Welcome to AntennaSelect™ Volume 54– February 2021

Welcome to Volume 54 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

In this issue:

DTV Over-Air Reception – Part 7 VHF Improvements

In the last issue of AntennaSelect™ we discussed briefly about problems some stations were having on Highband VHF. Having too little "real" ERP, lack of receiving antennas that work on VHF and overall less consumer knowledge of over the air reception were major problems.

So a Highband VHF station has given us the keys to the station to fix the problem. In the analog world 316 kW with a 12-Bay antenna was the norm in many situations. So what to do with the much lower ERP in-hand now. Can we make it better? How much better? 20 to 30 dB better in places? Yup !

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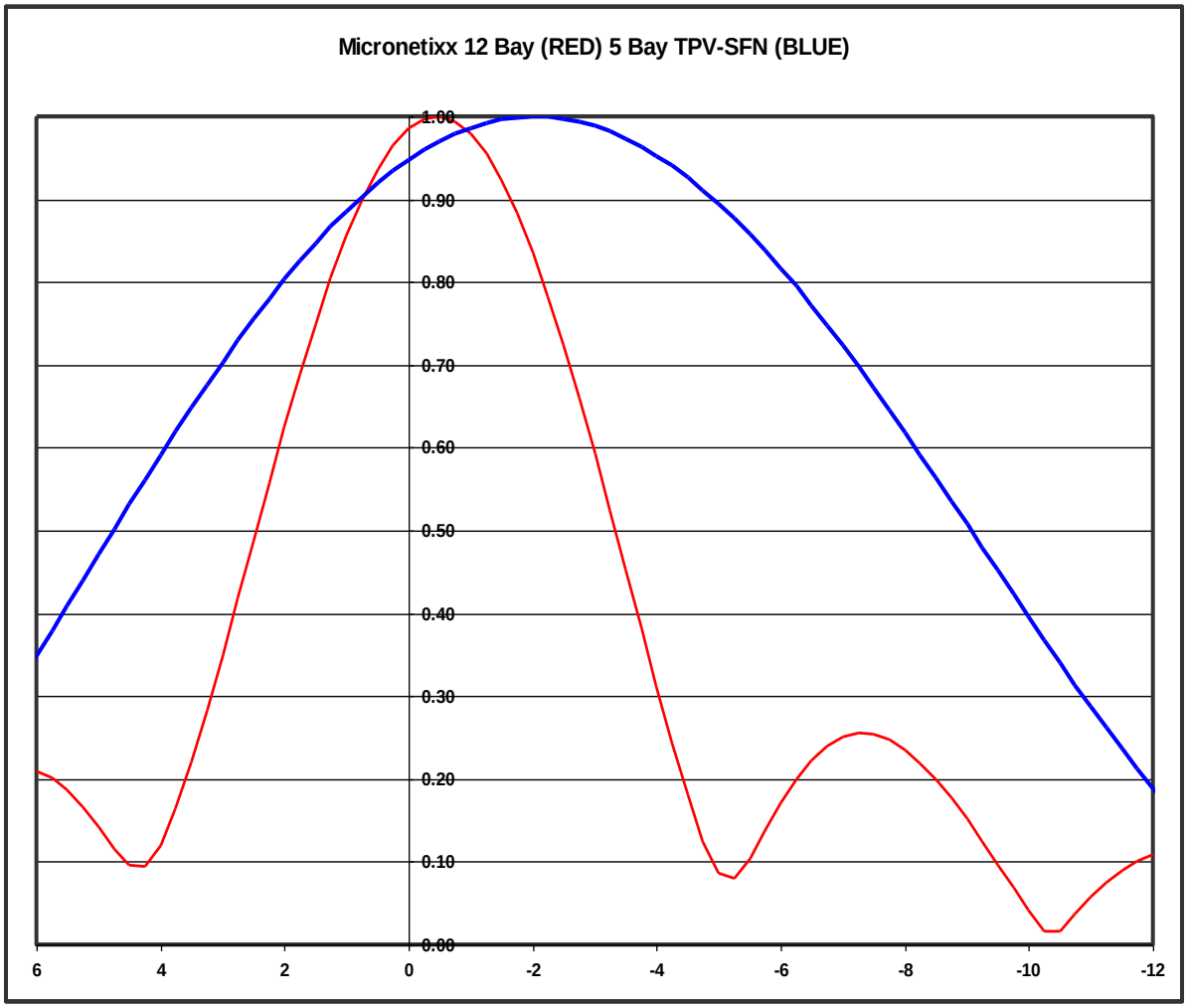

The graph above shows the elevation plots of two antennas, the 12-Bay analog antenna in service, (RED plot), and the new 5-Bay antenna we are studying (BLUE plot). With the 5-Bay antenna we were able to add more beam tilt, (3.50 degrees), and still keep the peak field at the horizon at about 94%. In the good old analog days the station wanted to get out as far as possible. Having as much signal as possible was the way to go.

In the digital era with reception on all sorts of devices, and roof top antennas not so common, the transmitting antenna design becomes just that much more important. So for this study we will use a 9 kW ERP. Using the 12-Bay antenna; anyone want take give a guess at to what the effective ERP is at the first antenna null; (5.25 degrees down)? ("Yikes" is a good guess.)

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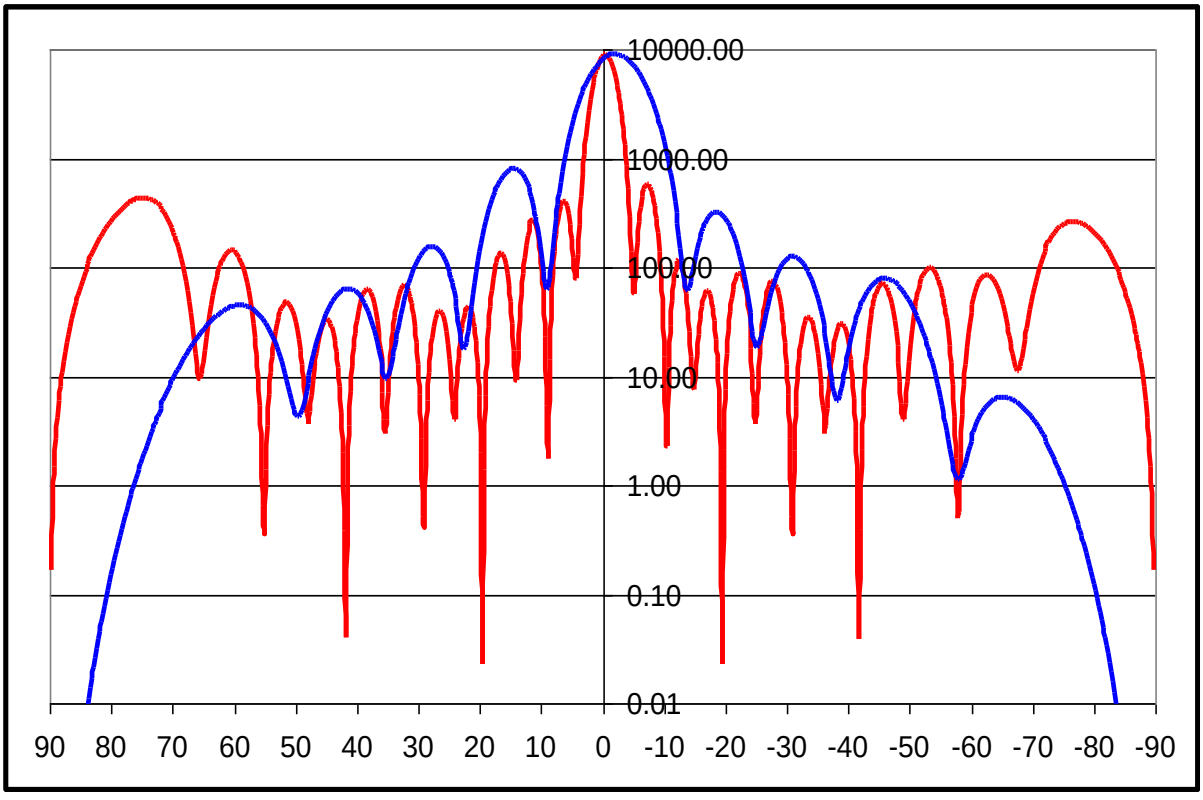
Depression Angle (degrees)	Current ERP	New Antenna ERP	Signal Difference
0.00	8.75 kW	8.09 kW	-0.34 dB
-0.50	9 kW	8.47 kW	-0.26 dB
-3.00	3.16 kW	8.80 kW	+4.45 dB
-4.25	475 Watts	7.95 kW	+12.23 dB
-5.25	58 Watts	6.92 kW	+20.76 dB
-6.25	290 Watts	5.69 kW	+12.92 dB
-8.00	501 Watts	3.45 kW	+8.38 dB
-10.00	15 Watts	1.40 kW	+19.70 dB

The chart above shows the effective ERP of the current 12-Bay antenna versus depression angle, and the effective radiated power, (ERP), of the 5-Bay new antenna we are studying. At the horizon both antennas provide close to the same ERP. Going down in depression angle between about -3.00 degrees and -7.00 degrees is the main population center we really need to cover. At -5.25 degrees the ERP drops down to just 58 Watts. That's the "yikes" answer! At -10.00 degrees which is only 1 mile from the transmitter, we have a whole 15 Watts to work with.

The chart below is a plot of ERP version angle of the two antennas (12 bay in RED – 5 bay in BLUE)



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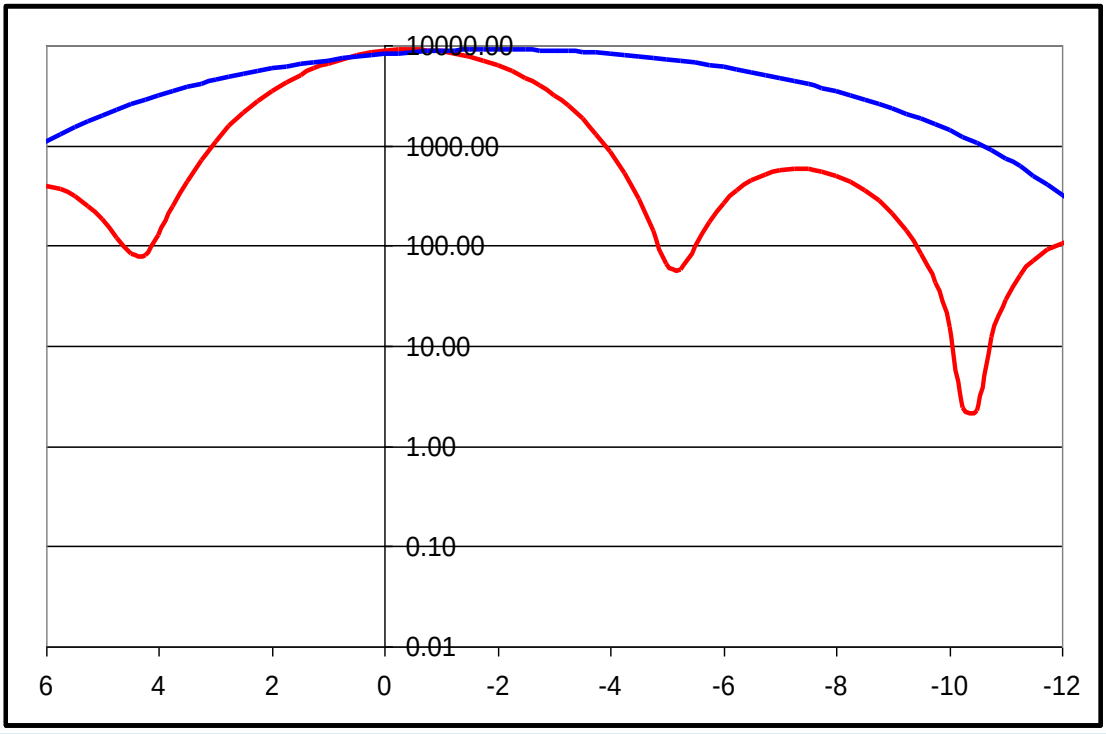

The zoomed in chart above shows the big ERP difference with the new antenna (BLUE plot). A 10 to 20 dB signal boost seems to be the ticket. Now what else could go wrong?

Depression Angle (degrees)	Current ERP	15 dB Faraday loss ERP
0.00	8.75 kW	277 Watts
-0.50	9 kW	316 Watts
-3.00	3.16 kW	99 Watts
-4.25	475 Watts	16.7 Watts
-5.25	58 Watts	1.83 Watts
-6.25	290 Watts	11.27 Watts
-8.00	501 Watts	16 Watts
-10.00	15 Watts	0.47 Watts

Introducing Faraday rotation. Faraday Rotation to a signal happens when a signal strikes an object (hill, large building etc.) and leaves at a different polarization than what it was transmitted in.

The impairment of Faraday rotation can be between 1 and 20 dB. The chart above shows the ERP at different angles with a 15 dB impairment. At -5.25 degrees that leave us less than 2 Watts of ERP… A much bigger “YIKES”!

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Elliptical Polarization to the rescue! By adding Elliptical Polarization to the transmitted signal, impairments from Faraday Rotation are greatly reduced. The polarization sense of the receive antenna becomes less important.

The chart below shows the ERP of the new 5-Bay antenna with Elliptical Polarization, versus the H- Pol only 12-Bay antenna. The power split is 70/30, (42.8% vertical) with the new antenna. Overall there is over 20 dB more signal getting to the viewing public. Having this added polarization guarantees that at least 42.8% of peak signal will be available everywhere..

Depression Angle (degrees)	5 Bay H ERP	5 Bay V ERP	12 Bay Faraday Impaired ERP	Net Signal Difference
0.00	8.09 kW	3.47 kW	277 Watts	+10.97 dB
-0.50	8.47 kW	3.62 kW	316 Watts	+21.58 dB
-3.00	8.80 kW	3.76 kW	99 Watts	+23.50 dB
-4.25	7.95 kW	3.40 kW	16.7 Watts	+22.00 dB
-5.25	6.92 kW	2.96 kW	1.83 Watts	+32.07 dB
-6.25	5.69 kW	2.43 kW	11.27 Watts	+21.91 dB
-8.00	3.45 kW	1.47 kW	16 Watts	+19.62 dB
-10.00	1.40 kW	600 Watts	0.47 Watts	+31.06 dB

We estimate that 90% of the Highband VHF stations having coverage issues are due to a transmitting antenna with too much gain and linear polarization in H-Pol only. Besides greatly improving reception, going to a lower gain antenna can greatly reduce tower loading (think a 30 foot long antenna versus a 70 foot one), and lower costs to the station for the antenna. For low power stations, even a lower gain antenna (3 bays) will cover your market like a wet blanket with 3 kW.

For the FM guys out there, some of the same thoughts about bay-count ring true on FM as well. We have done the homework and would love to share the answers when you are planning your next TV or FM project. Antenna size really does matter.

FM Directional Antennas

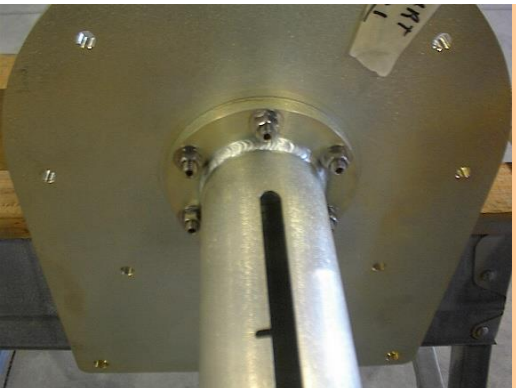
We get a number of inquiries for lower power directional FM antennas. A number of customers look at the proposal and ask, why is a fairly simple antenna so expensive. The FCC requires more testing and proof of performance points for FM Directional Antennas.

To do this we build a model of the antenna requested and run a full set of pattern measurements per the station's tower and antenna mounting configuration(s). The mount could be simple like an outrigged 3" DIA pole, or much more complex like a tower section. Since FCC rules require exacting documentation of both the horizontal and vertical azimuths, this takes a lot of test time.

As a long time manufacturer of FM antennas we get requests for directional antennas with rather odd patterns. Some of these patterns were created to shoehorn in a station for a crowded FM dial. We have turned down a number of requests due to having little or no chance of producing the pattern.

A better path is for the antenna client to tell us what constraints they face and let us propose some ideas that will work. This will help all parties get to a design that can be licensed and put on the air. In the end a well engineered FM antenna gets the signal to the listeners.

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



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