WCARC Beacon Project

Update 2
June, 2008

Doug Leach – VE3XK

WCARC Beacon Project

Status Report

- **Enclosure complete - houses up to six beacon modules**
- **70CM module has been running flawlessly for 8 wks into 70CM KU4AB omni antenna mounted on a PVC conduit mast at about 10 ft up pending tower mount**
- **Heard in Cumberland, Kemptville and Perth**
- **135CM module has been working for almost a month into 135CM omni antenna on second PVC conduit mast, about 10 ft up pending tower mount.**
- **Also heard around area with slight chirp. That's the way that commercial product works.**

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Status Report (cont)

- **Kieran - VA3KS has decided to restore operation of his 2M store & forward SSTV repeater, so 2M is now available for WCARC weak signal beacon use.**
- **Sean - VE3HXP is donating a GE Mitrek handheld for an interim 2M beacon pending WCARC buying a TA-51/144**
- **Our KU4AB 2M omni order had been switched to a 6M omni for use initially with W4TAA's 6M beacon.**
- **We need to now re-order that KU4AB SQ-144.**
- **Soon we will hang the enclosure and mast 58" (1/4 wave on 6M) off the side of my tower with 3 bands.**
- **While beacon is here we will continue to use my 15A internal power supply with 115VAC run up my tower.**

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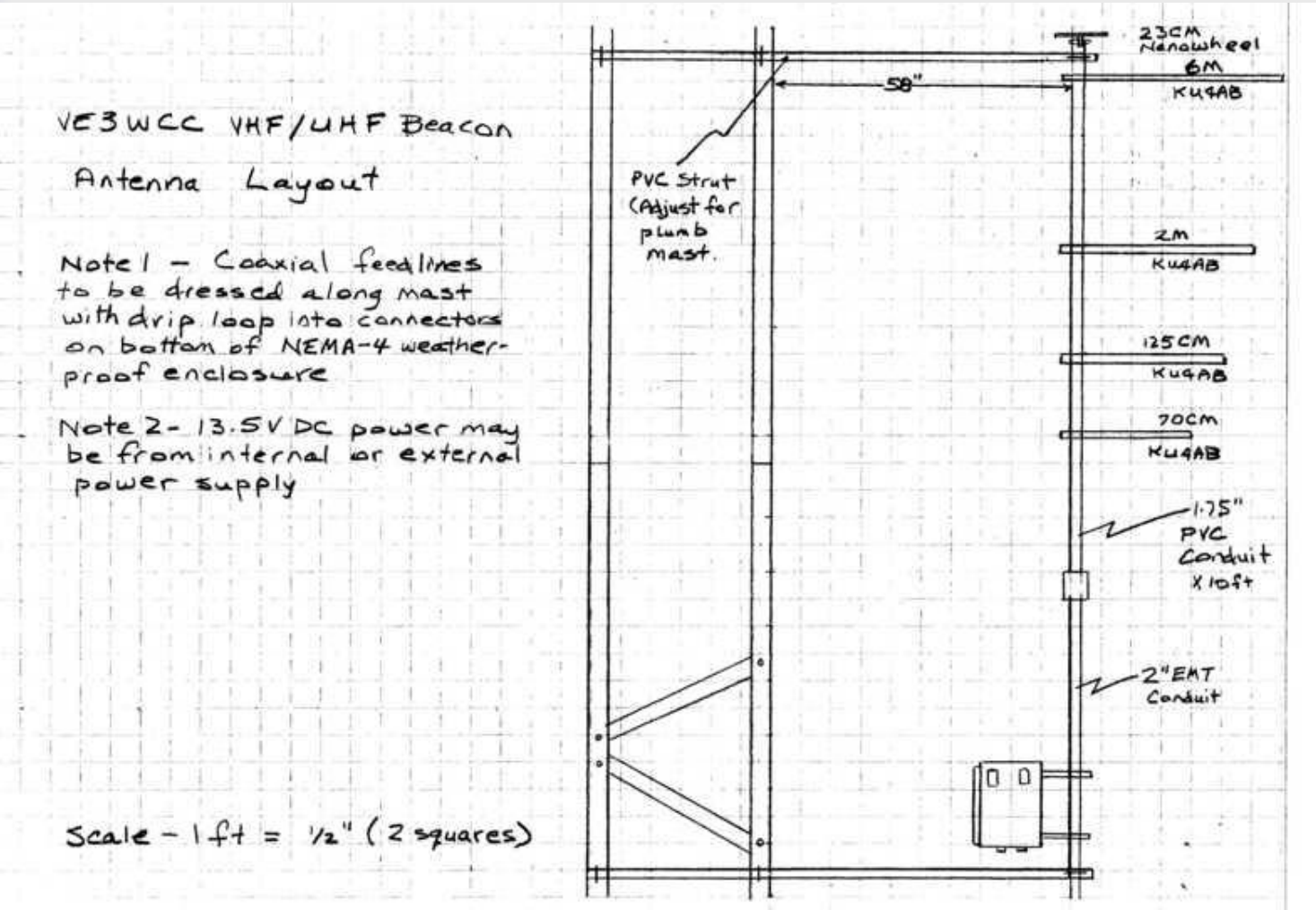

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- **U-bolts on tower allow L-bracket and strut to slide in (for access) and out to the 58” spacing.**
- **With the proposed Tree configuration, the 6M omni is on top, a half wave at 6M above the enclosure, with the lower band omnis each spaced their half wave below their neighbour.**
- **In theory, the smaller antennas would have minimal effect on the larger 6M antenna, and the 6M antenna is outside the capture areas of the smaller antennas.**
- **The future 23 CM “Nano-Wheel” antenna must be mounted on top of the PVC mast with a pipe clamp around the coaxial connector.**
- **Before thinking 23CM let’s examine our other antennas**

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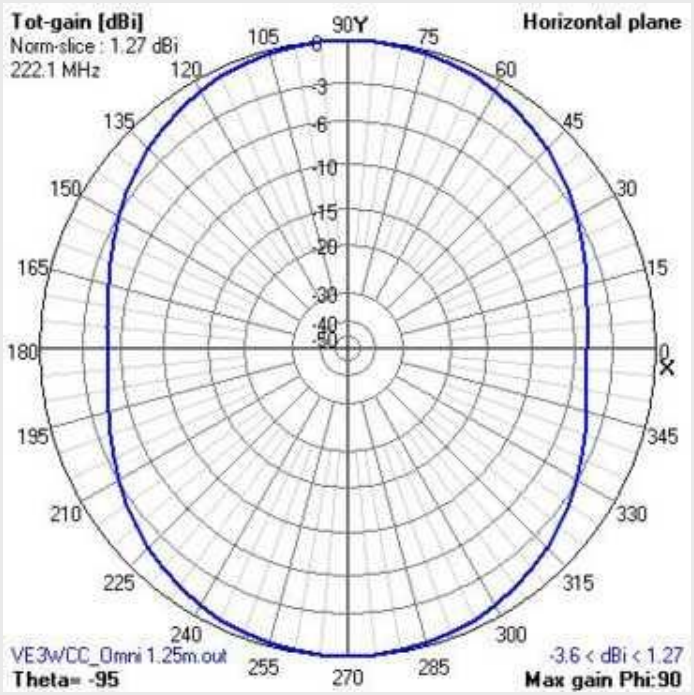

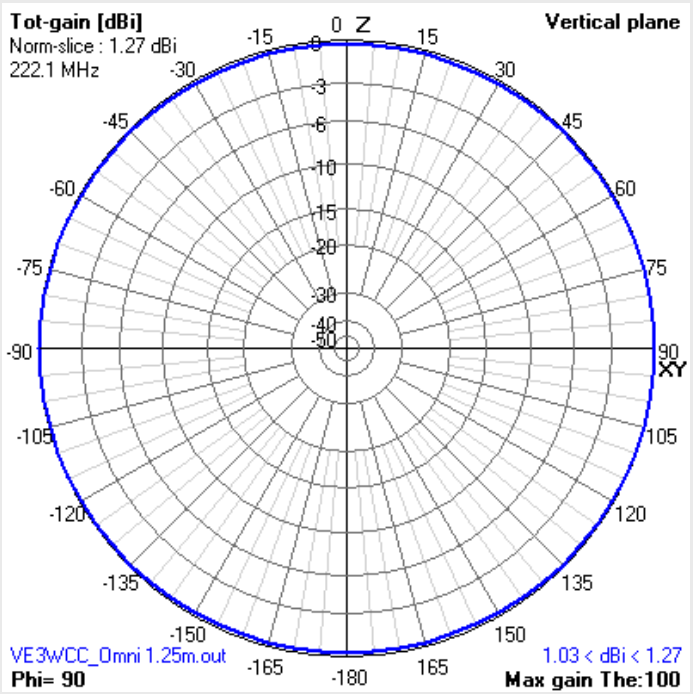

- **Typical KU4AB Omni (<u>Free Space</u>). Note the surprising amount of Vertical Plane radiation (Both Left Hand & Right Hand circular polarization at high angles!)**

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- **If the KU4AB omni antennas are pretty marginal as stand-alone antennas in Free Space, how is one of them going to perform in the proposed Christmas Tree configuration over a Perfect Ground?**

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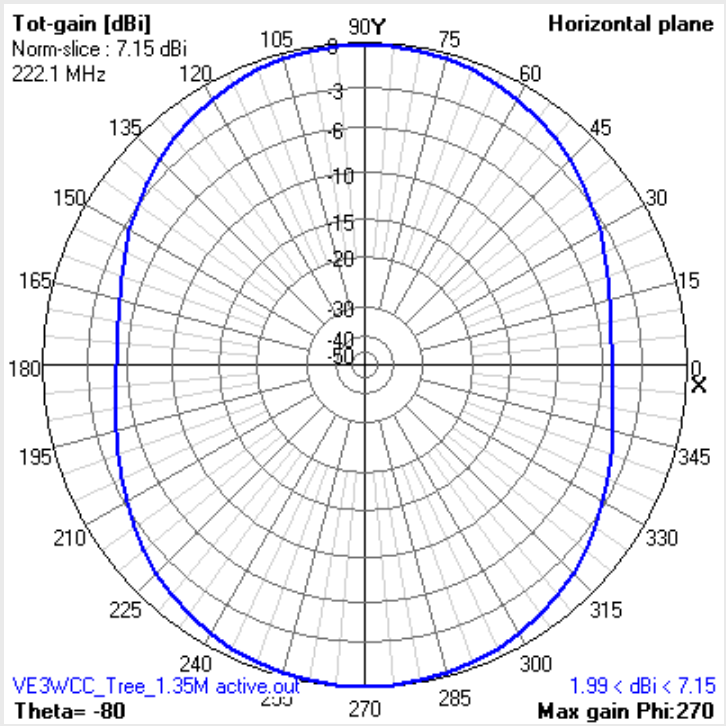

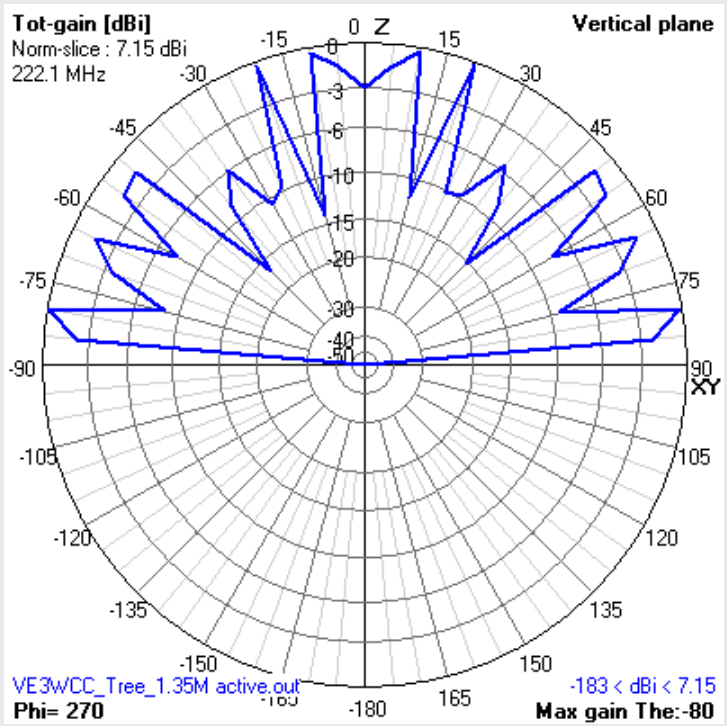

- **SQ-222 antenna in the proposed upside-down Christmas Tree configuration over "Perfect Ground". Shows 5.88 dB "gain" from ground enhancement.**

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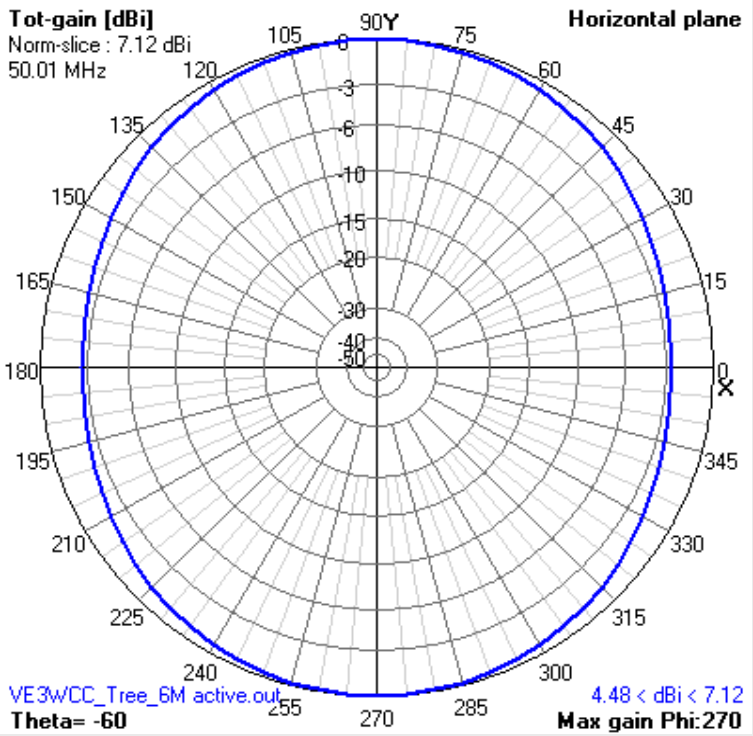

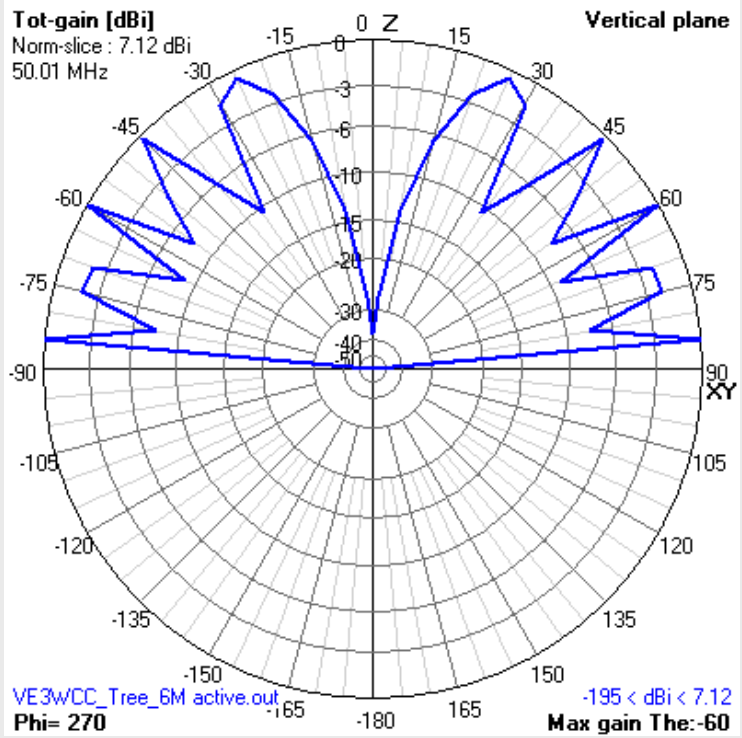

- **SQ-50 antenna in the upside-down Christmas Tree configuration over "Perfect Ground". Shows 5.83 dB "gain" from ground enhancement. SQ-144/432 similar**

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- **KU4AB promotes the stacking of his omnis for better performance.**
- **Is this just sales hype?**
- **What effect will stacking have on the performance we saw for a single omni in Free Space?**
- **What gain difference will we observe with 5/8 wave stacking (for maximum gain) over normal 1/2 wave stacking? What is the tradeoff?**

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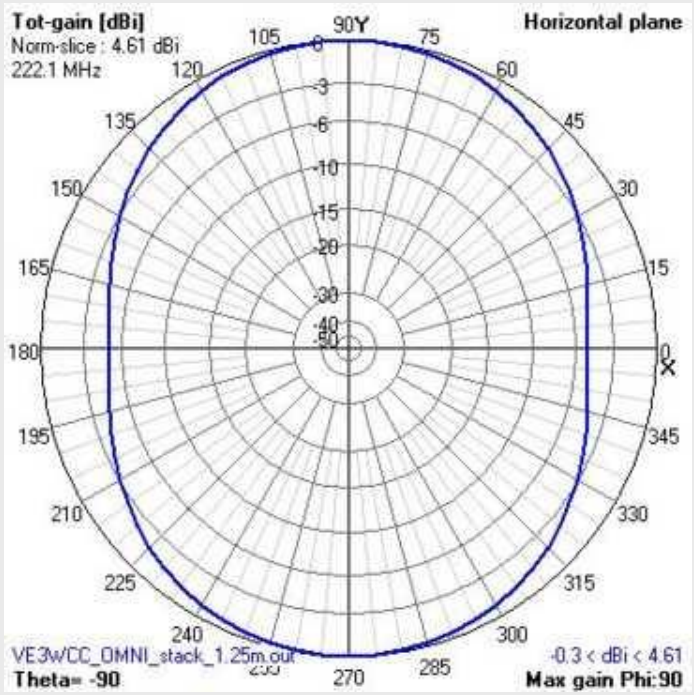

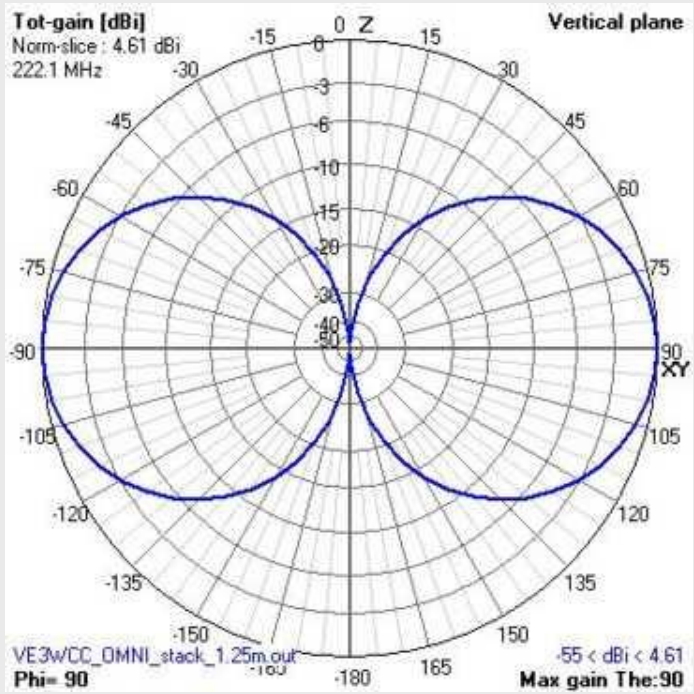

- **SQ-222 Omni Half-Wave Stack (Free Space). Half-wave stacking (as shown) gives 3dB gain and excellent Vertical Plane. All SQs show similar Free Space results**

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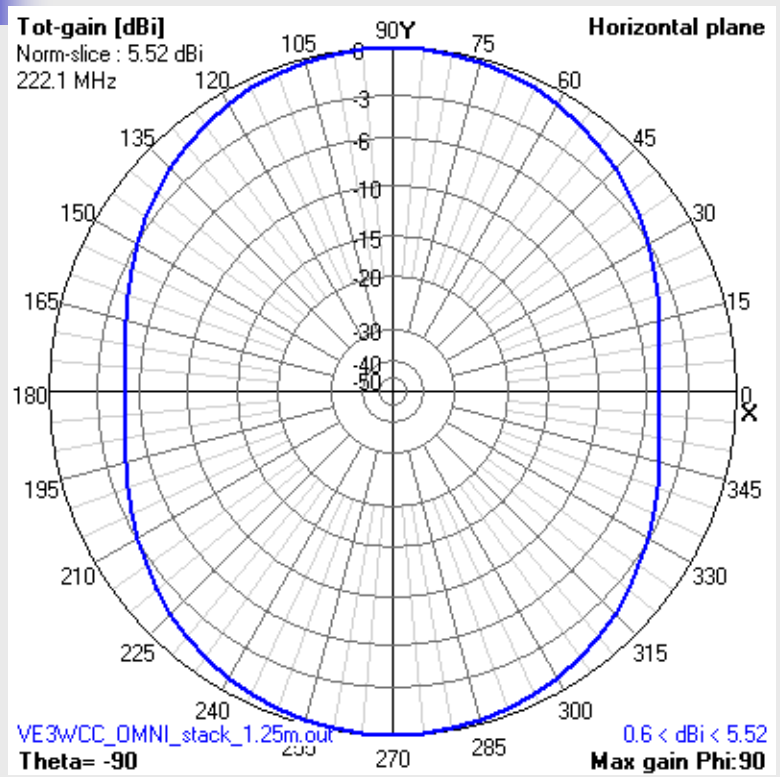

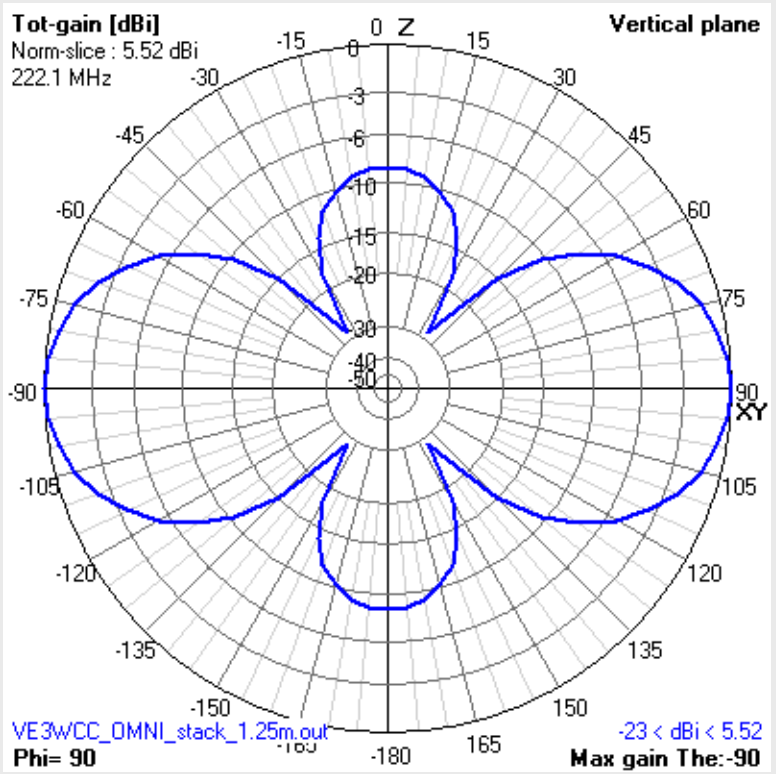

- **SQ-222 Omni 5/8 Wave Stack (Free Space). The added 0.92 dB gain over half-wave stacking comes at the expense of high vertical lobes. Not a good trade-off.**

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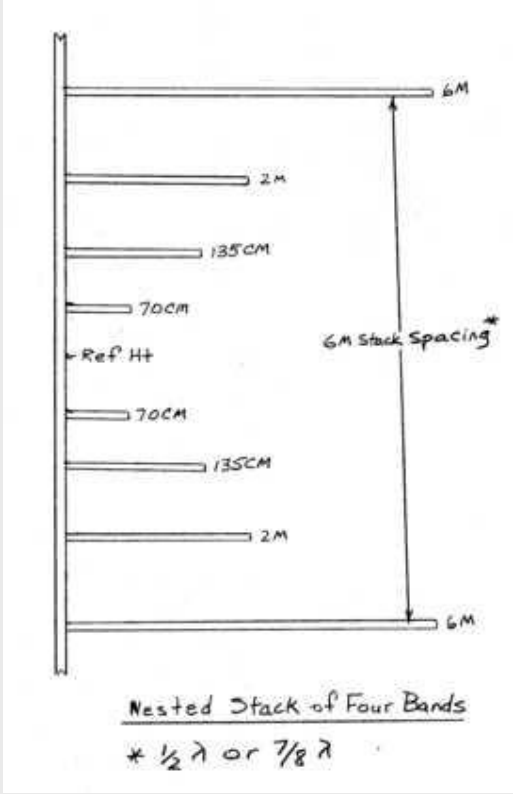

- **If one stack produces good performance, what about nesting 2M, 135CM and 70 CM stacks in a 6M stack?**

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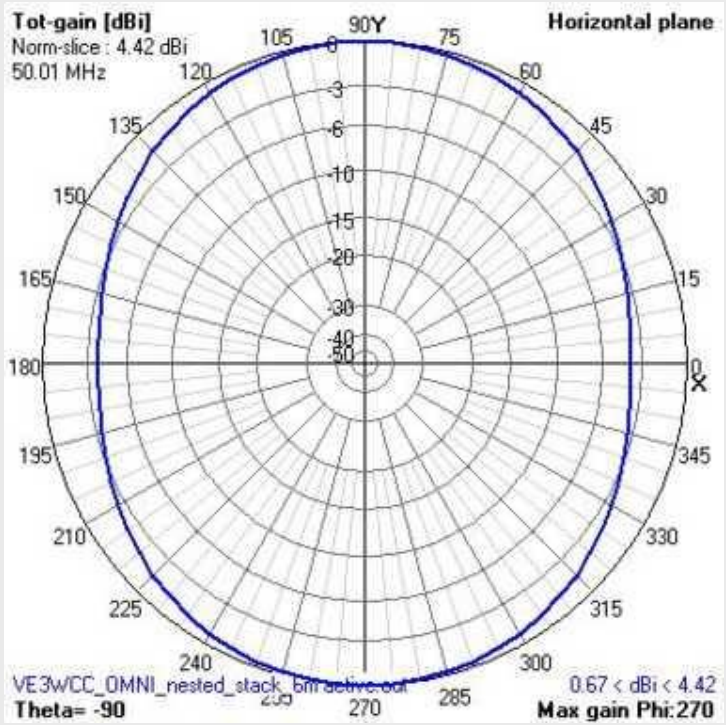

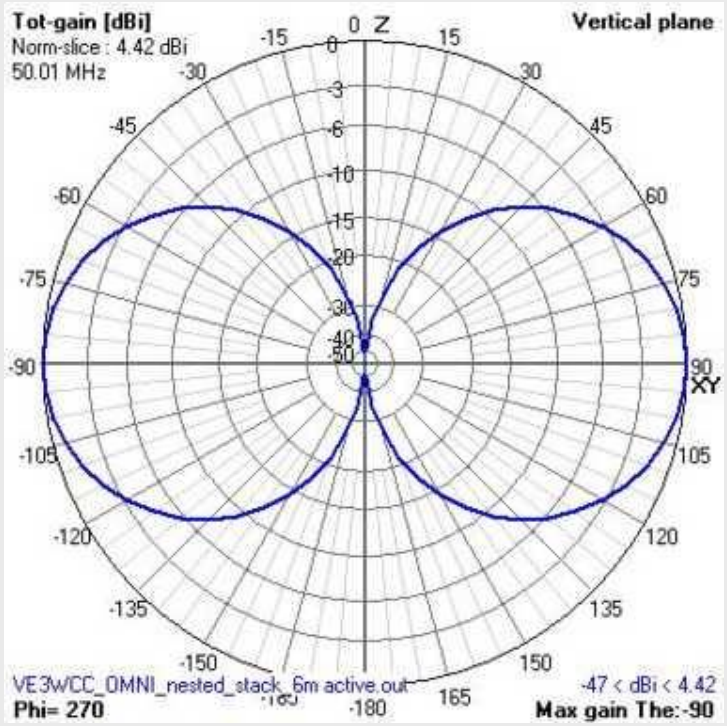

- **SQ-50 Omni active in half-wave stack containing nested 2M, 135CM and 70CM stacks (Free Space)**

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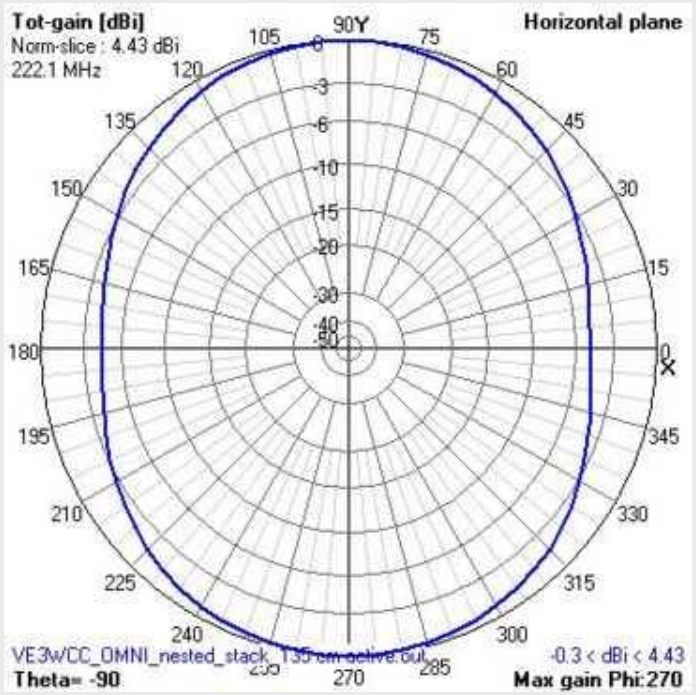

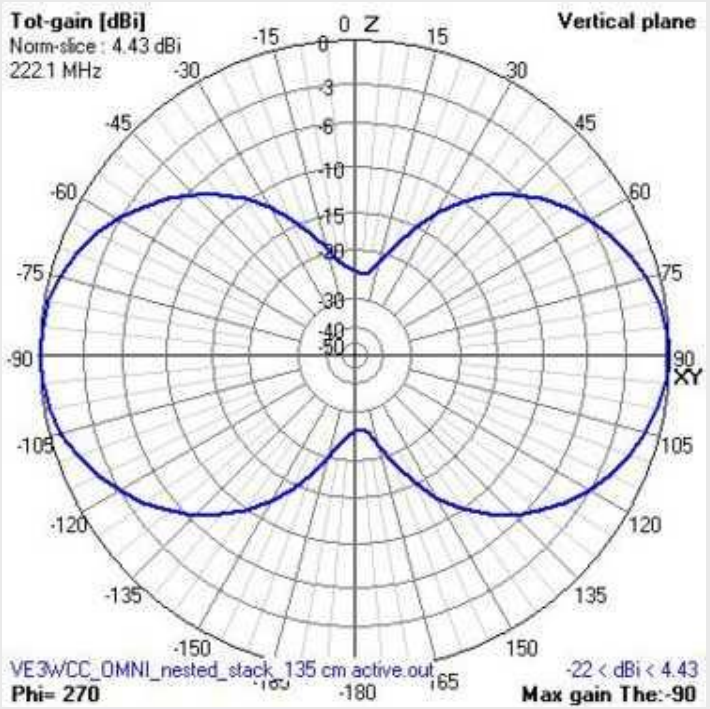

- **SQ-222 active in half-wave stack nested within 2M and 6M stacks and containing 70CM half-wave stack (Free Space). Note slight ground effect in Vertical Plane due to proximity to 6M and 2M stacks.**

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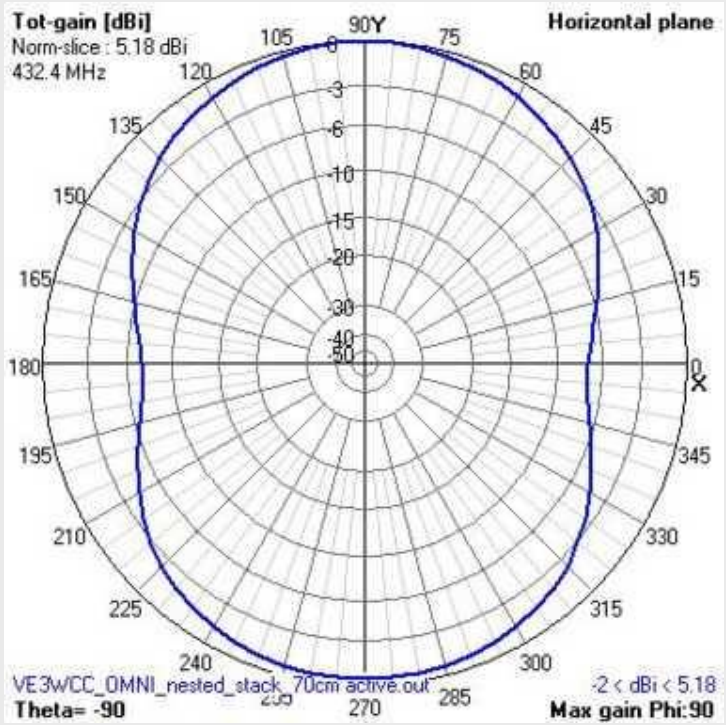

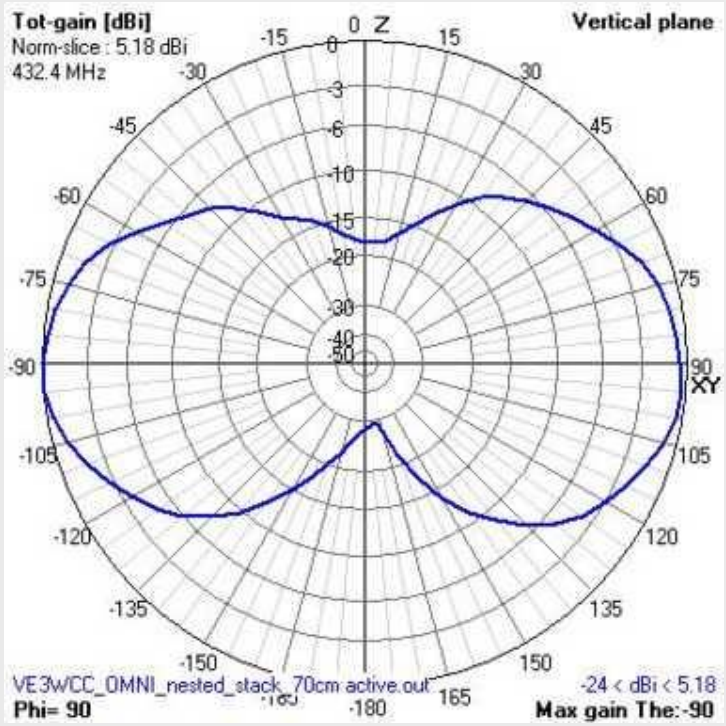

- **SQ-432 active in half-wave stack nested within 135CM, 2M and 6M stacks (Free Space). Vertical Plane shows effect of proximity to other stacks, but good gain.**

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- **There appears to be no advantage in positioning a smaller stack anywhere but midway between the antennas in a larger (lower band) stack. Any advantage above is lost below and v/v.**
- **You can't nest inside a Three-Stack or Four-Stack.**
- **Previous projected theoretical performance is in Free Space, but what about working over Ground?**
- **There are so many types of ground from salt-water marsh to desert sand, I have chosen to model with Perfect Ground as that provides the maximum effect of Ground on projected antenna performance.**

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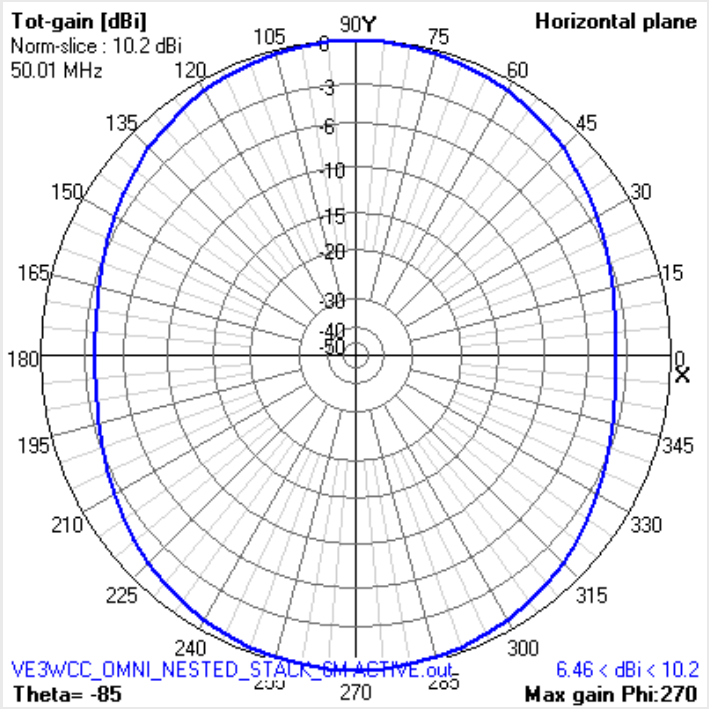

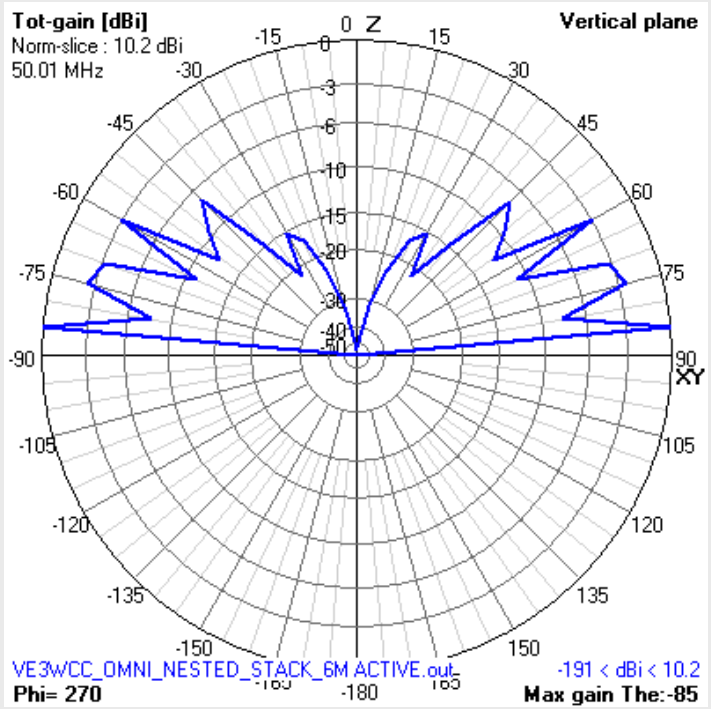

- **SQ-50 active in half-wave stack containing nested 70CM, 135CM, and 2M stacks (Perfect Ground). Shows 8.9 dB gain over Free Space and ok Vertical Plane.**

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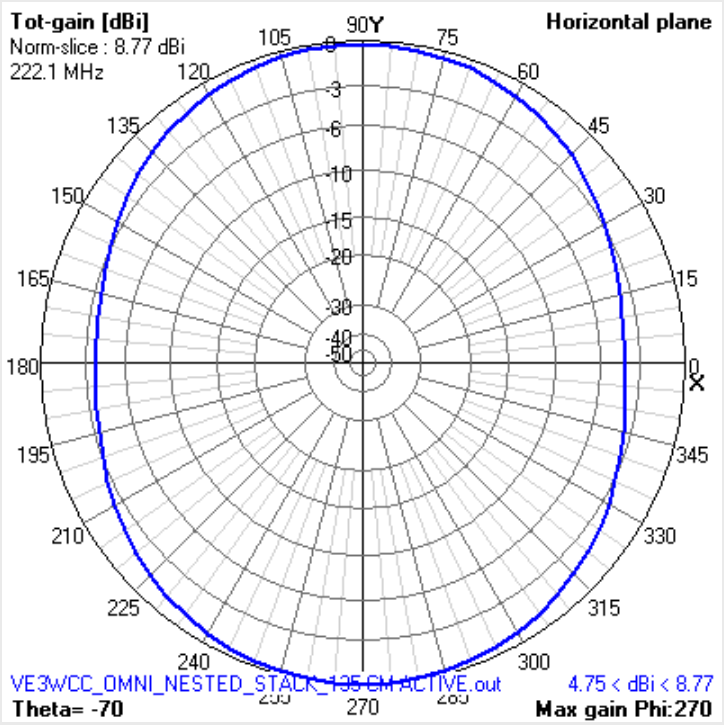

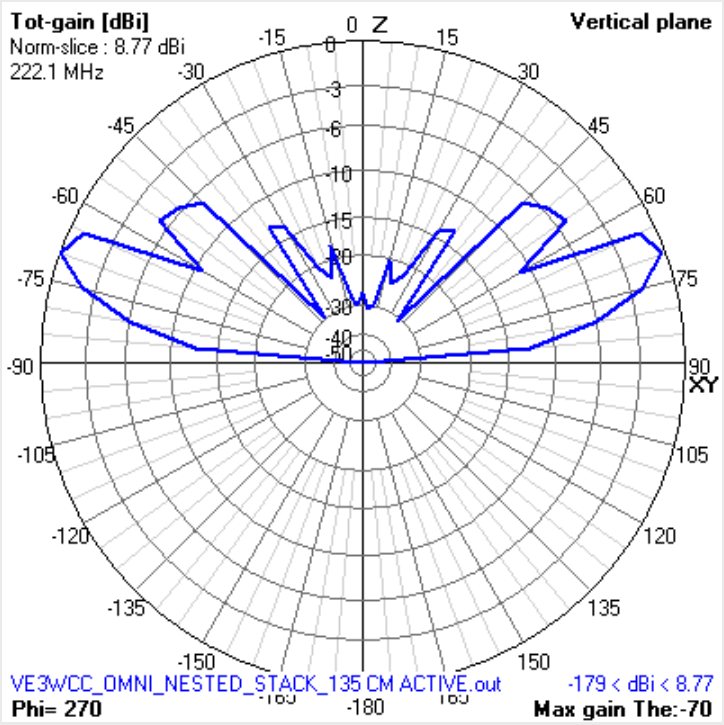

- **SQ-222 active in half-wave stack containing nested 70CM, 135CM, 2M and 6M stacks (Perfect Ground). Shows 7.5 dBi ground enhancement, ok Vertical Plane. Similar performance with other SQ models.**

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- **Note that KU4AB omnis are not loops but bent dipoles**
- **Photo shows SQ-50 6M and SQ-222 135CM Omnis. Note the connector, & matching stub with shorting bar (adjustable for resonance and best impedance match).**
- **The SQ-50 has plastic tubing across the opening for added rigidity. The SQ-432 has no "fourth sides".**

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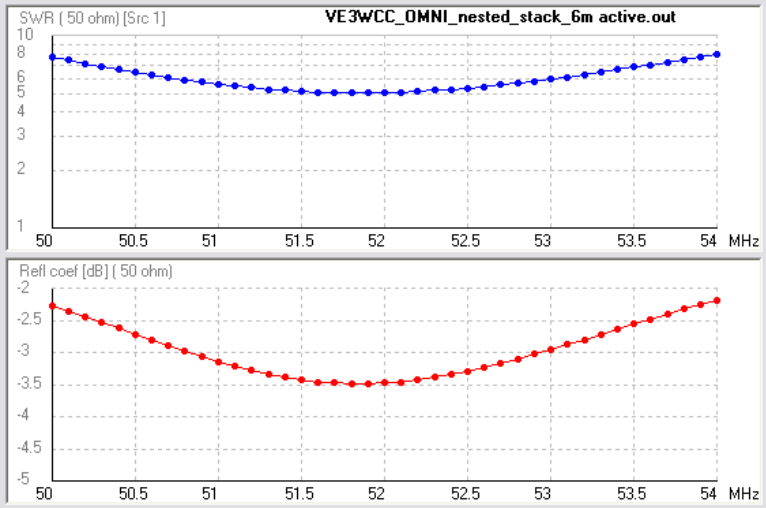

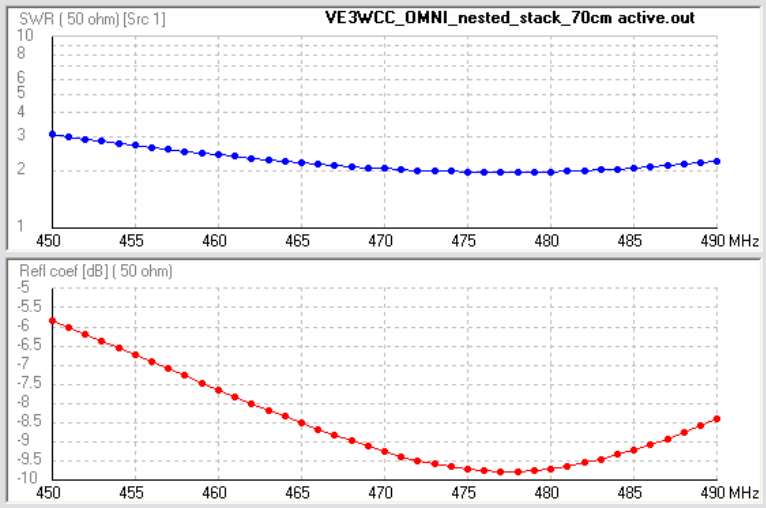

- **For these 4NEC2 models we ignored the stub so their resonance is higher than the real "tuned" antenna.**
- **The short is slid up and down to achieve 50 ohm match.**
- **Stack spacing can also be adjusted "in situ" for best overall match. This adjustment is probably interactive.**

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Conclusions

- **Stacking dramatically improves performance of KU4AB Omnis over their performance as single antennas.**
- **Nesting of stacks does not greatly compromise performance of the stacks, and saves significant mast space. A 6-2-1.35-.7 nest fits onto 10 ft of mast space.**
- **The purchase of additional antennas to allow stacking should be our next priority now that we have an interim 2M beacon coming, using a converted Mitrek.**

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Additional Antenna Equipment Prices

- **KU4AB SQ-50 - US$71.95 (one more needed)**
- **KU4AB SQ-144 - US$32.95 (two needed)**
- **KU4AB SQ-222 - US$32.95 (one more needed)**
- **KU4AB SQ-432 - US$34.95 (one more needed)**
- **Plus 4 short runs of LMR-240 (feedlines), 4 coaxial 'T's, eight 75 ohm RG-6 phasing/matching lines, 24 crimp PL-259s, 20 Wurth 74270035 Ferrites (for use as choke baluns) and 100 ft 115VAC outdoor extension.**
- **Total for all antennas & hardware needed now - C$250**
- **Hamtronics TA-51/50, cabling, etc - C$350**
- **TA-51/144 C$350 next year?**

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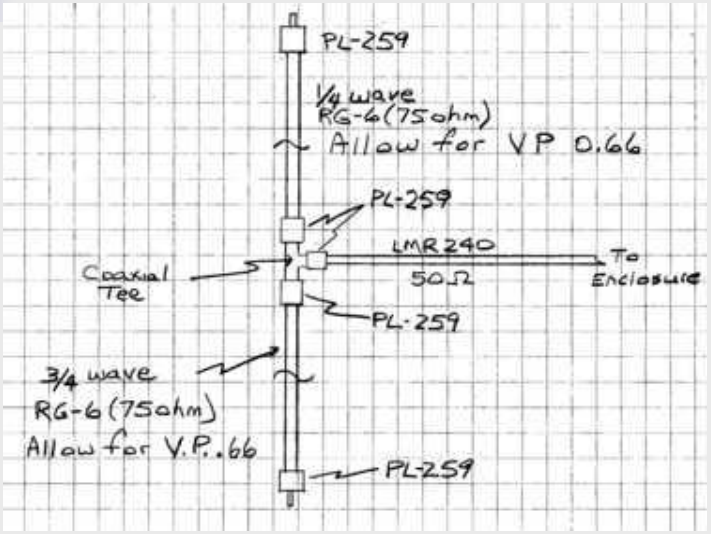

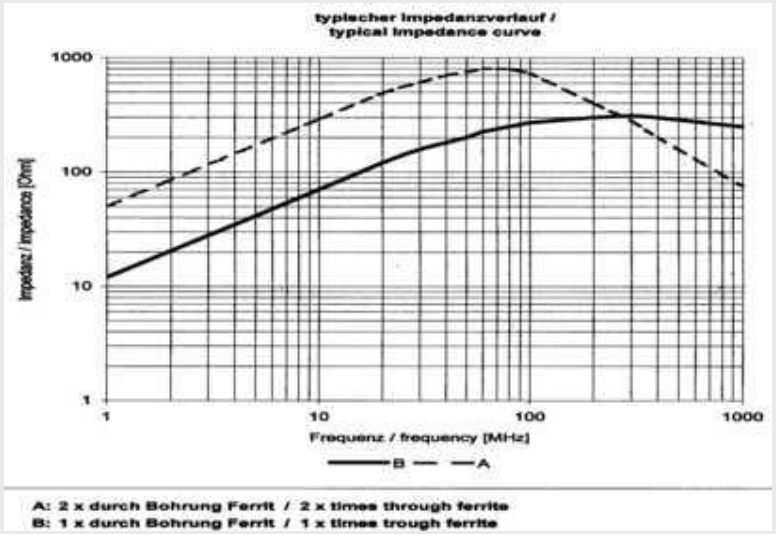

- **Q-Section stacking harness for each pair of omnis**
- **For a choke balun to reduce RF current on the outer coax shield by 20 dB, you need 500 ohms of impedance (20 log [500/50]). Three (50MHz) or two (over 100 MHz) of Wurth 7470035 ferrite cylinders provide 500 ohms with ID of 6.9 mm for LMR-240 or RG-6. 23CM?**

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- **Kuhne Electronic GMBH (DB6NT) 23 CM Beacon Module**
- **800 mw output power, CW Keying, -20C to +40C**

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- **MKU 13 is only available Wired and Tested ~C$370**
- **Kuhne/DB6NT more expensive than Hamtronics**
- **Product quality is superb - proper microwave packaging and excellent craftsmanship.**
- **With other modules inside our enclosure, -20 to +40C temperature range should not be a problem.**
- **Other Kuhne Beacon modules cover all 2.4 to 24 GHz ham bands, if and when we want to expand there.**
- **Kuhne is the perfect complement to Hamtronics - same size for convenient mounting in our enclosure.**
- **Maybe next year?**

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*T*hank You

- To the WCARC members for your attention and patience. I hope this project update was as interesting and informative to you as its preparation was to me.

- To Dave Conn - VE3KL for advice and assistance with 4NEC2 antenna modeling and choke baluns designs.