long antenna pylons indoors. With the TV repack starting and a large uptick in industrial microwave and defense projects, the guys on the shop floor are already enjoying the move.

The new facility is set up with a large entry door that a flatbed can back into. This will be great as the Maine winters can make outdoor loading a cold and slippery chore.

Elevation patterns on broader band antennas

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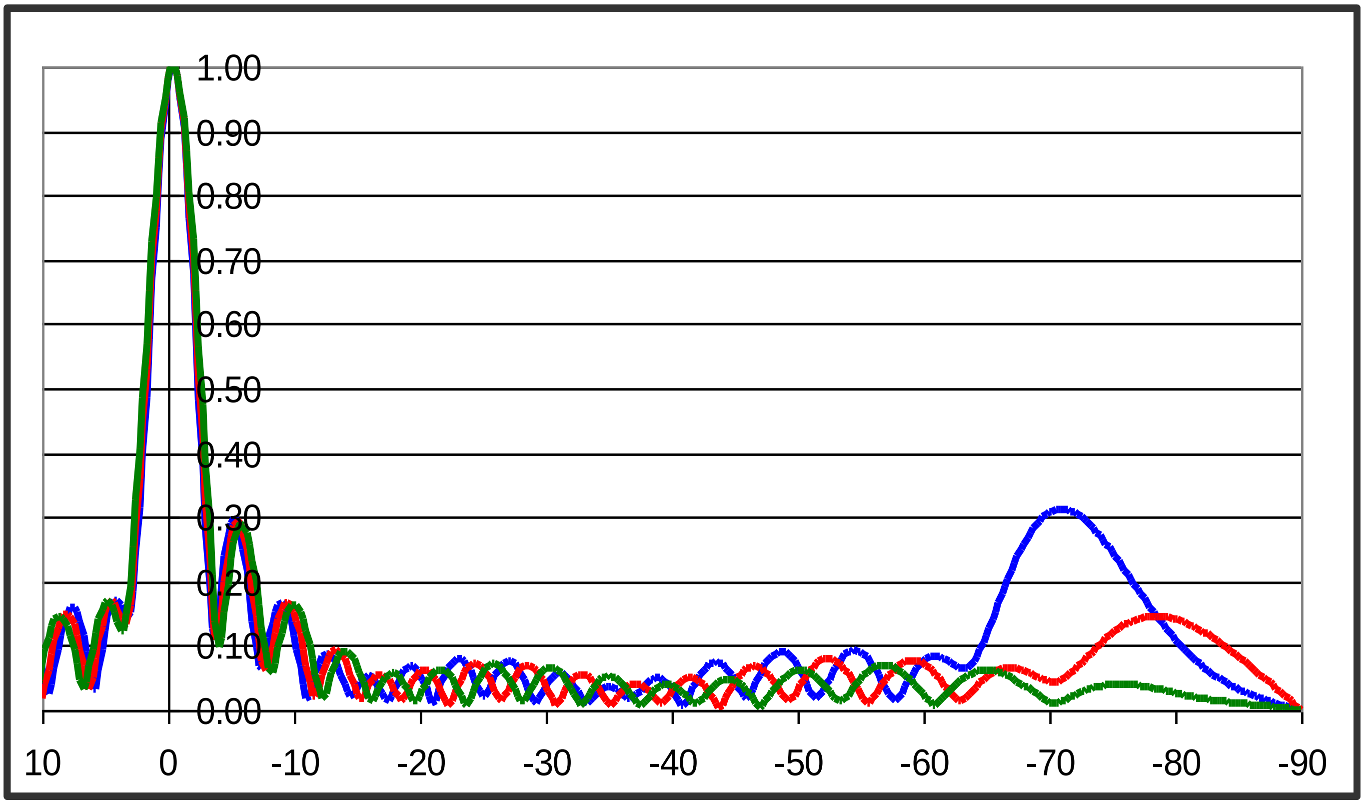
So here is the question of the day from one of our readers. Do the elevation patterns of multiple channel antennas change from channel to channel ? The answer is yes. To show the results we will model a 10 channel wide UHF slot antenna. We will use two 16 bay antenna families, a standard spaced antenna (1 wavelength spacing) and a second with half wave spacing. We will model the antenna for operation from channel 20 to 30. We will set the beam tilt for a half of degree at the middle channel 25.



Here is the plot of the standard 16 bay antenna, with 0.5 degree of beam tilt. The RED plot is at channel 25, the GREEN plot is at channel 20, and the BLUE plot is at channel 30. Note the large lower grazing lobe that has formed at channel 30. As the spacing at channel 30 is more than 1 wavelength, the grazing lobe will get bigger. At channel 20 (GREEN), the spacing is below 1 wavelength. This will suppress the grazing lobe at -75 degrees.

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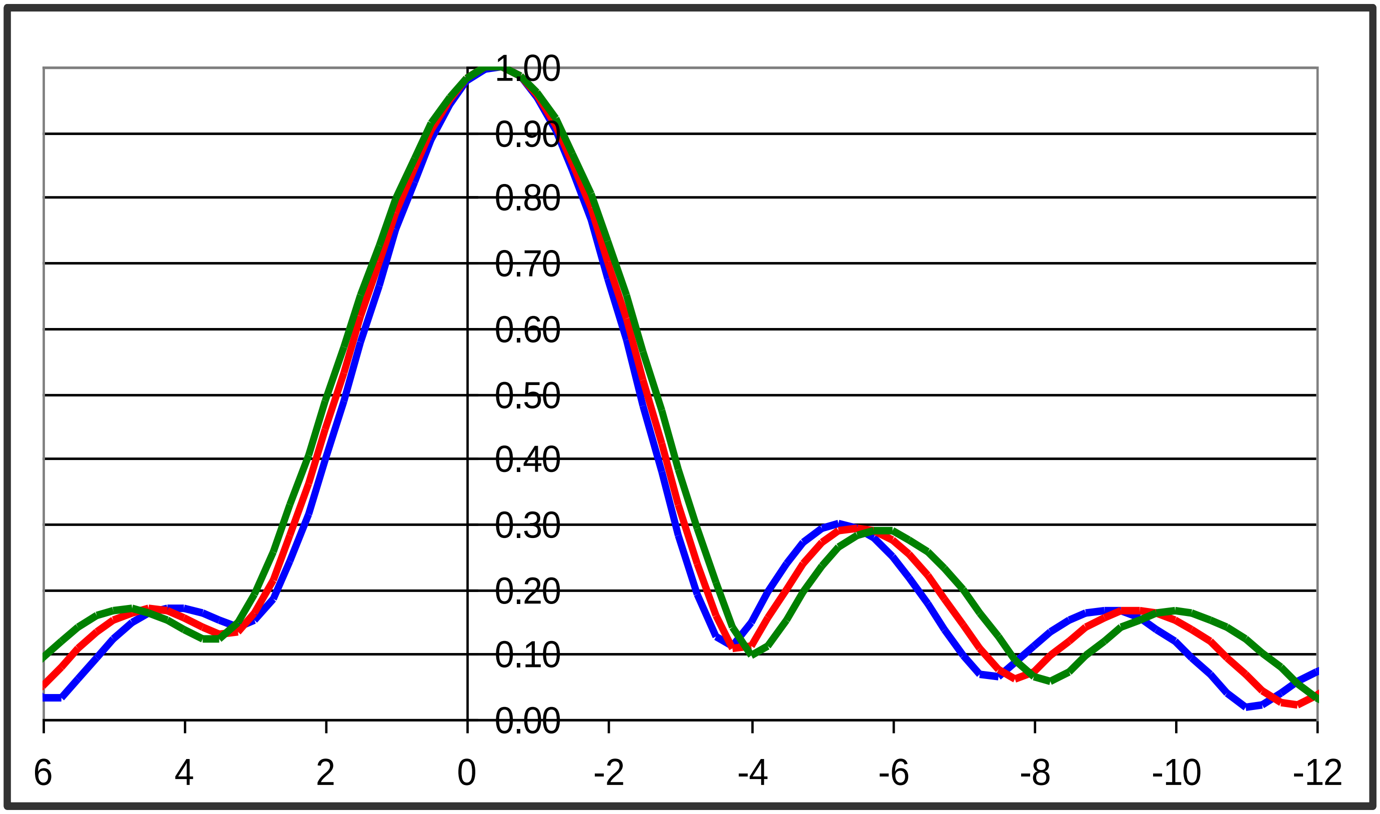

Here is the zoomed in plot of the elevation pattern we saw on page 2. The RED pattern is 360 degree, or 1 wavelength spaced at channel 25. Notice the main beam on channel 20 GREEN is slightly wider than channels 25 or 20. Which of the three elevation patterns has the highest gain ?

A wider beam normally would indicate a lower gain. However the answer is channel 25 has the highest gain (17.45) followed closely by channel 20 (17.27). The gain at channel 30 has dropped to (15.92), mainly due to the high grazing lobe around -70 degrees. As spacing between elements on a full wave antenna exceeds 360 degrees or 1 wavelength, the aperture efficiency of the array drops. The grazing lobe around -65 or -70 degrees becomes even larger, firing a lot of wasted energy towards the ground, lowering the gain of the main beam even more. At channel 20, the aperture efficiency is close to a full wavelength array. The high angle grazing lobe is almost gone, increasing the gain of the main lobe.

Now lets take a look at a half wave spaced array.

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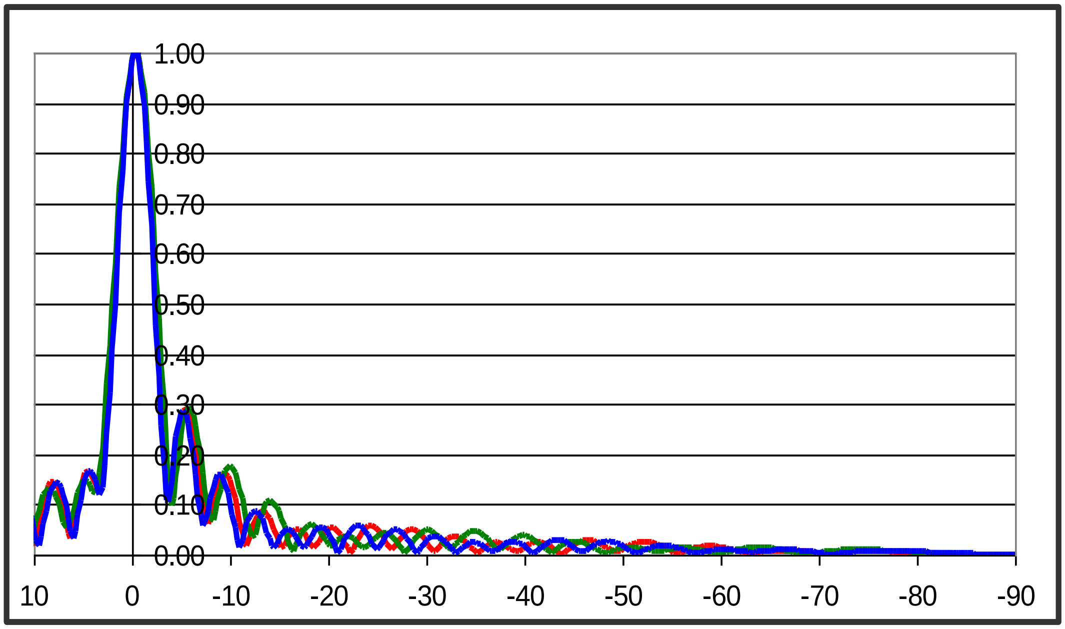
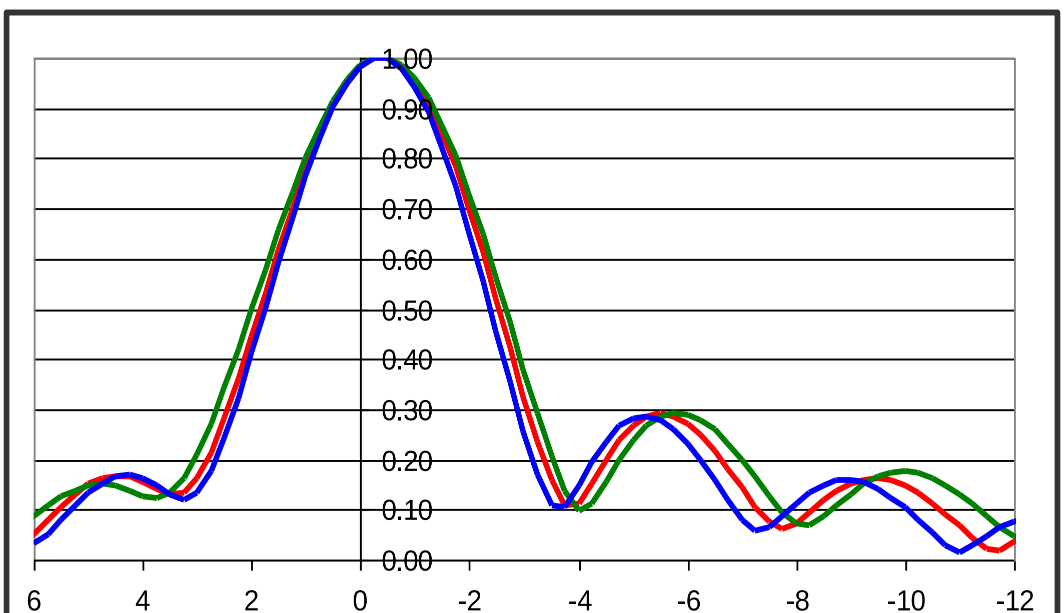


The plot above is for one of our 16 Bay half wave spaced SFN slot antennas. The RED plot is for channel 25, the GREEN is for channel 20 and the BLUE is for channel 30. With half wave and close to half wave spacing, there is very little radiation from about -45 degrees to - 90 degrees. With little radiation at higher depression angles, the elevation gain of the main beam increases over a standard spaced array. In this model the elevation gain is 7.4% higher using the half wave spaced model.

The plot below is zoomed in and shows the elevation patterns between 6 and -12 degrees.



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At channel 25, the spacing between the slots is 180 degrees or a half wavelength. At channel 20, the spacing drops to 170.6 degrees, and at channel 30 it rises to 190 degrees. As the frequency of interest drops, the elevation gain also decreases as the electrical aperture is getting shorter and less efficient. The elevation gain decreases from 18.74 at channel 25 to 17.80 at channel 20. At channel 30 however, the gain goes up due to the longer aperture length at the higher channel (in this case a gain of 19.60).

Looking at the zoomed in elevation pattern on the last page, The main lobe at channel 20 (GREEN) is the widest, and has the lowest elevation gain. Channel 30 has the narrowest main beam, and a corresponding higher gain of 19.60.

Each of the 3 channel has close to 10% first null fill, with the highest channel having (30) having the null at the lowest depression angle. The first null on all three channels is very close to -3.75 degrees.

So yes the performance of a broadband slot antenna does vary over 10 channels or so. The half wave spaced antenna has an advantage of slightly higher gain, and about 20 dB less radiation at high depression angles.

Translator rooftop antenna mounting questions

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A number of questions come up about mounting FM translator antennas on building roof tops. In some markets there are buildings that are 150 feet or more in height, and they do have space for communications facilities. In a number of cases FM translator antennas are mounted small diameter monopoles. These are typically under 25 feet long. A single bay C/P antenna has a gain of 0.49 (3.10 dB), and with a ERP of 250 Watts would take a TPO north of 500 Watts. Mounted 20 feet off the roof, the antenna creates high levels of RFR. Anytime there is work being done on any of the mechanical systems, the station would need to shut down.

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A much better approach when using a short monopole is to go with a two bay half wave spaced antenna. Not only will the RFR levels drop, the reflections caused by outdoor mechanical equipment will decrease.

One reader was lucky to find a small face tower on a building roof top that could hold several small FM antennas. The only have 20 vertical feet of space available on the 75 foot tower and want to put in two translators antennas. Can the antennas share common vertical space ? Yes – in this case the tower has an 18 inch face. The translator antenna (in this case our **FML** series), presents loads smaller than many consumer antennas. So here was our suggestion. Run a 10 foot long set of 3” or so pipe as horizontals. Install a pole on each end of the pipe – for a two bay antenna 15 feet long is ideal. The antennas will be about 5 feet off the tower leg, and be 10 feet apart from each other. There will be some pattern distortion. Since the two antennas are at the same elevation, they will be in the main lobe. What needs to be looked at is how does the transmitter respond to a signal coming back into it from the opposing antenna. Contact your transmitter manufacturer. A band pass or band reject filter may be needed on the transmitter output.

If space had been available, stacking the antennas vertically would have lowered coupling about 40 dB between them. For stacking, a half wave spaced antenna is far superior.

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

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