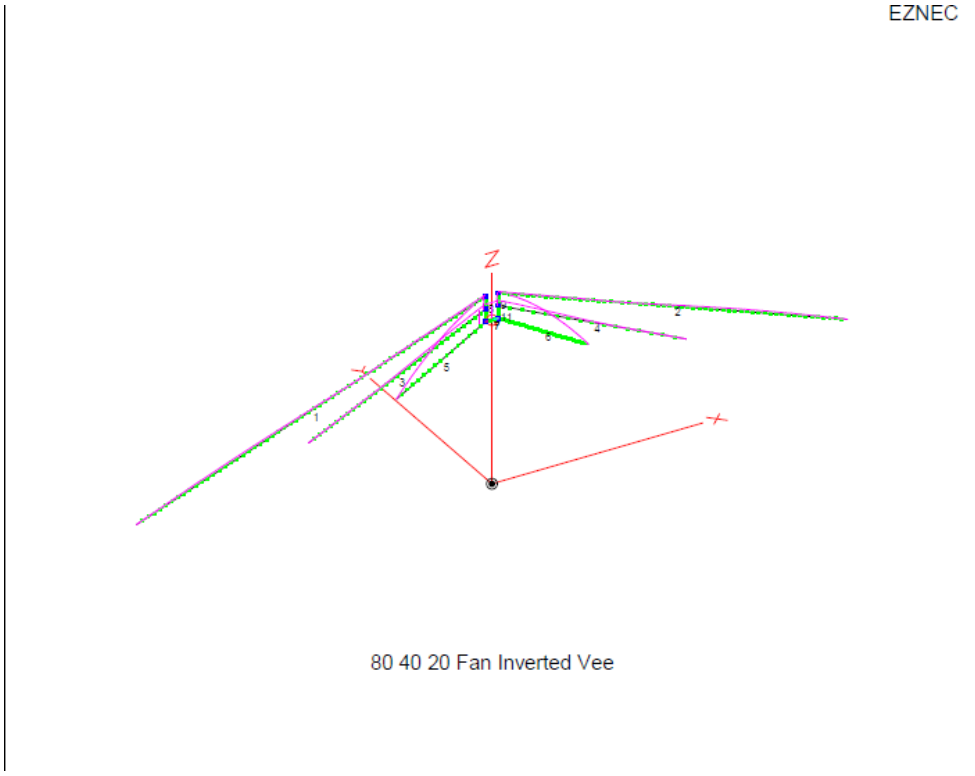
A Wide-Spaced Fan Inverted Vee For 80/40/20 Meters For Field day

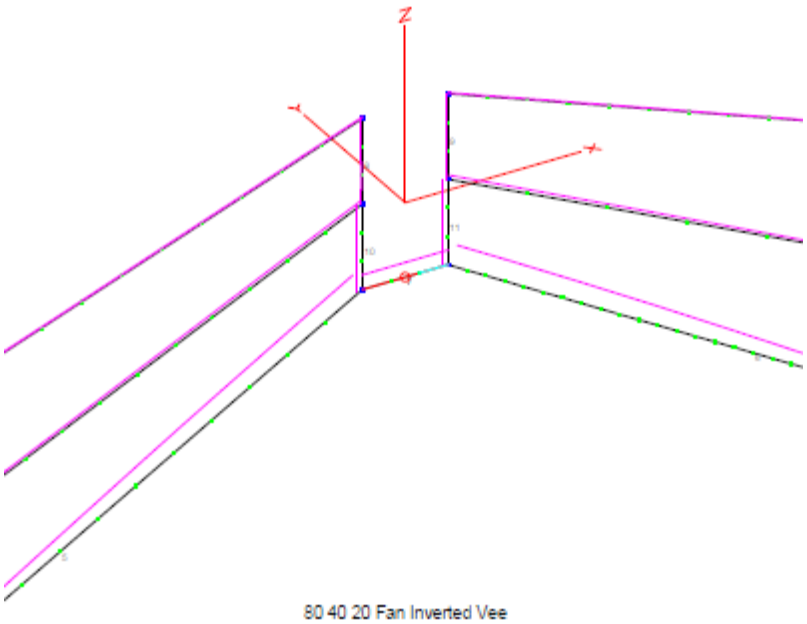
For Field Day phone operation, a 3-band dipole or inverted vee for 80/40/20 meters is proposed. We could consider a trap dipole or a fan dipole. A trap dipole is smaller and may be easier to set up. However, there are 2 issues with a trap dipole for our goals for phone, but a trap dipole is a good choice for digital or CW which have reduced bandwidth requirements. A major issue is that the bandwidth on 80 meters may be only 50 to 100 KHz with a trap dipole which is very limiting for FD phone operations. Another issue is that the bands cannot be independently tuned in position to minimize coupling to CW and antennas which is important for the phone antennas which will only be about 250 feet from the CW antennas. A fan dipole has wide bandwidth for the lowest frequency band, which is important to cover 80 meters, and bandwidths of 150 to 200 KHz are possible. It does restrict the bandwidth of the higher frequency bands, but as shown later, the use of a wide spread fan can mitigate the limitations on bandwidth for the higher frequency bands, and the wide spread design allows independent position tuning for antenna isolation on each band.

For an 80/40/20 meters multiband inverted vee optimized for wide bandwidth and low VSWR for Phone we have these goals:

- Only one tall support in the center using an inverted vee fan configuration
- Wide bandwidth on 80 meters phone and full coverage for 40 and 20 meters (2:1 VSWR)
- Ability to tune each band independently for minimum coupling to nearby verticals



EZNEC



80 40 20 Fan Inverted Vee

The center is designed to spread out the components for the different bands as much as possible, and with a balun feed in the center at the bottom of the spreaders to minimize capacitive coupling to the coax feedline shield from the antenna elements. It is shaped like a capital letter U with the balun and coaxial feed at the bottom of the U with a size of 2 feet wide and 4 feet high. It can be built with ½" plastic water pipe. The 80 meter legs originate from the top 2 points of the U. The 40 meter legs originate from the mid points of each side of the U, and the 20 meter legs originate from the bottom sides of the U. The center support is at 30 feet. Then the legs on each side are spread at 5 degree angles between each band to achieve large spread between the end points. This design gives an impedance at resonance very close to 50 ohms on each band, and the bandwidths for each band are very good.

The Completed 80/40/20 Meters Widespaced Inverted Vee

A Balun is placed at the bottom of the spreading form. The 3 wire legs on each side of the spreading form can be independently rolled up and attached to the spreading form for storage.

Each leg (6 in all) of the multiband antenna is independently secured to a ground stake after a run of light rope to achieve the desired angles (20 degrees on 80 meters with stakes 90 feet from the center pole, 25 degrees on 40 meters with stakes 66 feet from the center pole and 30 degrees on 20 meters

with stakes 52 feet from the center pole). This allows the placement of the endpoints to be independently moved, so that isolation to CW vertical antennas can be independently tuned for maximum isolation on each band. The lengths of the legs are 59 feet, 32 feet, and 16 feet for 80, 40 and 20 meters (not including the U center unit which adds some lengths to each leg).

For EZNEC simulations, the impedance at 14.2 MHz is about 68 ohms and VSWR at 50 ohms is about 1.4 (14.0 to 14.35 < 2.0). The impedance at 7.225 MHz is about 40 ohms and the VSWR at 50 ohms is about 1.4 (7.175 to 7.35 < 2.0). The impedance at 3.8 MHz is about 50 ohms and the VSWR at 50 ohms is very close to 1:1 (3.7 to 3.86 < 2.0). The antenna covers 200 KHz on both 80 and 40 meters at < 2.5 VSWR, and covers the entire 20 meter band at less than 2.0 VSWR.

For 15 and 10 meters phone and GOTA on 15 and 10 meters, the proposal is to use verticals such as the Chameleon MPAS 2.0, hamsticks, MA5VA… placed near the pavilion operating position. The manuals for MPAS 2.0 show that low SWR can be achieved on 10 meters by operating with the whip only, and low SWR can be achieved on 15 meters by operating with the whip and the extension. That will allow good performance with the bandpass filters as well as a good match for the rig. Using 4 uniform radials for a counterpoise will be good for performance and also help achieve a more accurate vertical polarization. We can also use hamsticks or an MFJ MA5VA (KA2C) which would be resonant on 15 and 10 meters. Using verticals on 15 and 10 meters for phone near the pavilion provides polarization isolation with the digital dipole which may be only about 200 feet away which is helpful. However, CW is also planned to use verticals which is an issue. But the CW verticals will be further away. Still there is likely to be inter-station interference from CW for 15 and 10 meters phone. That can be mitigated by time coordination. Also CW operates very little on these bands.

Depending on the results, in the future we can consider rotatable dipoles for 15 and 10 meters phone to null out CW interference (although this reduces isolation with digital) and possibly a diplexer and bandpass filters for 15 and 10 meters to use a shared antenna. GOTA needs a third antenna. Possibly GOTA can share the 75 meters phone antenna with the primary 75 meters rig during daylight hours when the number of QSO's on 75 meters may be limited due to propagation.

Setup and storage:

- Masts – coil/uncoil the 3 guy ropes & pulley rope and attach the coils to the top mast section with small ties - allows rapid setup, teardown and easy storage
- 3x – 3 foot posts for guy stakes – spaced at 120 degrees and 30 feet from the mast
- Need care to avoid entangling the 6 element wires
- Remove, coil, and store separately the ropes
- To raise
    - Place end point posts
    - Uncoil the 80 meters wires first and place on the ground close to guy ropes.
    - Uncoil the 40 meters wires and place on the ground at a sharper angle than the 80 meters elements
    - Uncoil the 20 meters wires and place at a sharp angle

    - Attach the coax and carefully raise the center element taking care that none of the wires become entangled
    - Attach ropes to the 80 meters elements, lift them over the guy rope and tie the rope to the corresponding post, similarly for 40 meters, and for 20 meters (using an 8 foot step ladder to reach the wires
- Use 5 foot steel T posts for inverted vee end points with ropes tied about 4 feet above the ground
- End point points – 80 meters +- 75 feet, 40 meters +- 55 feet, and 20 meters +- 40 feet

SWR after tuning for the phone bands–

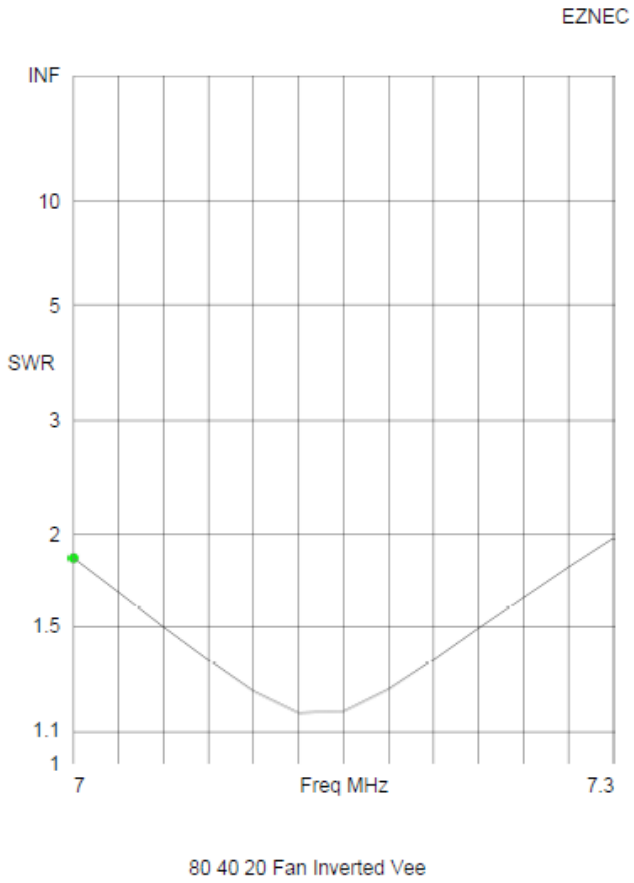
80 meters was tuned first, then 40 meters, and then 20 meters. There was negligible effect on the lower frequency bands during tuning of the higher frequency bands.

Freq	SWR
3.50	7.2
3.55	6.3
3.60	5.5
3.65	3.95
3.70	2.8
3.75	2.0
3.80	1.4
3.85	1.5
3.90	2.0
3.95	2.8
4.00	3.6
7.00	4.6
7.05	3.7
7.10	2.7
7.15	1.9
7.20	1.4
7.25	1.3
7.30	1.7
14.0	1.75
14.1	1.26
14.2	1.06
14.3	1.17
14.4	1.44

Appendix A

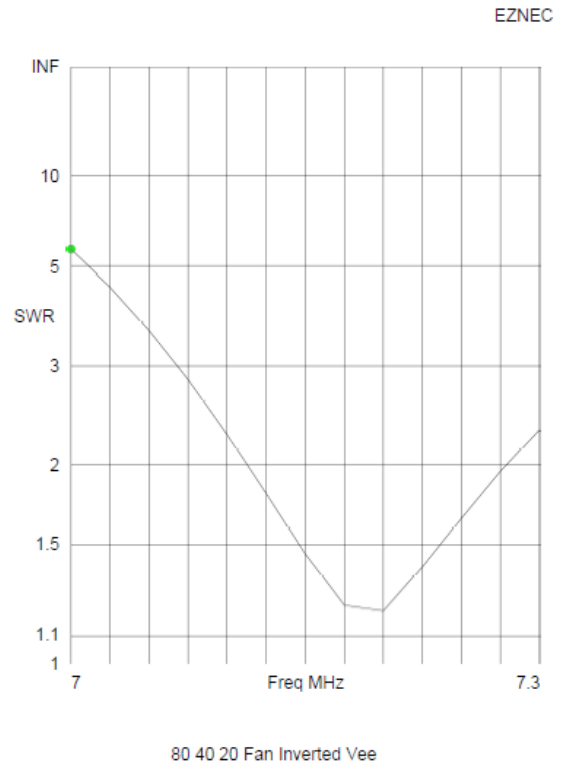
40 meter inverted vee bandwidth

1) Single band 40 meter inverted vee
2) Multiband 80/40/20 meter inverted vee with wide spacing
3) Multiband 80/40/20 meter inverted vee with narrow spacing

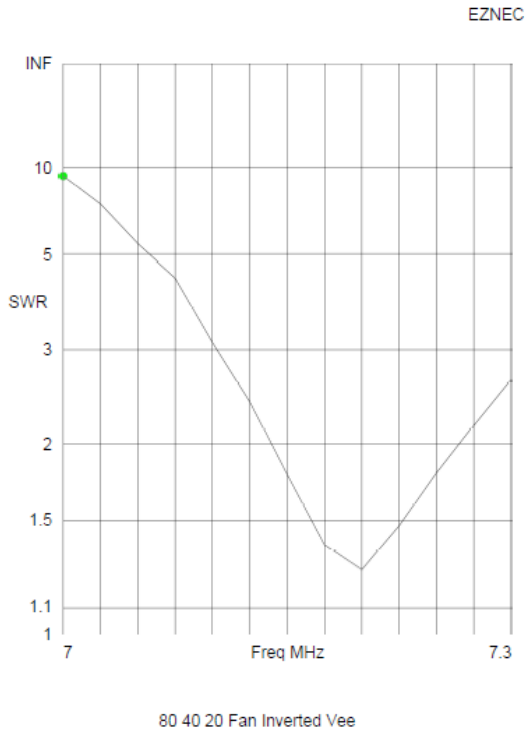


This is a single band 40 meter inverted vee covering the entire band at < 2.0 VSWR

The higher frequency bands of a fan dipole or inverted vee are reduced in bandwidth significantly by a factor of about 3:1 for a closely spaced fan. This can be mitigated by spreading the fan, but the bandwidth reduction is still quite large for a modest spread of the fan (5 to 10 degrees). If a higher frequency band legs are rotated by 90 degrees to the other bands around the center support, the bandwidth is broadened to nearly that of a single band antenna. However, for the case of achieving polarization isolation for FD, this is not possible.



This is an 80/40/20 fan inverted vee with wide spacing – 2.0 VSWR bandwidth on 40 meters about 165 KHz

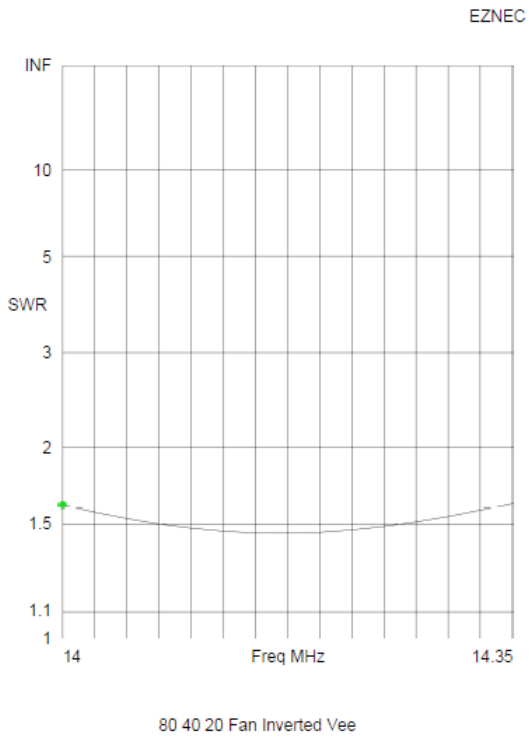


This is an 80/40/20 fan inverted vee with close spacing – 2.0 VSWR bandwidth on 40 about 125 KHz

Appendix B

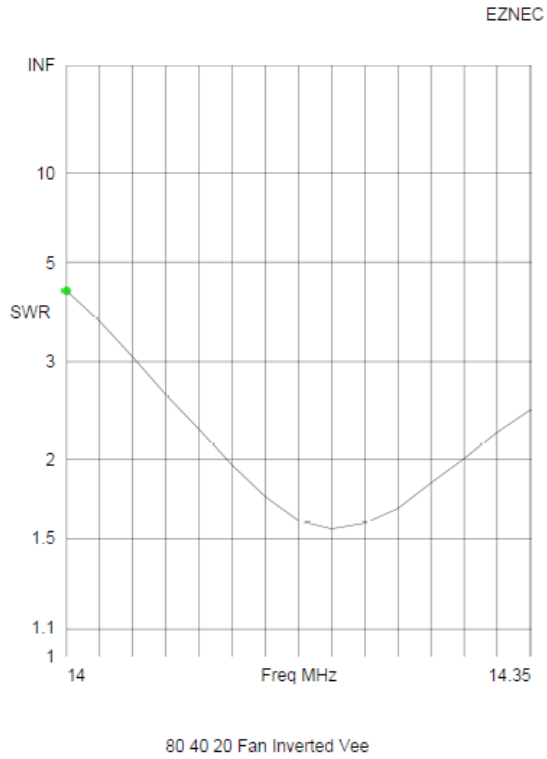
20 meters inverted vee bandwidth

1) Single band 40 meter inverted vee
2) Multiband 80/40/20 meter inverted vee with wide spacing
3) Multiband 80/40/20 meter inverted vee with narrow spacing

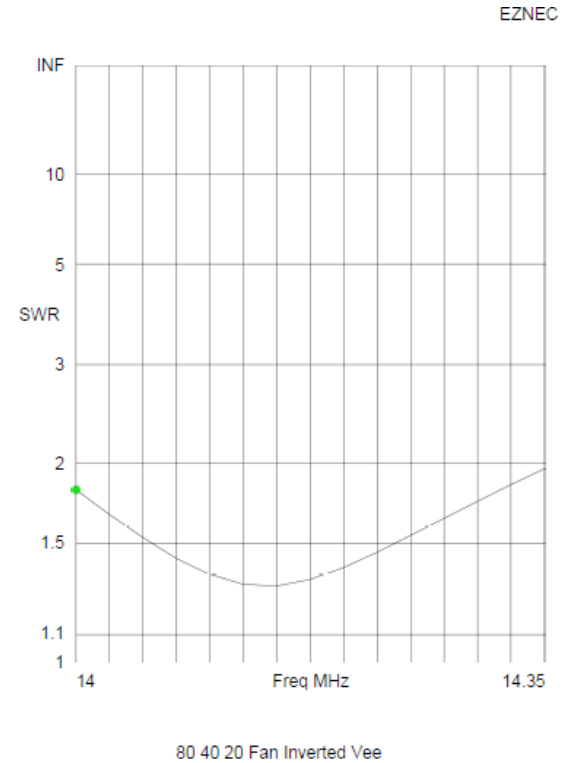


This is a single band 20 meter inverted vee covering the entire band at < 1.7 VSWR

A 20 meter dipole is very broadband. A fan dipole covering 80/40/20 can cover the entire 20 meter band at < 2.0 VSWR with wide spacing and has very good matching at resonance to 50 ohms. A close spaced fan only covers about ½ of the band at < 2.0 VSWR & the match at resonance is only fair.



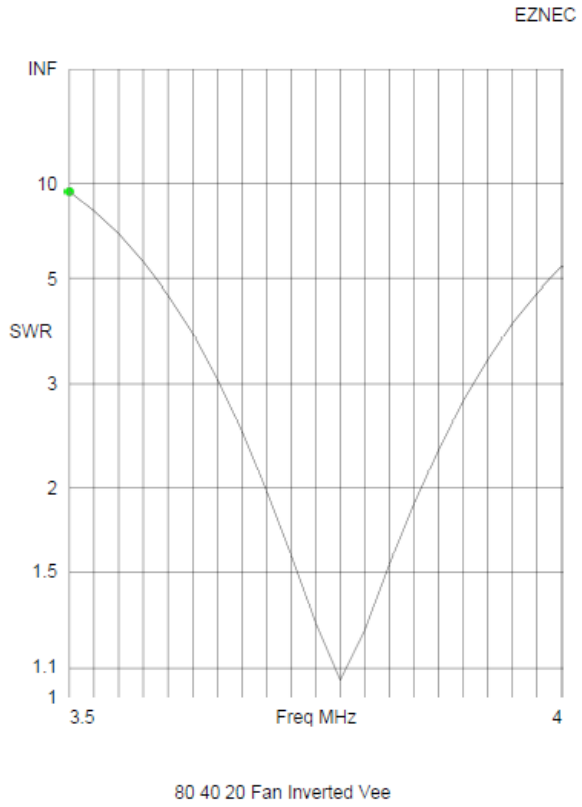
This is an 80/40/20 fan inverted vee with close spacing – 2.0 VSWR bandwidth on 20 about 175 KHz



This is an 80/40/20 fan inverted vee with wide spacing – 2.0 VSWR bandwidth on 20 is full band

Appendix C

80 meters inverted vee bandwidth



80 meters SWR with wide spaced 80/40/20 fan inverted vee – about 160 KHz bandwidth < 2.0 SWR