

## **Topband Dx'ing from the East Coast of North America into Japan on 160M**

**By Jeff Briggs, K1ZM/VY2ZM**

**About a week ago in late May 2006, I had the pleasure of traveling to the annual Dayton Hamvention in Dayton, Ohio, USA where I met my old friend Toshi Kusano, JA1ELY. Toshi asked me to write an article for JA Five-Nine Magazine on the subject of Topband Dx'ing from the East Coast of North America into JA which gives rise to this material. What follows are largely my own anecdotal experiences of working DX on Topband for over 30 years and I hope they prove useful to my JA 160M friends. By way of background, I have been active on Topband for several solar cycles now and have worked and confirmed WAZ-40 on 160M from K1ZM and presently have 340 countries confirmed on 160M. I am also an avid 160M contester and have the claimed world record score for 160M for the CQ Worldwide CW DX Contest, this set from my station at VY2ZM on Prince Edward Island, Canada, CQ zone 5, in November 2005.**

**When I first started operating on Topband, I experimented initially with all sorts of antennas. I tried a high inverted vee dipole at 45m high (and still use this antenna as a backup system occasionally today), a single inverted L, a single  $\frac{1}{4}$**

**wave vertical with over 300 on ground radials and, finally, phased vertical arrays of multiple radiators in combination. These experiences, taken over time, have convinced me that from the Northern hemisphere, the very best results on Topband for contesting and Dx'ing will be achieved from a vertically polarized system of multiple radiators in combination.**

**As can be seen in any vertical handbook, here are the representative performance numbers for the most common vertical systems that can be employed by Topband amateurs today:**

**Single  $\frac{1}{4}$  Wave Vertical - omnidirectional pattern – low takeoff angle making it a very good transmit antenna for dx'ing and contest work. Requires at least 66 on-ground radials to work well or perhaps 12 elevated radials as an alternative (I prefer on-ground radials personally.) Using a single vertical for xmit usually requires separate listening antennas (beverages, loops, K9AY, pennant) as the single vertical can be noisy on Rx.**

**Phased Pair of  $\frac{1}{4}$  Wave Verticals –  $\frac{1}{4}$  wave spaced “End Fire” array – This is a better system than a single vertical because it can provide gain and front to back in two directions. When the elements are fed with 90 degree phasing using a**

**quadrature hybrid coupler (Comtek Systems or other) a cardioid pattern results with a broad forward lobe and about 3db of gain and a typical front to back ratio of from 10-12db. Reversal of the hybrid to switch the 90 degree phasing delay to the rear element produces the second pattern – again end-fire, which allows the antenna to be used for two directions on xmit with similar performance numbers. Such an antenna can usually be used for Rx as well as Xmit because of the gain it develops and the front to back ratio it produces which often allows cancellation of incoming noise from the less-favored directions.**

**Phased Pair of  $\frac{1}{4}$  wave Verticals –  $\frac{1}{2}$  wave spaced**  
**“Broadside” array – I personally like this system very much and I often refer to it as the “building block” for most of my 160M xmit systems that I have employed in recent years. The only drawback to this system is that the  $\frac{1}{2}$  wave spacing between the two elements is 266 feet (81.09m) which means that a large piece of land is required in order to erect this antenna. It is important to note that this antenna is a broadside array; the best patterns are created when the two elements are fed “in-phase” with zero phasing – and radiation occurs at right angles to the line drawn between the two elements. The broadside pattern is a bi-directional pattern with about 4 db of forward gain and deep nulls off the sides of the antenna. If one side of the array is fed with an electrical  $\frac{1}{2}$  wave coaxial delay line, this**

**antenna will change its pattern to an end-fire array with about 2 db of bi-directional gain in each of the offset end-fire patterns – which means the antenna can be used for (4) directions on xmit. Please note that the most gain occurs in the broadside configuration due to the better spacing – so this system should be aligned on the ground to aim the “broadside gain” in the two most preferred direction for Dx’ing. From the East Coast of North America, I always plant my elements in the NW and SE headings, so the antenna fires NE and SW with 4db of gain. This gives me meaningful performance to Europe from K1 and VY2 and also gain into KH6/VK/ZL off the rear of the antenna at the same time!**

**Phased Pair of  $\frac{1}{4}$  wave Verticals –  $\frac{5}{8}$  wave spaced broadside array - If more property is available, this configuration provides the most performance possible from a two element vertical array system. This system spaces the two elements 336 feet apart (102.43m) and this is why it produces more gain than a  $\frac{1}{2}$  wave spaced system. When fed at zero phase, the broadside gain is 5.2db in a bi-directional propeller pattern. And, when one side of the system is lagged at  $-180$  degrees using a  $\frac{1}{2}$  wavelength electrical coaxial delay line, the resulting end-fire pattern is about 2.5db, again bi-directional in the less preferred two end-fire directions. (I will come back to this system and describe how it can be used in a (4) vertical radiator driven array such as that used today at VY2ZM.)**

**Classic 4 square Array – 4 vertical radiators spaced in a square with  $\frac{1}{4}$  wave spacing down the sides - This system is quite common on 80m today and some amateurs with large parcels of property are even using it on Topband. The sides of the array are  $\frac{1}{4}$  wave apart in a square configuration (133 feet or 40.54m) and the diagonals of the square are about 188 feet or 57.31m. In this system a quadrature hybrid coupler feed is employed (Comtek Systems or other) which produces outputs at -180, -90, -90 and 0 degrees phasing. A relay system switches the phasing around the square at 90 degree increments which allows “electrical rotation” of the 4 square in each of (4) preferred directions. The system produces 5.68db of gain in each of the four headings and a front to back ratio of 24db is typical. From the Northeast USA, one usually sets up the ground layout with the diagonals NE/SW and NW/SE – as a 4 square array fires its gain along the diagonals which means gain is directed from NY or VY2 at Europe, Japan, Brazil and KH6/VK/ZL. This system is also an excellent receiving antenna and most often I find I do not need beverages when such a system is employed.**

**The VY2ZM 160m Xmit Array – Four  $\frac{1}{4}$  wave Verticals in a rectangular layout – fed as a 2 x 2 driven array – This is my personal favourite xmit antenna for Topband because it produces the most theoretical gain possible from a four**

**radiator system. It beats a classic 4 square array by about 2.5db in forward gain in the favoured patterns. I said earlier that I would come back to the two vertical array with 5/8 wave spacing in a broadside pattern (5.2db gain bi-directional propeller pattern at right angles to the line drawn between the two radiators) as this is the building block system for the VY2ZM antenna of today.**

**The VY2ZM array on Prince Edward Island Canada is a rectangle with 5/8 wave spacing across the front and 1/4 wave spacing down the sides.**

**Example:**

**Europe**

**Ant 1 -----5/8 wave spacing -----Ant 2**

**1/4 wave**

**1/4 wave**

**Ant 3-----5/8 wave spacing-----Ant 4**

**VK/ZL**

**In this system, it is necessary to think of Ant 1 and Ant 2 as the front leading element and Ant 3 and Ant 4 as the rear following element. Ant 1 and Ant 2 are fed with  $\frac{3}{4}$  wave electrical length phasing lines to a TEE connector.**

**Ant 3 and Ant 4 are also fed with  $\frac{3}{4}$  wave electrical length phasing lines to a second TEE connector. The use of  $\frac{3}{4}$  wave lines allows both TEE connectors to reach the center of the array where feed, phasing and directional switching takes place.**

**In its simplest form, if the front pair of elements (at the front TEE connector) is fed at**

**-90 degree phasing through a hybrid coupler and the rear pair of elements (at the rear TEE connector) is fed at 0 phase, the resulting gain is about 8 db of forward gain in a**

**unidirectional pattern aimed at 55 degrees true bearing – in other words at Europe from VY2ZM. The front to back ratio is only a modest 10-12 db but the forward gain is what is most important with this system and that was the principal design consideration for the array when it was conceived.**

**If one switches the hybrid coupler so the rear pair of elements is now lagged at -90 degrees and the front pair of elements (the Europe side of the array) is fed at 0 phase, the array now fires a singular lobe at VK/ZL – again with about 8 db of forward gain.**

**Other patterns are available with this system and are routinely used at VY2ZM:**

**North and East – two directions simultaneously – each with 6.0 db of forward gain**

**South and West – two directions simultaneously – each with 6.0 db of forward gain**

**NE and SW – bi-directional pattern – Europe and USA – each with 5.0db of forward gain**

**NW and SE – bi-directional pattern – KL7 and PY – each with 3.0 db of forward gain**

**From my experience over the years, working JA from New York on the East Coast of North America is possible twice daily during the Winter months – short path to the North (sometimes skewed to the Northwest) at sunrise 1200/1225z and again at East Coast sunset (JA sunrise) via the SE heading (155 degrees from NY and Cape Cod) via the long path 2120z-2155z – as sunrise crosses JA.**

**From PEI this sunset opening follows a very different routing which is directly over the North pole. I found this to be a curious anomaly from that experienced further South when I was operating from NY or from Cape Cod in Massachusetts. My JA friends tell me they also aim directly over the North Pole to work me on 160m from 2020z until 2215z when I am at VY2ZM. It took me some time to recognize the polar routing when I first moved to Canada as it was so different and not expected compared to my experiences at Sunset from NY and Massachusetts.**

**Over the years, the best signals coming to this side are JA1JRK, JA8ISU, JA1HQT, JA5DQH, JA1CGM, JA7NI, JA7QVI, JA8WKE, JA7BXS, JH1HDT and JA4DND. I have worked these JA friends from New York many times and most of them now from VY2ZM. From VY2, I aim my antenna due North over the pole starting at 2020z until JA SR occurs**

**in Western Japan around 2215z. The best signal from SW Japan is Shu-san JE6KYA, always with a remarkable signal.**

**It is quite possible to work into the East coast from JA if a vertical system is employed and preferably one with more than one element in order to produce gain and front to back ratio. With multiple vertical elements, beverages are not necessary (usually) as at VY2ZM I always listen on my xmit antenna! This may sound strange, but I can only report what has worked best at my home for many years.**

**I should point out that it is possible to work VY2ZM at VY2 sunrise as early as the end of September at the bottom of the solar cycle. For example, I usually work JA8ISU starting in early October each season but it is more common to work JA on the shortpath during November and December. Usually the period from 15 December – 15 January is the best time to look for the East coast from 1130z-1230z (shortpath) and again over the North pole (2020z-2215z) by beaming over the North pole from Japan.**

**Lastly, I should note that there is a slight difference in the heading of signals from NY and VY2ZM (as noted on my side). From NY, at sunrise 1200z, JA signals begin coming from the SW early on, then shift to the WEST as sunrise approaches – and then peak and fade out from the NW**

**heading – I usually can copy JA on a good day until 1235z or so from NY.**

**From VY2ZM, the path routing to JA is almost always directly over the North pole starting just after JA sunset at 0730z with the opening decaying slowly over time as sunrise approaches on Prince Edward Island each morning. The opening is strongest just after JA sunset with very rapid, intense polar absorption taking place the entire time. JA stations may answer one of my CQ's with a strong signal at first but by the time I answer them and send a report, they have all but disappeared on the next over with signals almost indiscernible in the noise. Then within seconds they again will reappear again with a steady, reliable signal for a few fleeting seconds only to disappear again within seconds as the QSO continues.**

**The best JA signals come from those with vertical arrays such as that employed by my friend Kaz, JA8ISU. I know he is using a vertical xmit array – so therein lies the secret to the story! You will do better on Topband from JA with a vertical system if you wish to work into the East Coast of North America – so, please go vertical on xmit if you can, with more than one element – if you can manage it!**

**Good Dx'ing to all my JA Topband friends! I hope to work many of you from K1ZM and VY2ZM during each Winter season....**

**73 JEFF K1ZM/VY2ZM**

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