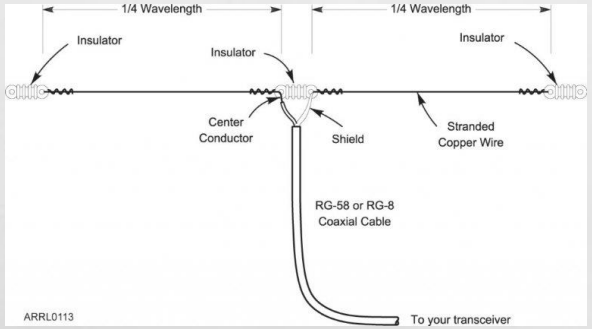
WIRE ANTENNAS

FOR HF OPERATIONS

THIS PRESENTATION

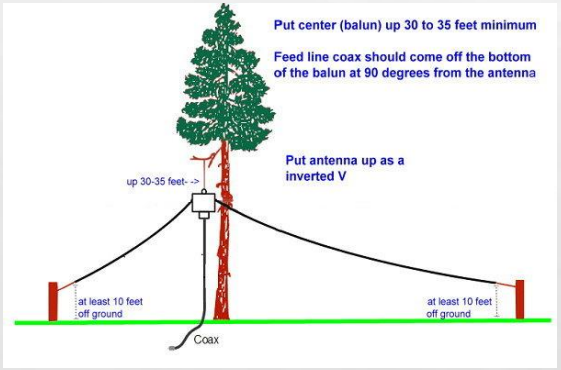
A FEW POPULAR WIRE ANTENNAS

...

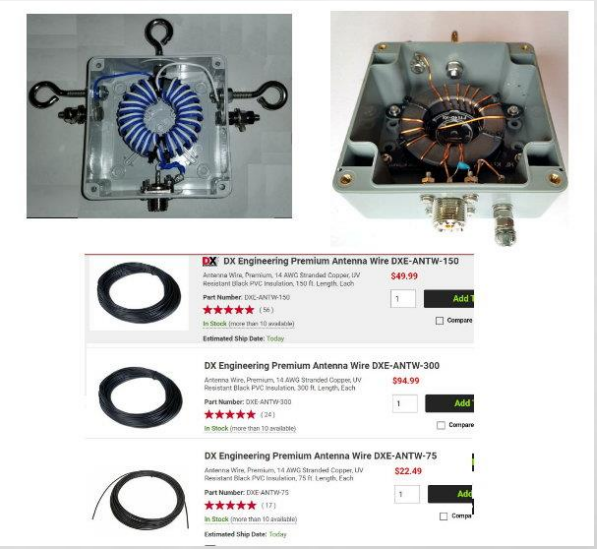


MY ANTENNA FARM

...

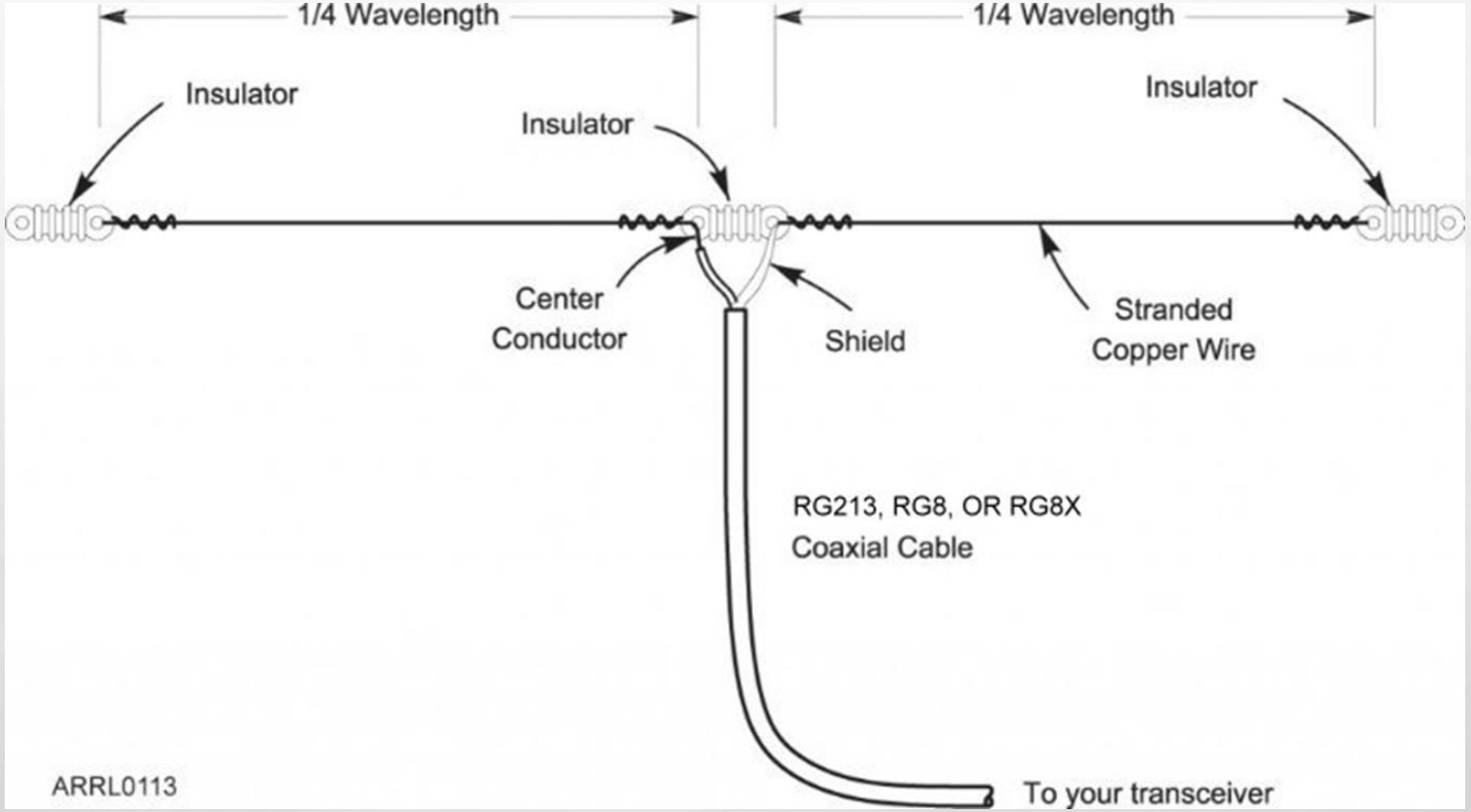


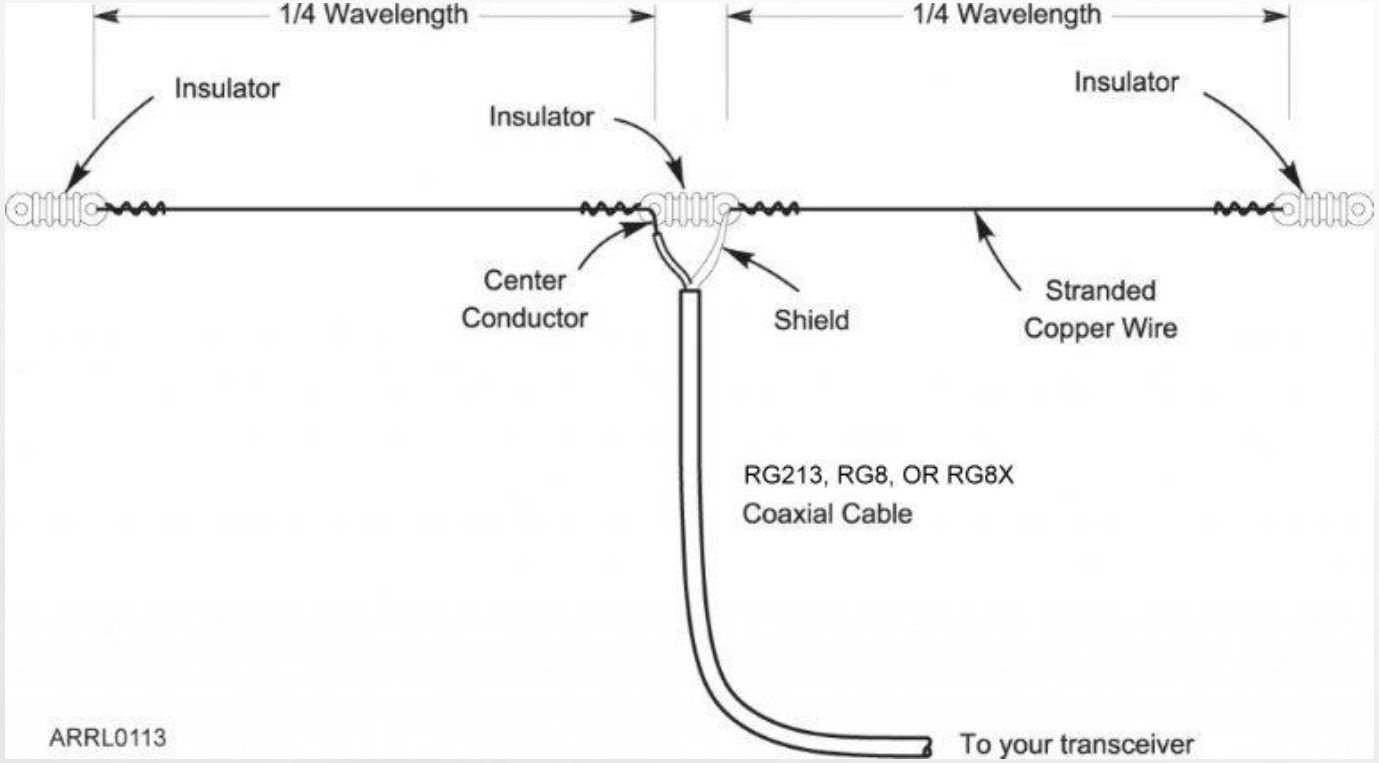
WHERE TO GET PARTS



1. The Simple Dipole
2. The End Fed Half Wave
3. The Off Center Fed
4. The Loop Skywire
5. The Delta Loop
6. The Fan Dipole
7. The Double Bazooka Dipole
8. The Doublet Dipole

SIMPLE DIPOLE





The higher the frequency, the shorter the antenna.

2m ½ wave: 468 / 146mhz = 3.2' or 19 3/16" each side.

The lower the frequency, the longer the antenna.

160m ½ wave: 468 / 1.9mhz = 246.315' or 123' 1 7/8" each side

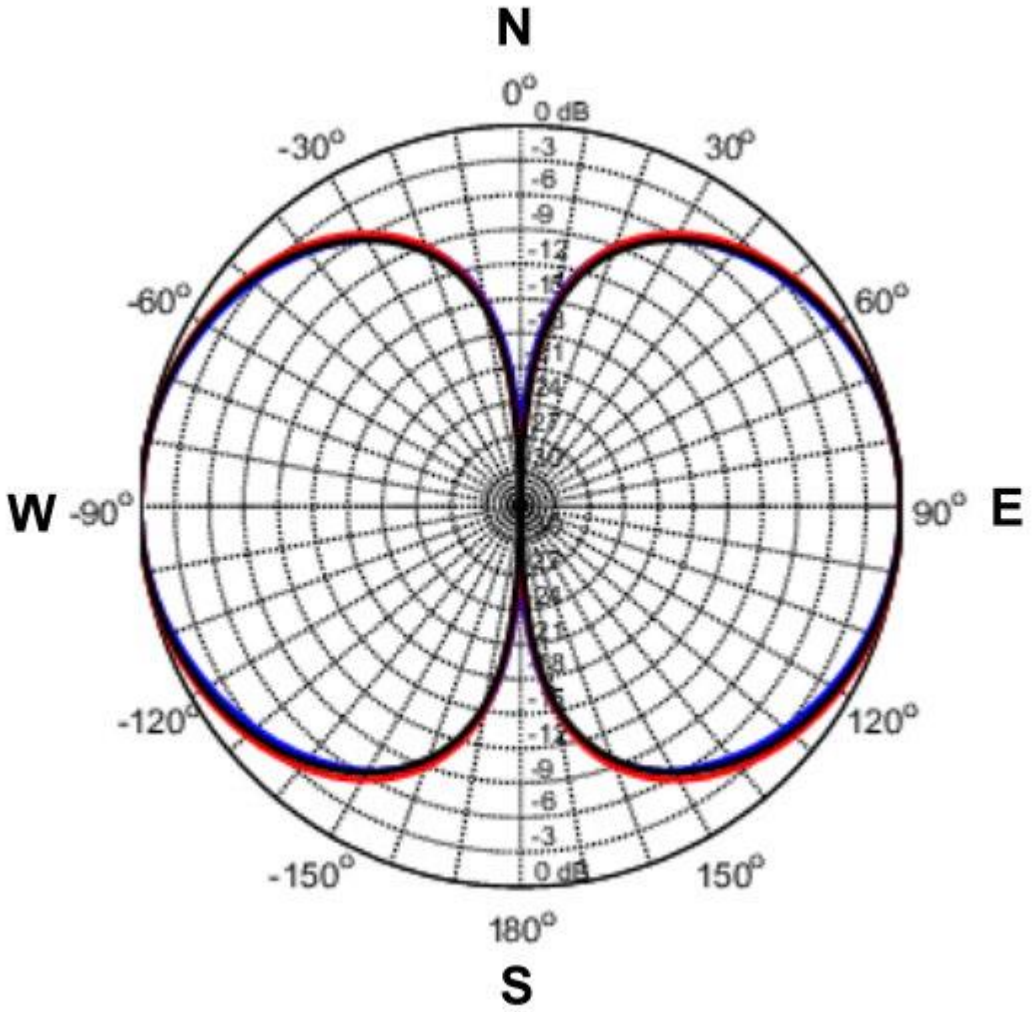
½ Wave Dipole Formula

468 divided by frequency

10-meter ½ wave dipole
468 / 28.5mhz = 16.42'
(16'5") total or 8.21' each side.
(8'2&1/2")

40-meter ½ wave dipole
468 / 7.15mhz = 65.54'
(65'5&1/2") total or 32.77' each side. (32'9&1/4")

Image found at ARRL.ORG



RADIATION PATTERN OF A HALF WAVE DIPOLE

When installing a half wavelength dipole, if the wire runs North to South the antenna radiates most of its signal East and West.

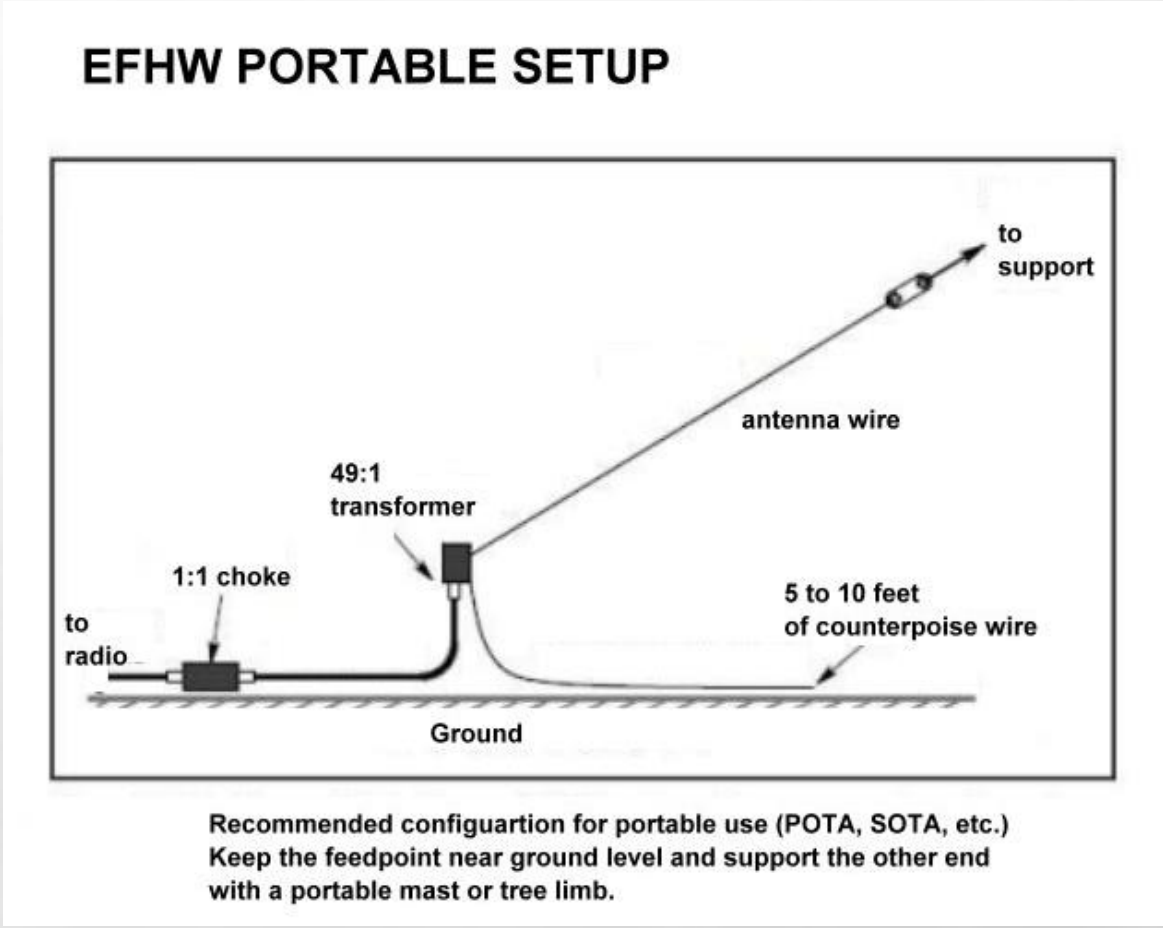
THE END FED HALF WAVE (EFHW) ANTENNA

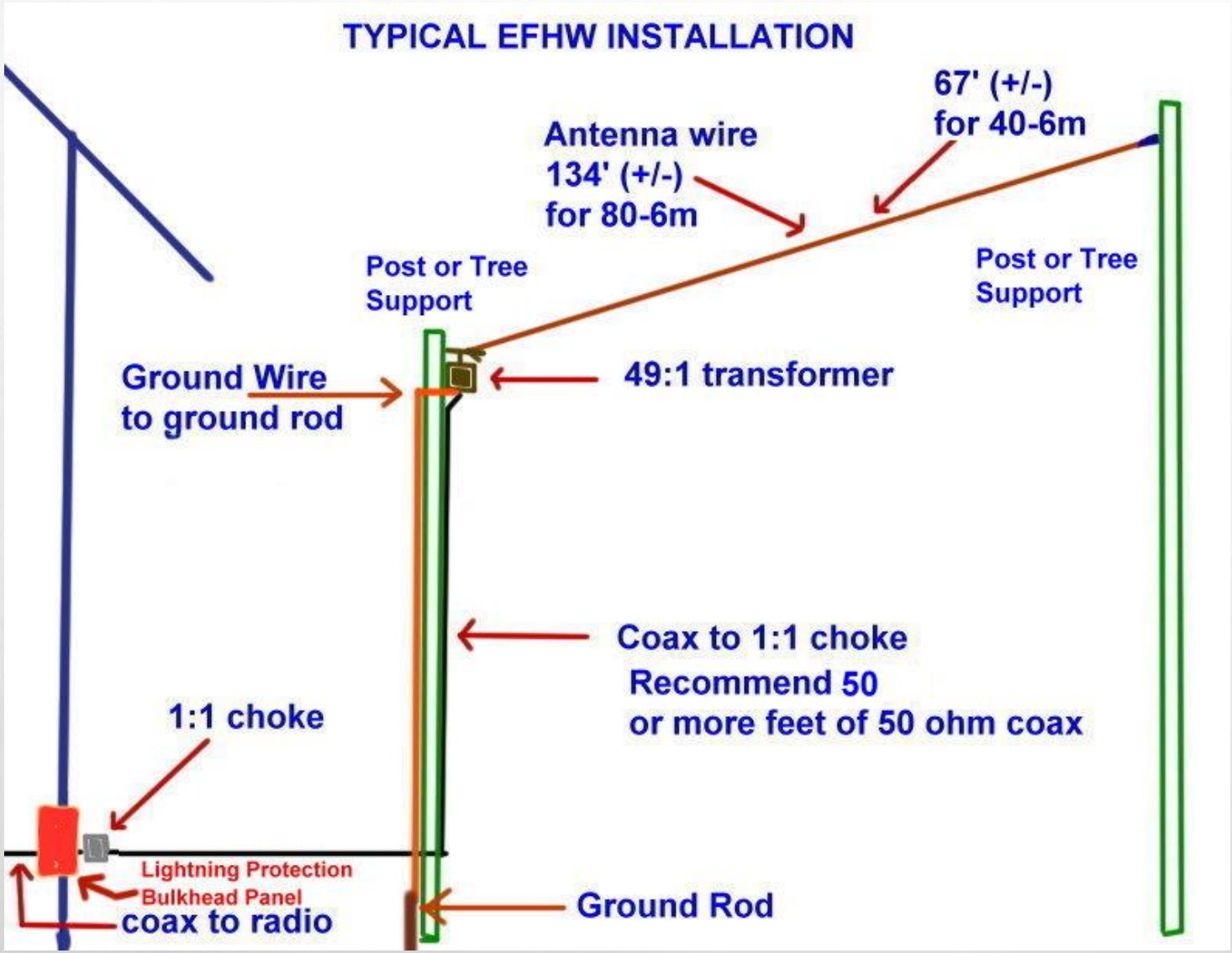
Formula: 468 / Frequency = Total Wire length.

468 / 3.5 = 133’ 8” 80-10m

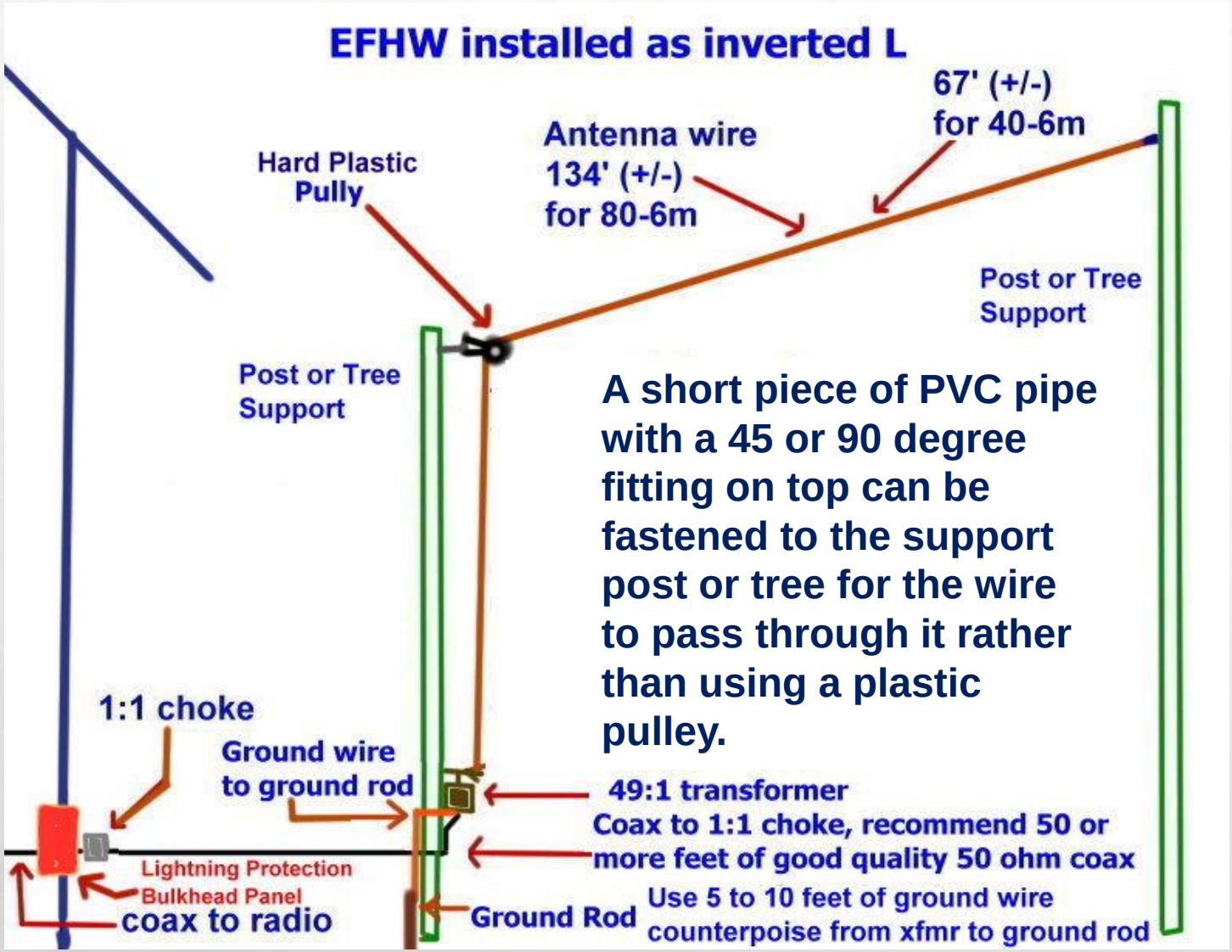
468 / 7.0 = 66’ 10” 40-10m

The 80-10m EFHW using an external tuner is capable of both 160m and 6m in most installations.



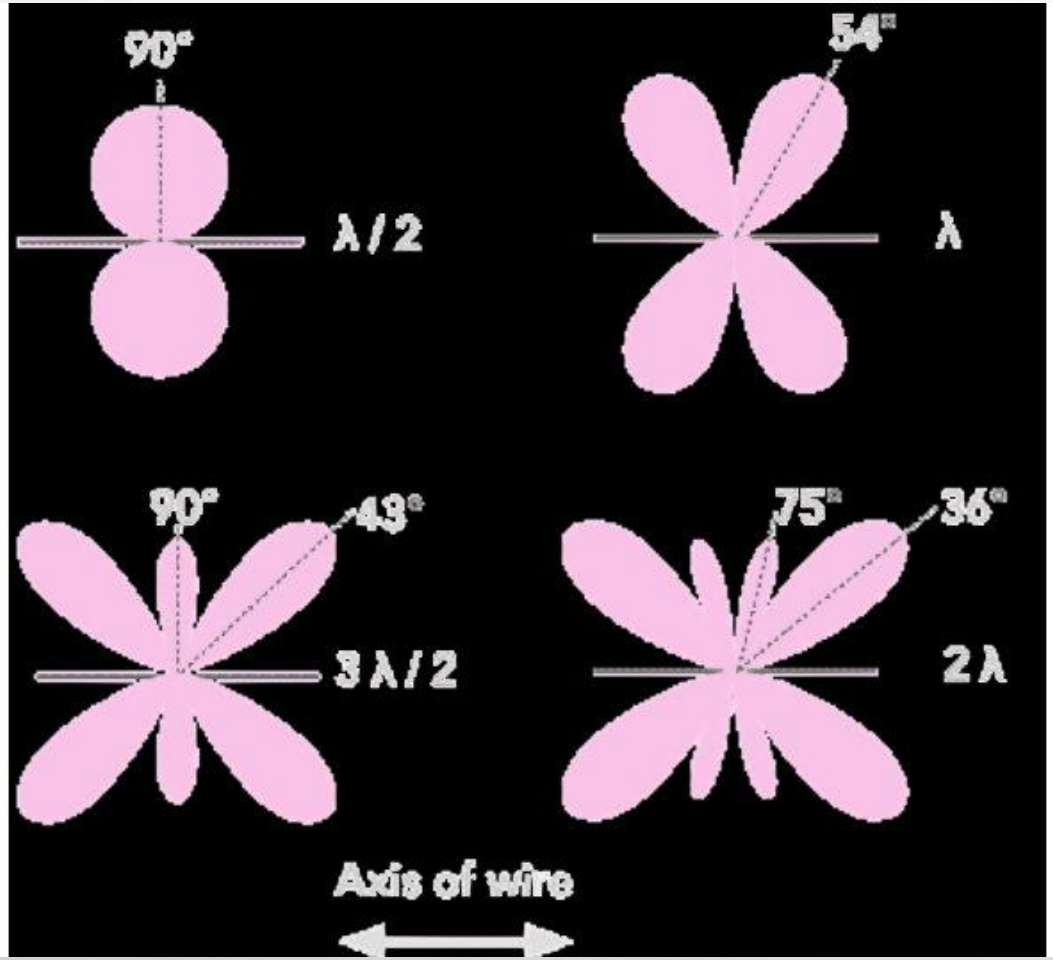


Unlike a Off Center Fed (OCF) antenna, the EFHW is capable of being used on the 15m band.



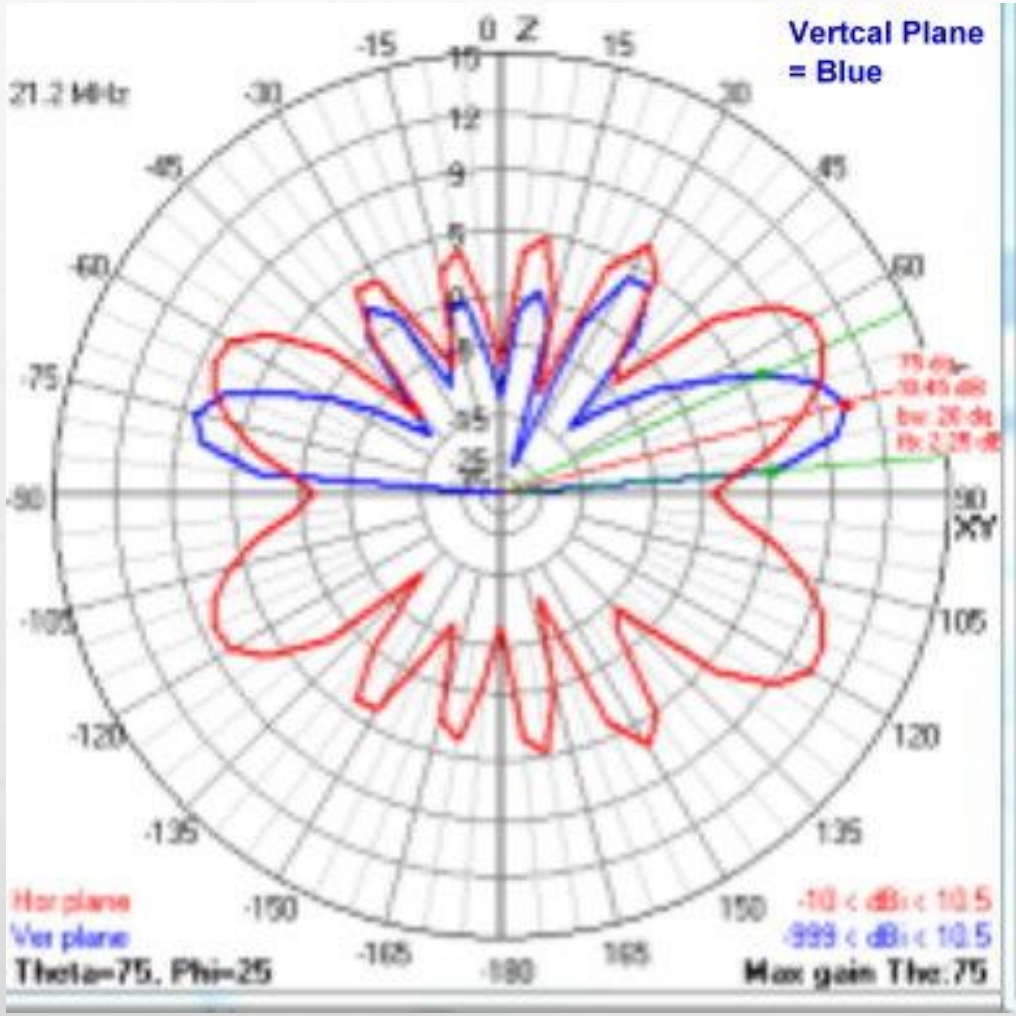
A short piece of PVC pipe with a 45 or 90 degree fitting on top can be fastened to the support post or tree for the wire to pass through it rather than using a plastic pulley.

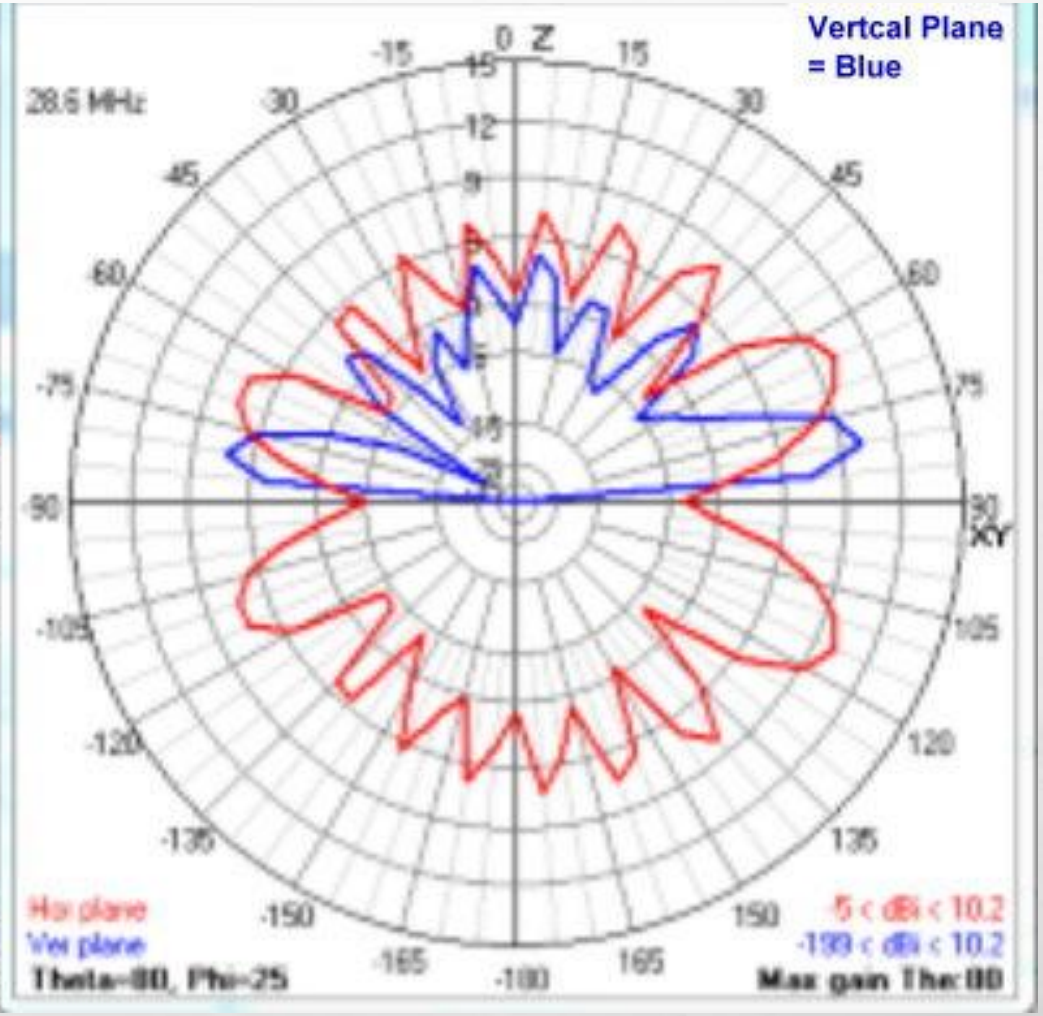
EFHW PATTERNS



80-10M	40-10M
1/2 WAVE 3.5MHZ	7.0MHZ
1 WAVE 7.0MHZ	14.0MHZ
3 1/2WAVES 10.5MHZ	21MHZ
2 WAVES 14MHZ	28MHZ
2 1/2WAVES 17.5MHZ	35MHZ
3 WAVES 21MHZ	42MHZ
3 1/2WAVES 24.5MHZ	49MHZ
4 WAVES 28MHZ	56MHZ
7 1/2WAVES 52.5MHZ	

Pattern image found at https://www.electronics-notes.com/articles/antennas-propagation





Red = Horizontal Plane Blue = Vert Plane

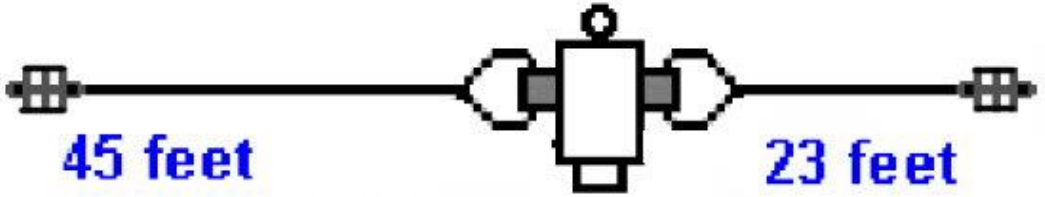
80-10m EFHW 15 and 10m Patterns

PATTERN IMAGES found at:

https://www.qsl.net/kk4obi/EFHW%20Straight.html

THE OFF-CENTER FED DIPOLE

80-6M 7 BANDS 80, 40, 20, 17, 12, 10, and 6 meters



40-6M 4 BANDS 40, 20, 10, and 6 meters

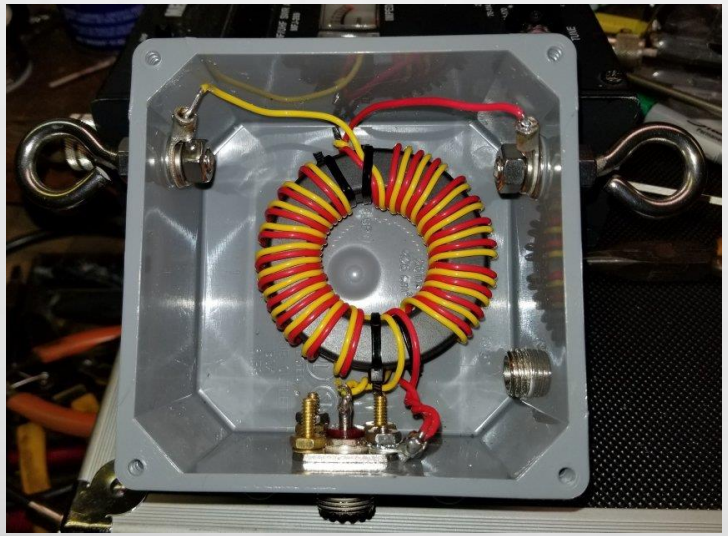
160-6M 8 BANDS 160, 75/80, 40, 20, 17, 12, 10, & 6 meters

OCF ANTENNA FEEDPOINT

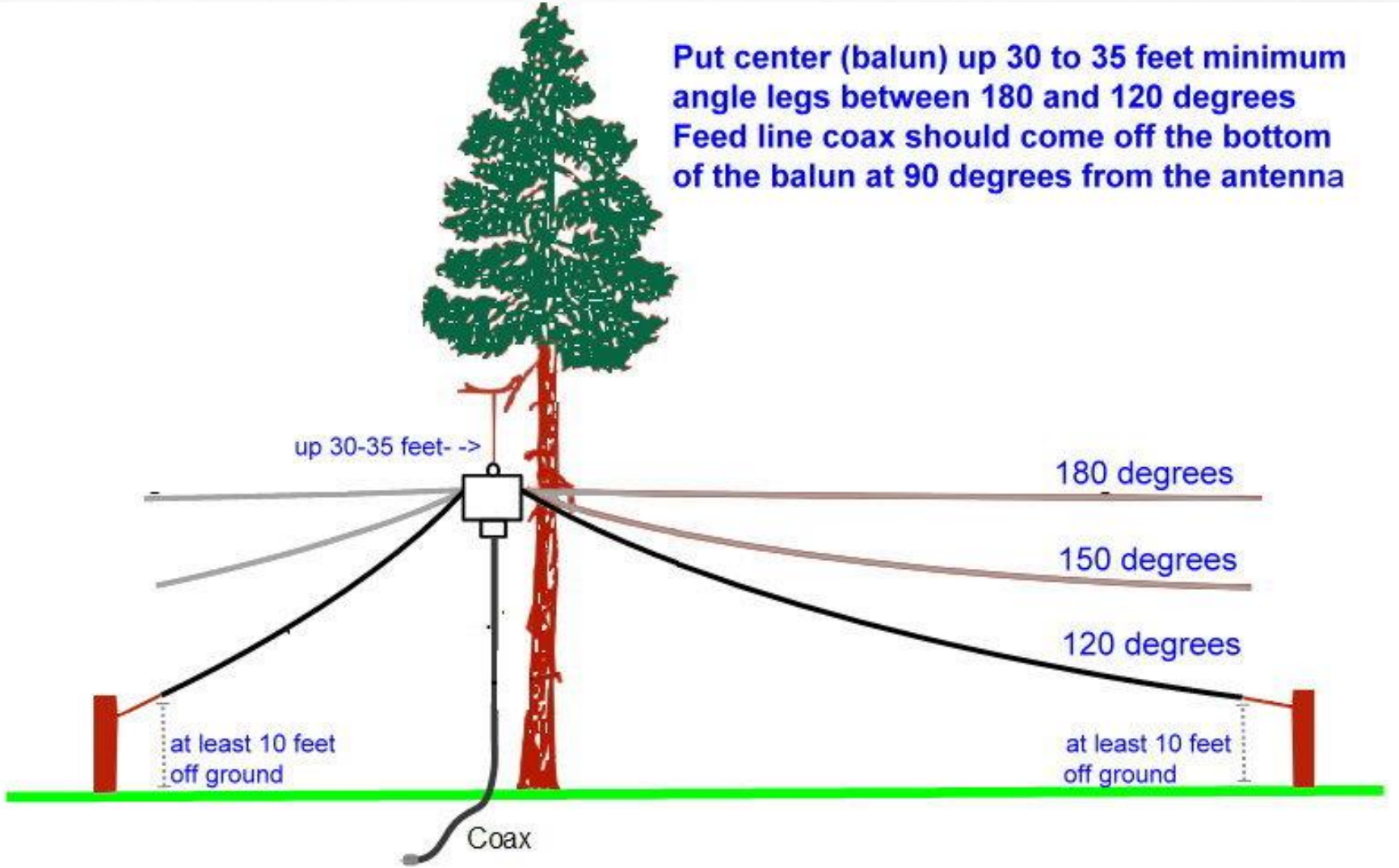
USE A 4:1 CURRENT BALUN

FEED WITH RG8X, RG213, LMR400

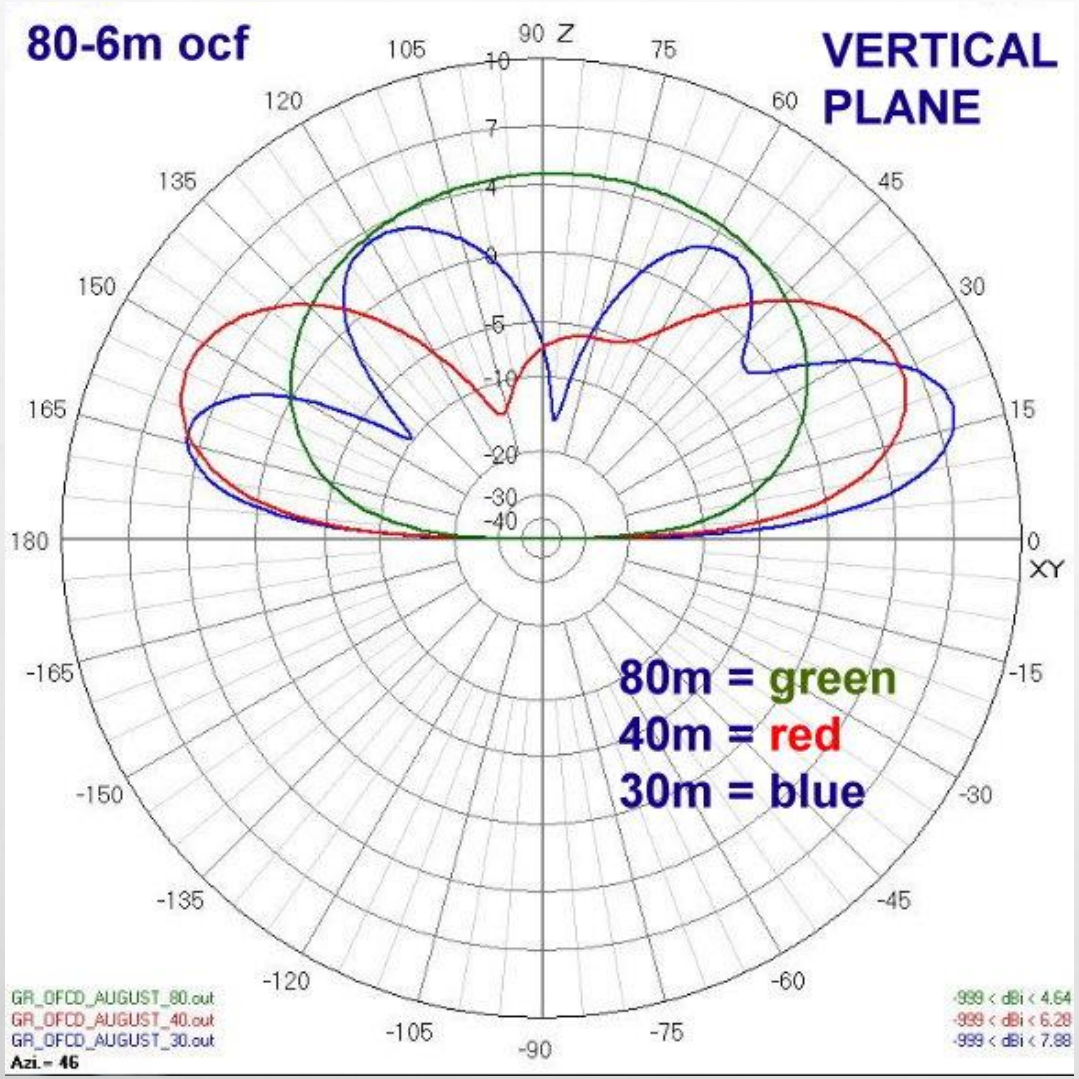
ANY GOOD QUALITY 50 OHM COAX

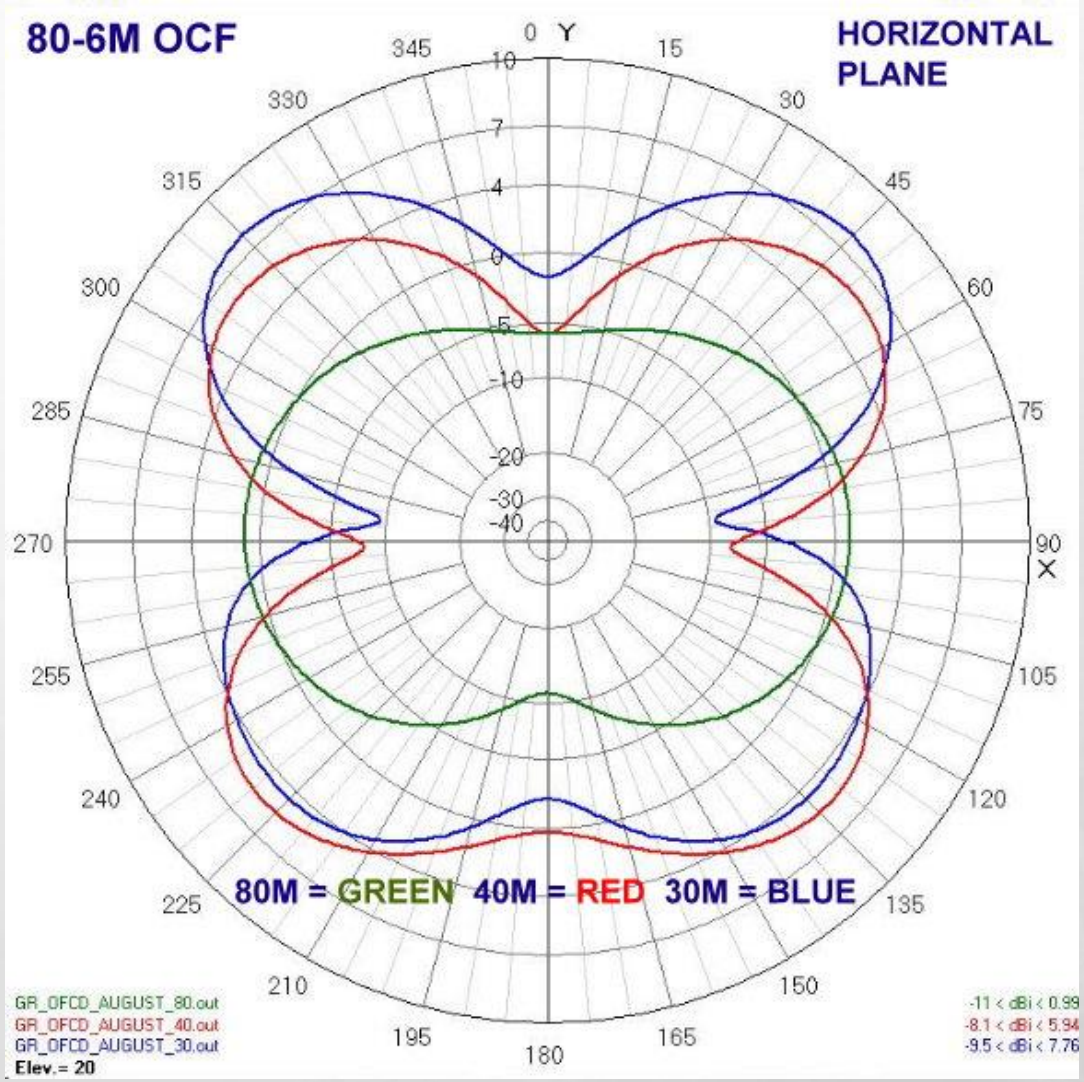


OCF ANTENNA INSTALL

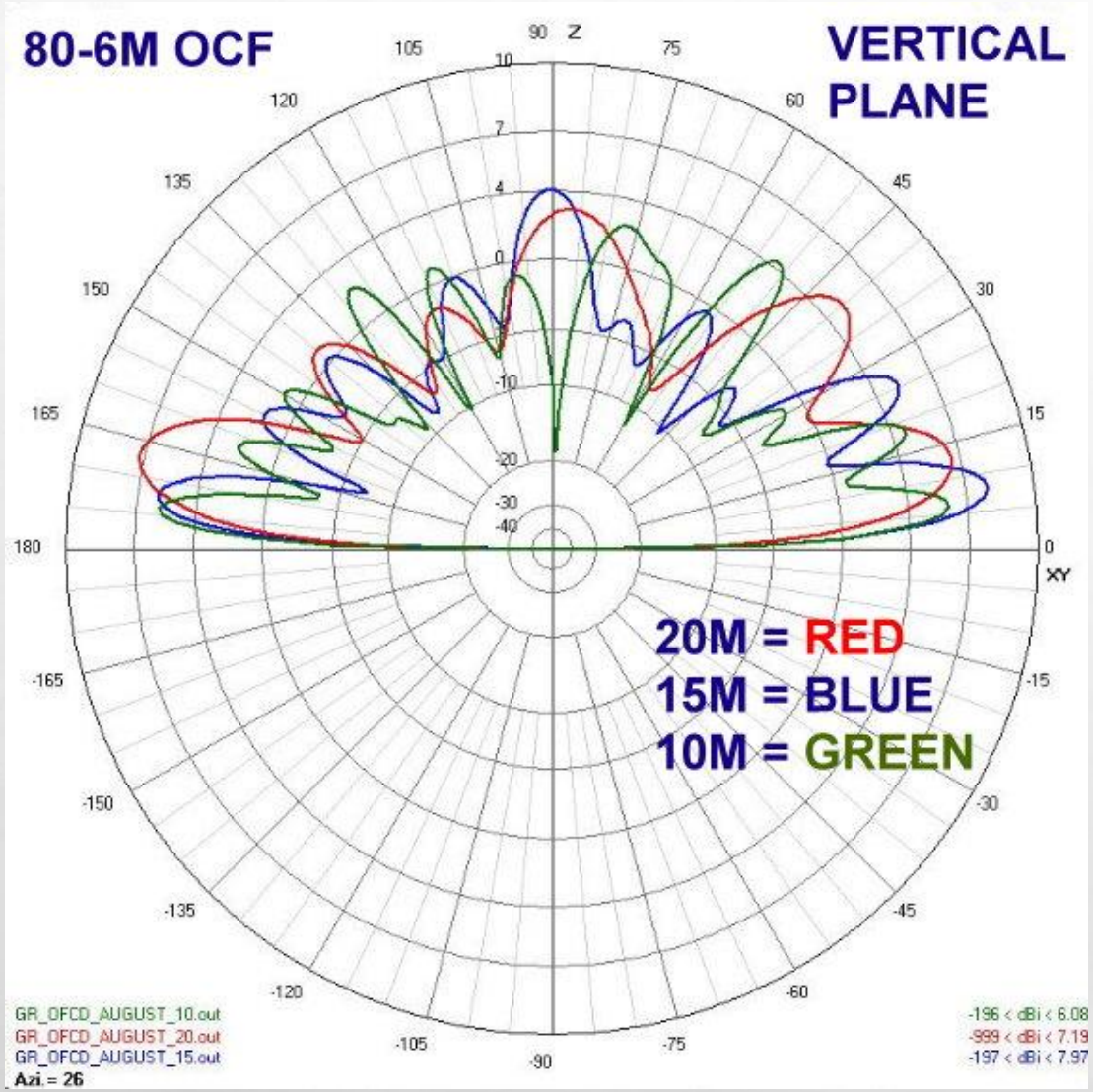


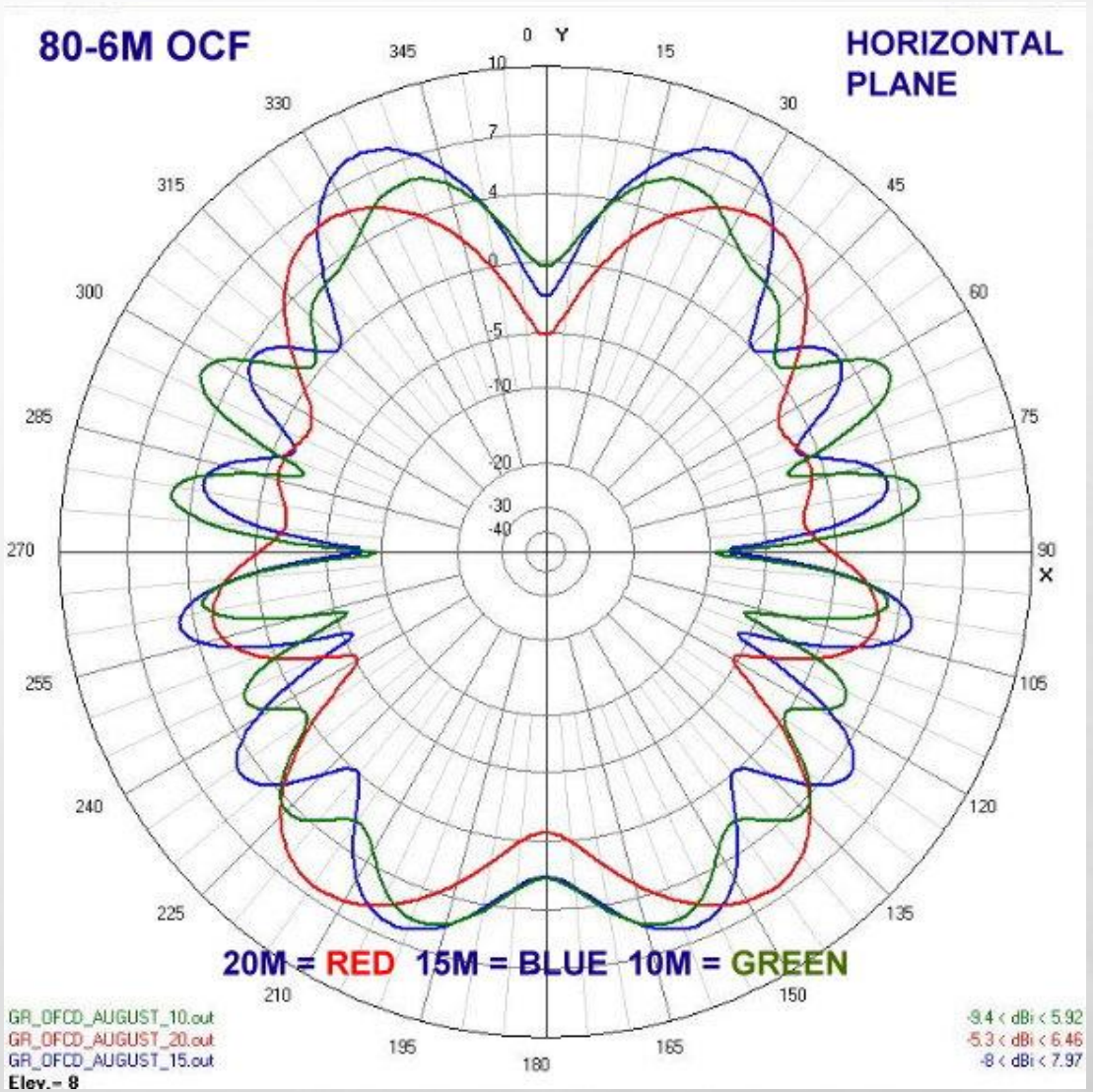
Similar image seen at https://hamcall.net/7bandocf.html



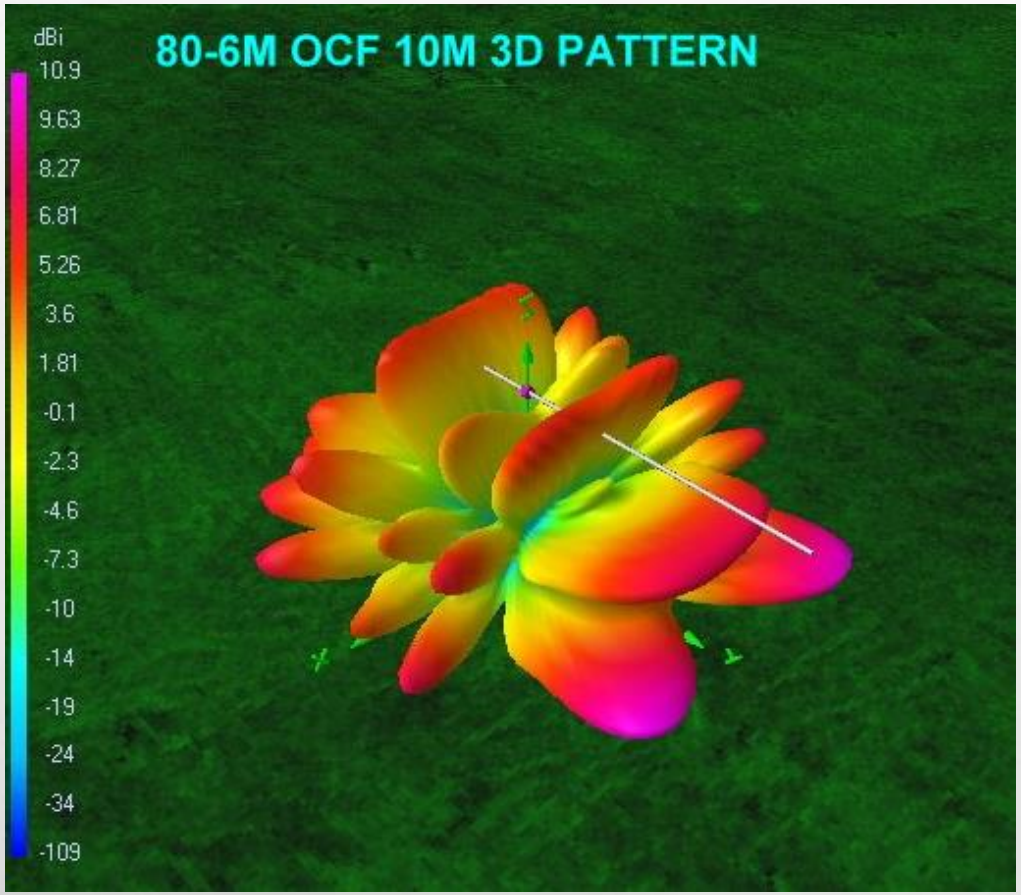


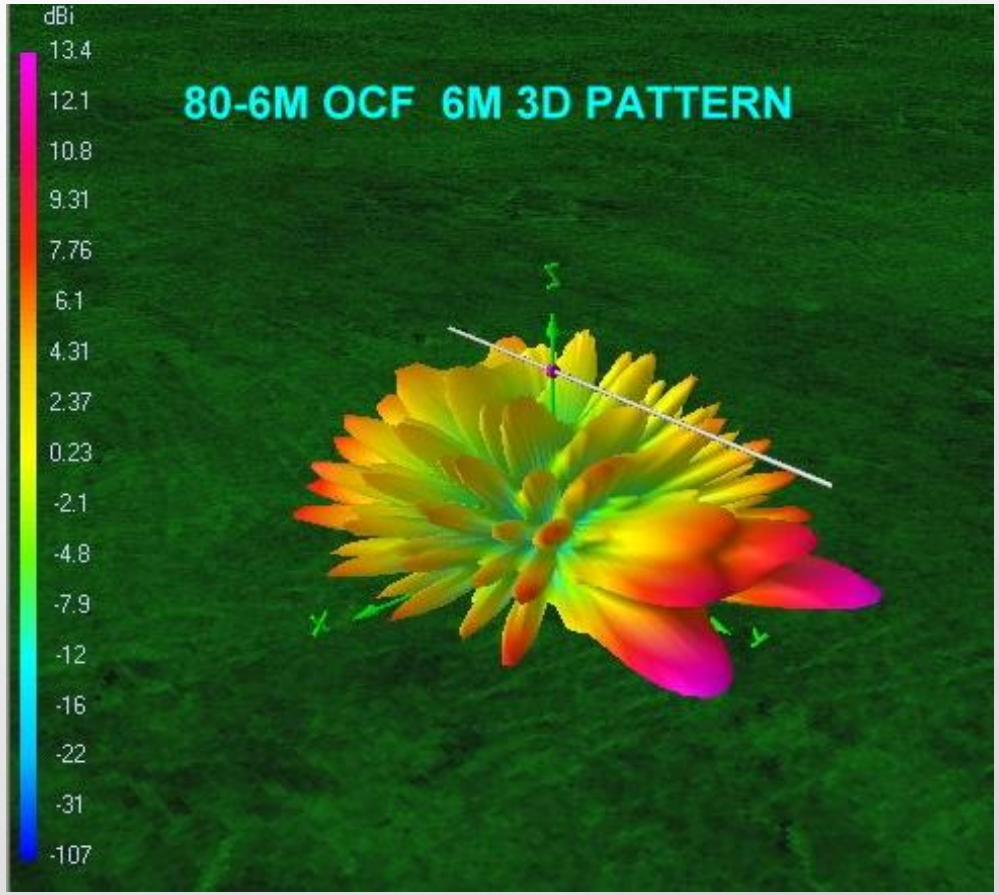
Patterns found at https://squashpractice.com/2015/10/25/the-off-center-fed-dipole-antenna-design/





Patterns found at https://squashpractice.com/2015/10/25/the-off-center-fed-dipole-antenna-design/



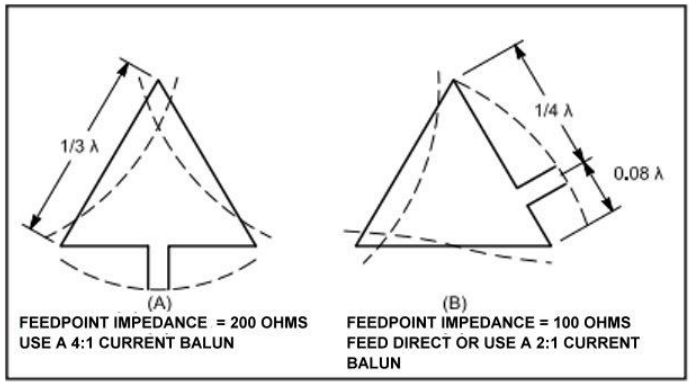


80-6m OCF on 10m = 8 wavelengths **80-6M OCF on 6m = 15 wavelengths**

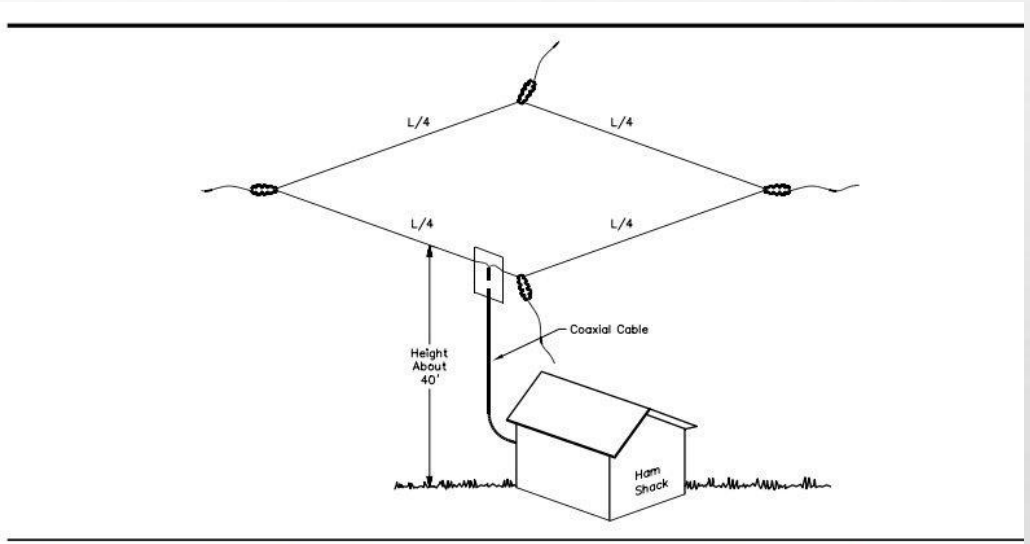
3d Patterns found at https://www.arraysolutions.com/ocf-patterns

THE LOOP SKYWIRE

THE DELTA LOOP



Current distribution for equilateral delta loops fed for (A) horizontal and (B) vertical polarization.



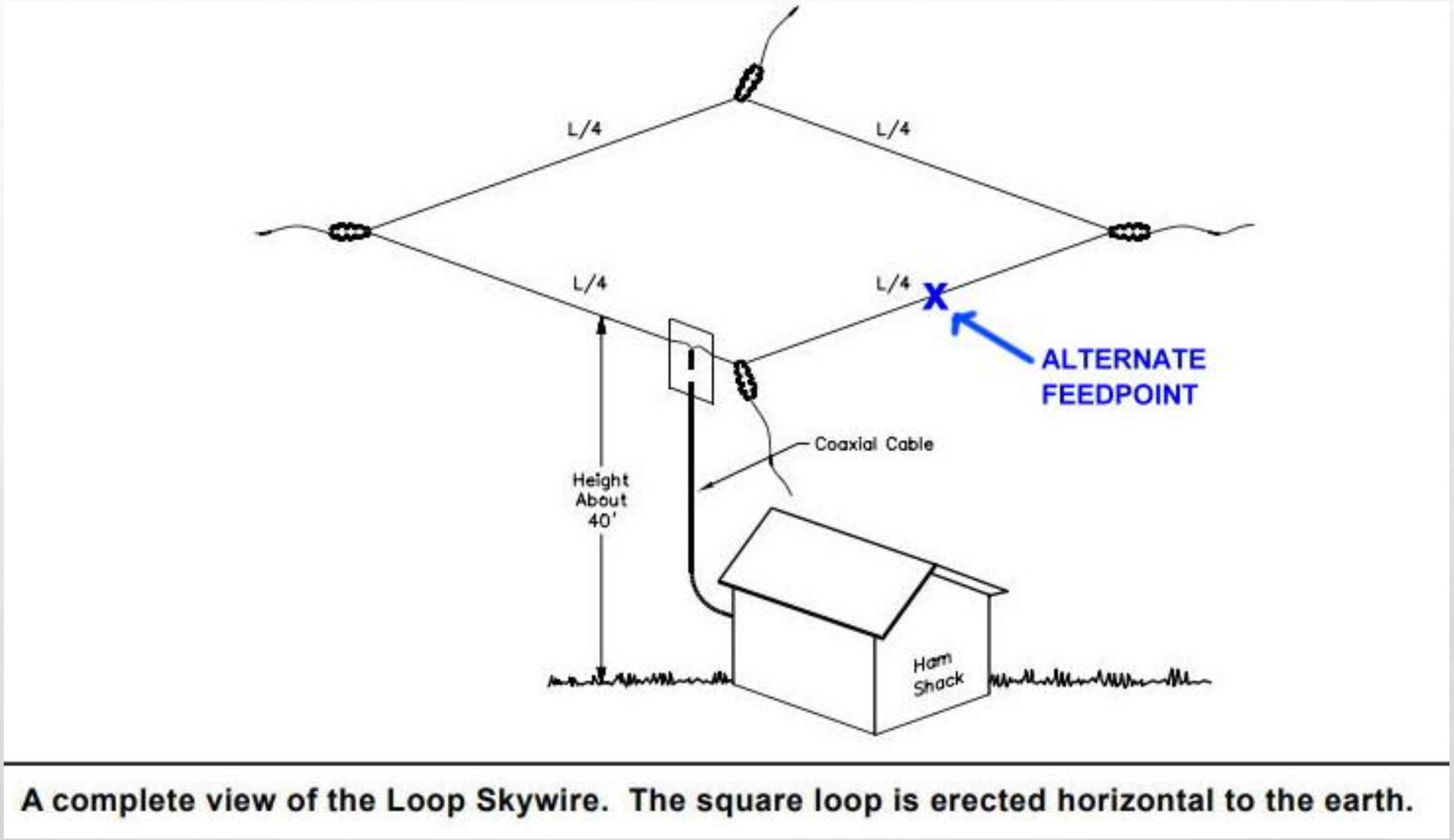
A complete view of the Loop Skywire. The square loop is erected horizontal to the earth.

- FORMULA: 1005 / FREQUENCY = TOTAL LENGTH OF WIRE

LOOP SKYWIRE HAS 4 SIDES DELTA LOOP HAS 3 SIDES

80M LOOP WORKS ON 80, 40, 20, 15, AND 10M

40M LOOP WORKS ON 40, 20, 15, AND 10M



A complete view of the Loop Skywire. The square loop is erected horizontal to the earth.

80M LOOP 281' TOTAL AND 70'3" EACH SIDE OF ANTENNA WIRE : ALTERNATE
40M LOOP 142 FEET TOTAL AND 35'6" EACH SIDE OF ANTENNA WIRE : 17' 9" FEEDPOINT

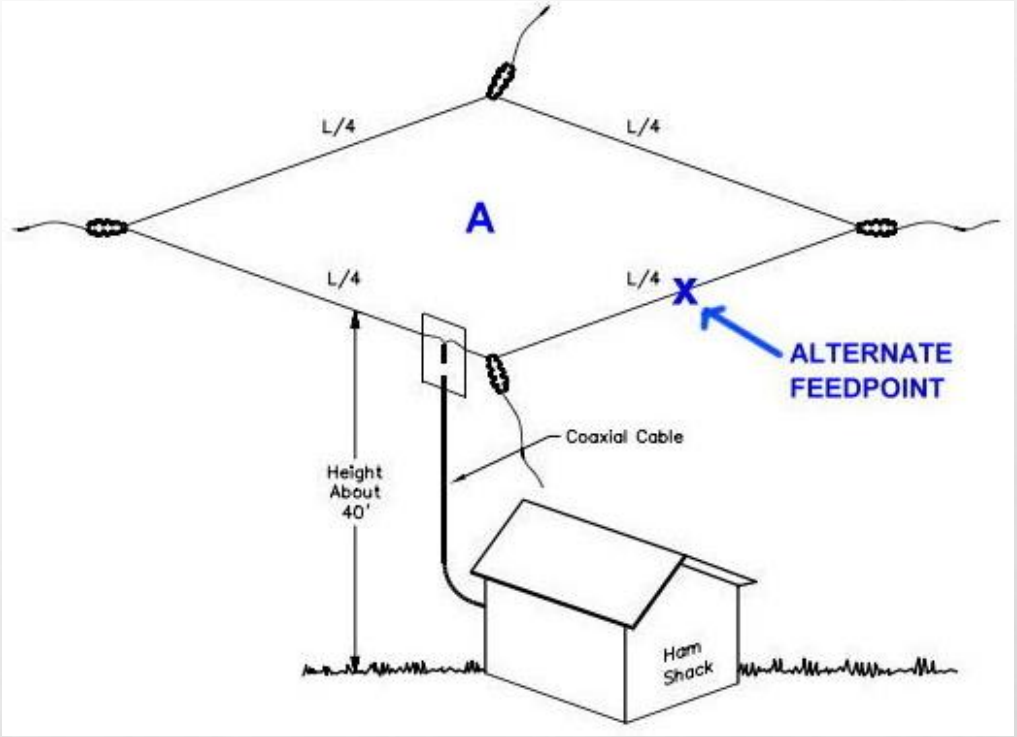
THE LOOP SKYWIRE ANTENNA

BY DAVE, BOX 888578, ATLANTA, GA CIRCA 1984, A RESULT OF A QSO.

This antenna has the practical maximum area (A) enclosed between its conductors; excellent bandwidth / impedance performance. Its feed impedance is considerably less affected by its height above the earth.

The antenna has about 2db of gain over the “electric” half wave dipole. It is effectively omnidirectional on its fundamental frequency and all harmonics when mounted flat (horizontally) above ground.

The antennas pattern and impedance are considerably less affected by metallic and almost unaffected by semiconducting objects in its vicinity.



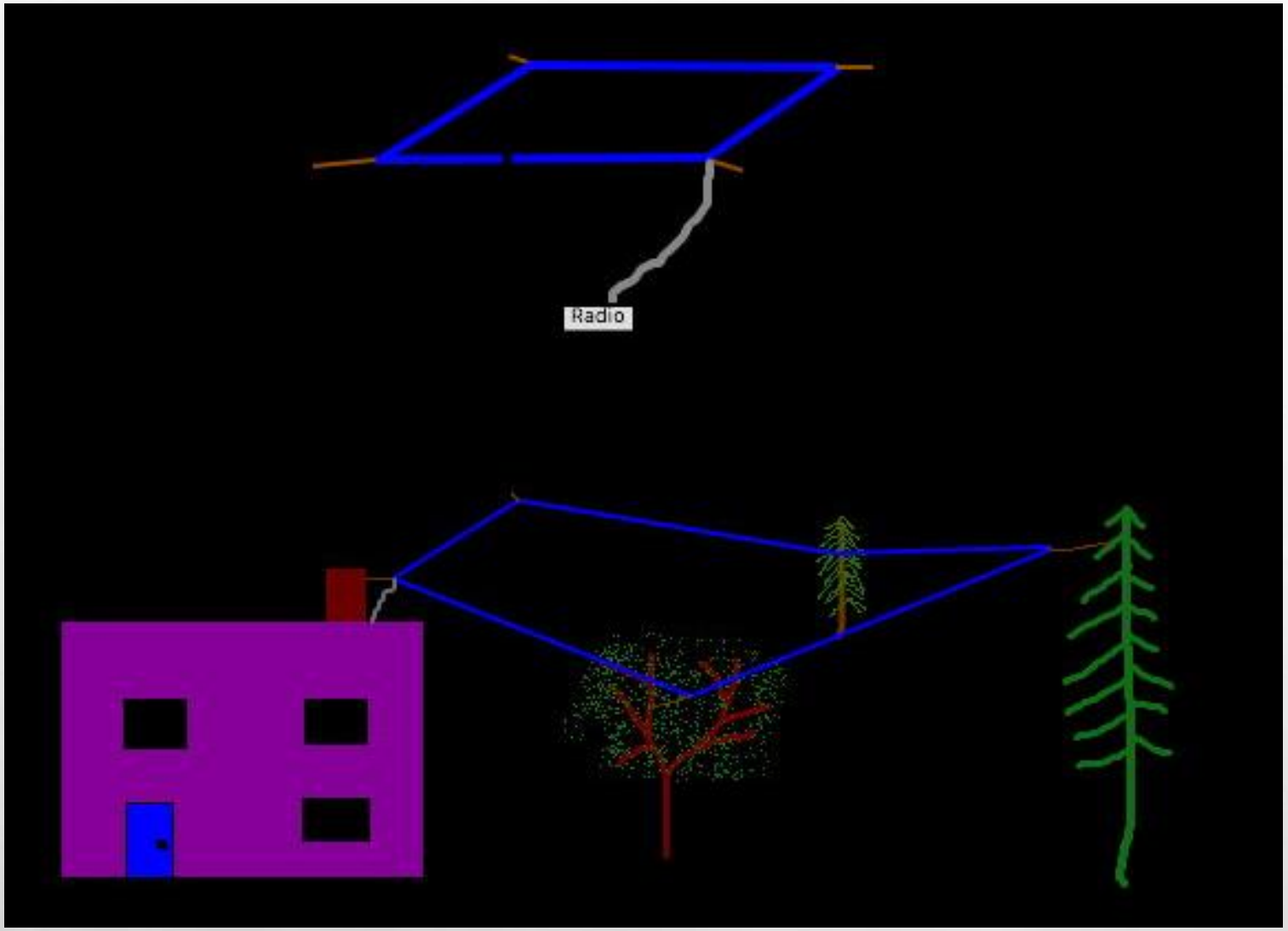
LOOP SKYWIRE

THIS ANTENNA IS A “MAGNETIC FIELD ANTENNA.” IT IS CONSIDERABLY LESS RESPONSIVE TO MAN-MADE AND ATMOSPHERIC NOISE. IT HAS MUCH BETTER SIGNAL-TO-NOISE RATIO / RESPONSE : MANY SAY 3-4 S UNITS, 18 TO 24DB IMPROVEMENT.

NOTE: THIS CONFIGUATION OF 4 EQUAL ¼ WAVELENGTH SIDES IS OPTIMUM. ANY OTHER THAN SQUARE LOOP CONFIGURATIONS WILL WORK BUT THEIR PROPERTIES WILL VARY BETWEEN ELECTRIC AND MAGNETIC BEHAVIOR. THE “RULE” IS TO MAKE AREA (A) AS LARGE AS PRACTICALLY POSSIBLE.

DAVE SAYS: CONSTRUCTING THE ANTENNA. *DO NOT USE BALUNS* *HIGH DIELECTRIC INSULATORS, INSULATED WIRE, AND THE NECESSITY OF KEEPING THE ANTENNA FREE AND CLEAR OF TREES, LIMBS, ETC. ARE NOT REQUIRED*. DIMENSIONS: 1005 / FREQ = FWL IN FEET. MOUNT THE LOOP HORIZONTAL TO THE EARTH. USE ANY GOOD 50 OHM COAX FASTENED DIRECT TO THE ANTENNA.

FINAL COMMENTS FROM DAVE; I HAVE USED THIS HARMONIC ALL BAND ANTENNA SINCE 1957 IN MANY LOCATIONS AND ENVIRONMENTS. MY OPINION IS IT’S THE BEST MULTIBAND ANTENNA.
C U ON CW ! DAVE



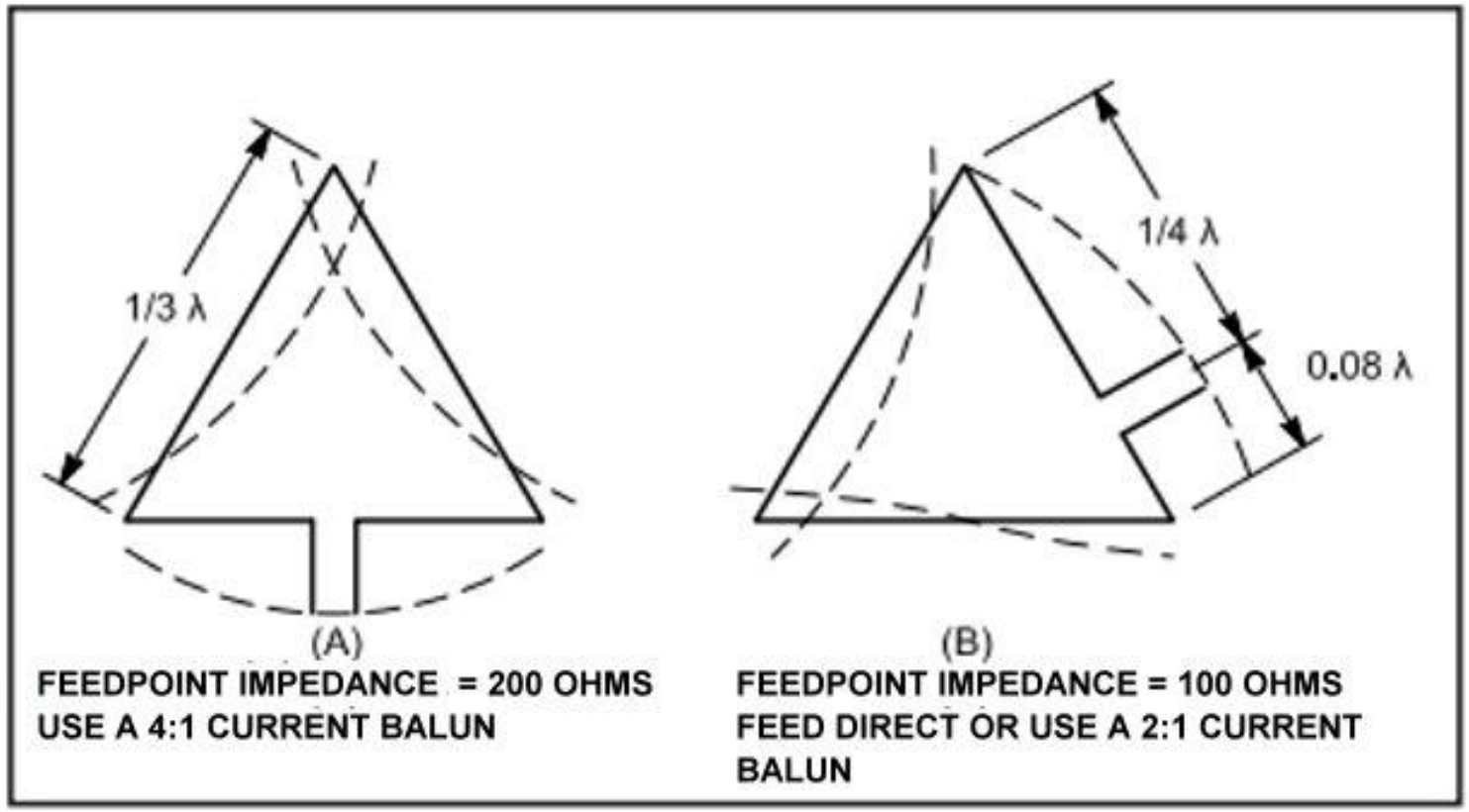
SKYWIRE LOOP

PREFERRED CONFIG

MORE REALISTIC CONFIG WITH OBSTACLES

Image found at https://practicalantennas.com/theory/loop/full-wave/

THE DELTA LOOP

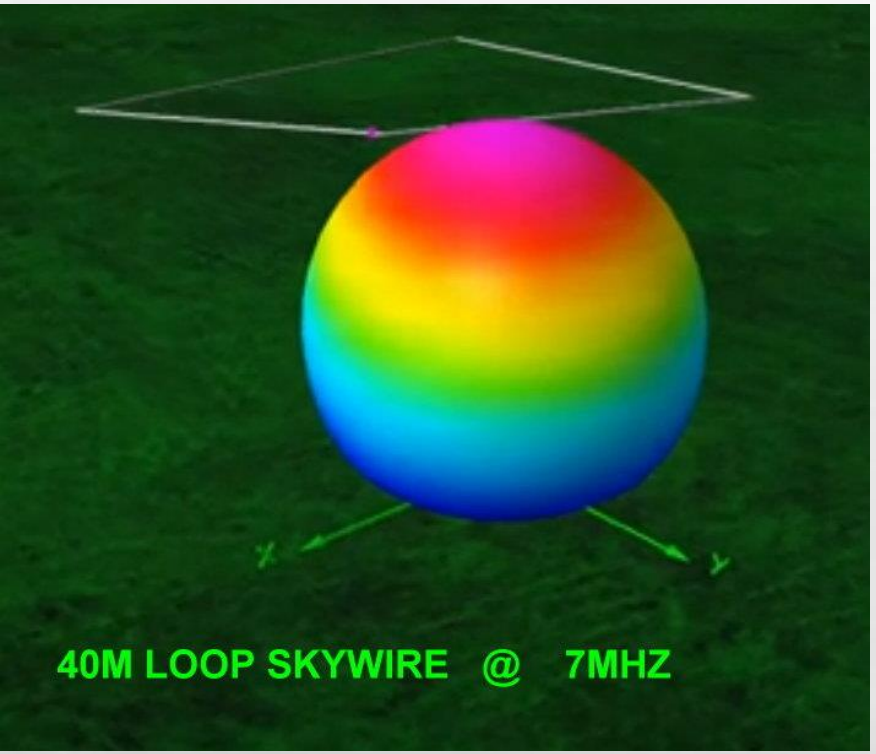


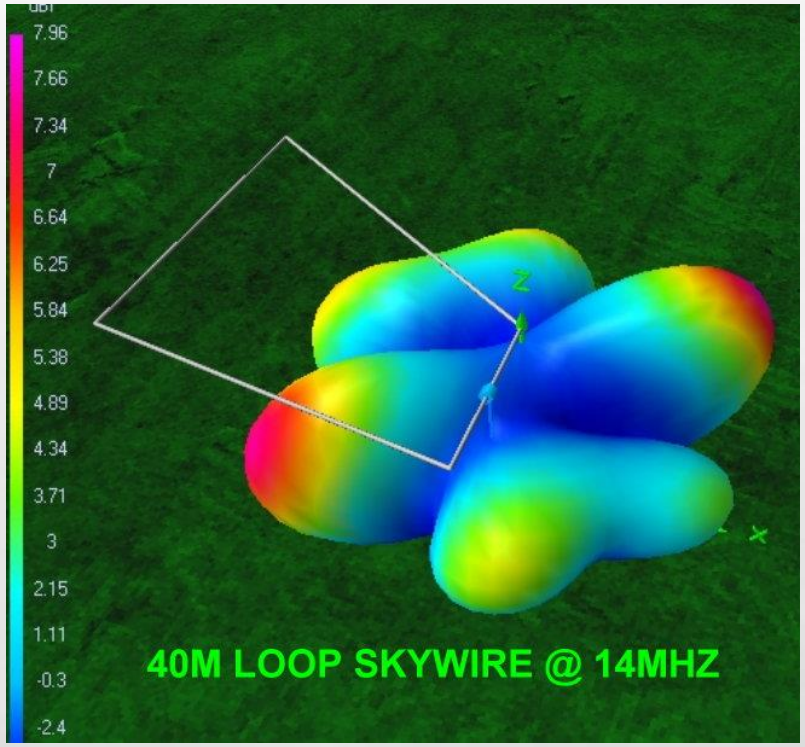
Current distribution for equilateral delta loops fed for (A) horizontal and (B) vertical polarization.

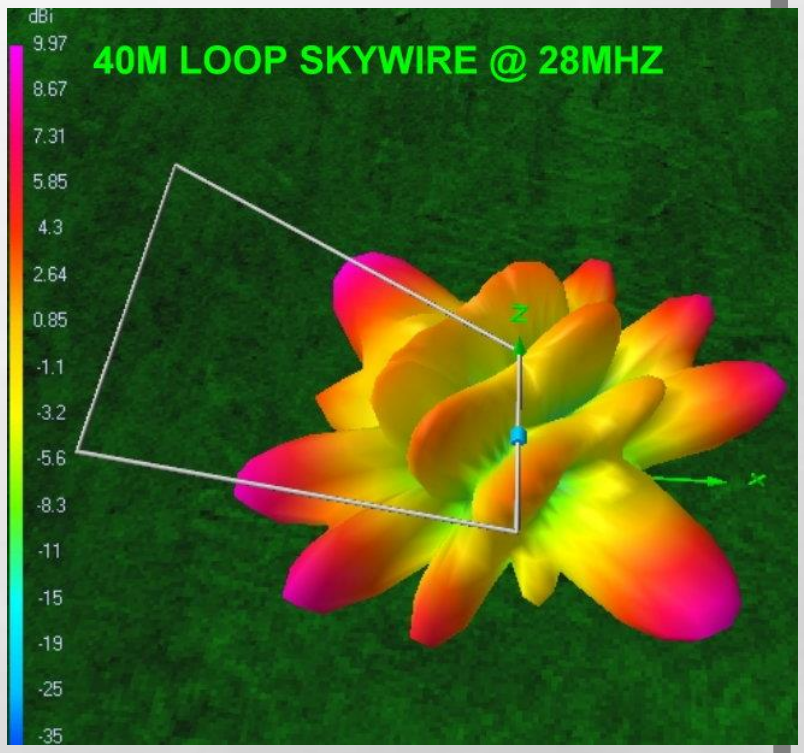
STILL A FULL WAVELENGTH LOOP BUT WITH 3 SIDES AND INSTALLED VERTICALLY. IT IS NOT OMNIDIRECTIONAL LIKE THE SKYWIRE. THIS ANTENNA IS BIDIRECTIONAL AND CAN BE CONFIGURED FOR HORIZONTAL OR VERTICAL POLARITY.

Image found at https://topbandhams.com/10.pdf

40M LOOP SKYWIRE RADIATION PATTERNS







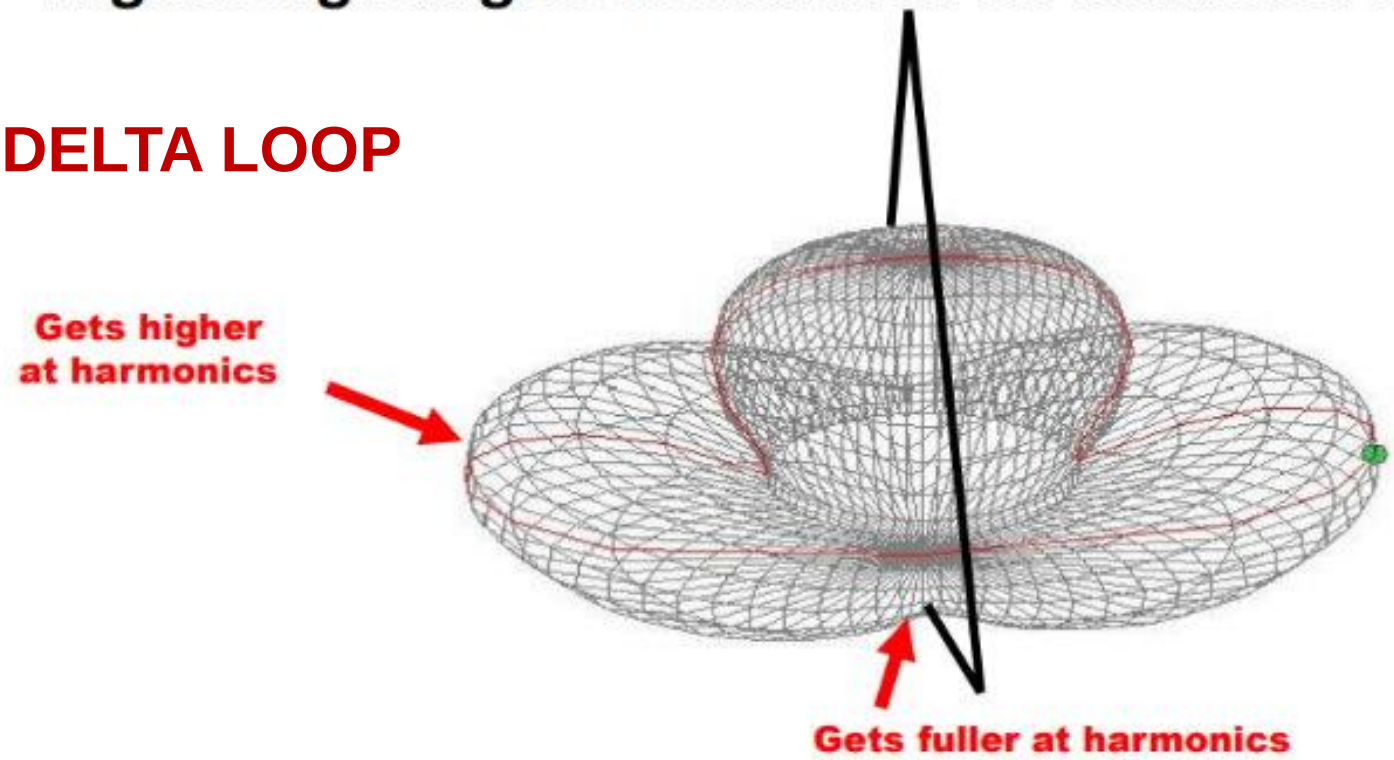
3d patterns found at https://vk3il.net/projects-antenna/horizontal-loop-antenna/

- A loop antenna is resonant at integral multiples I.E. 40, 20, 15, 10M
- Harmonics 200 - 300 ohms (50-75 after 4:1 BALUN)
- Less directivity at harmonics

USING 4:1 IF FED AT BOTTOM CENTER

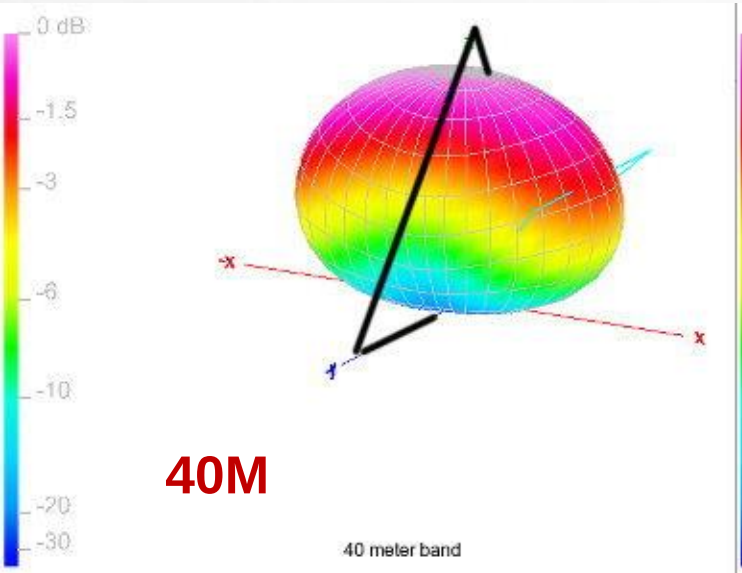
- Higher high angles of radiation on harmonic frequencies.

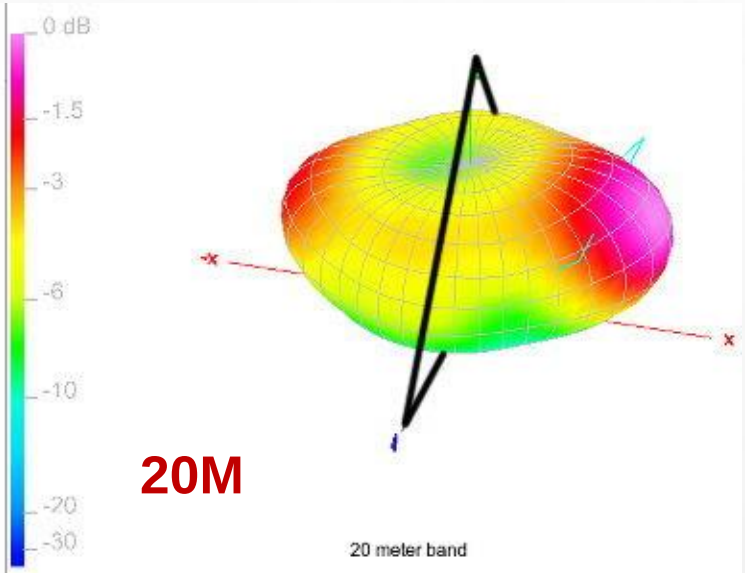
DELTA LOOP

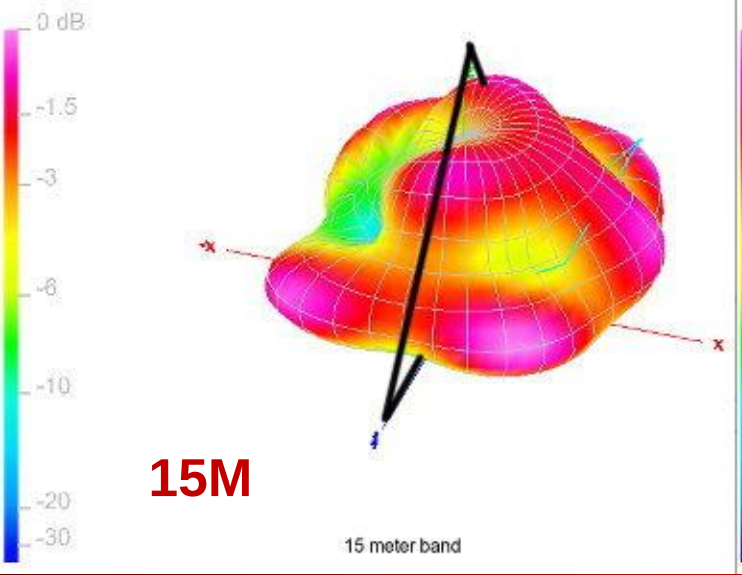


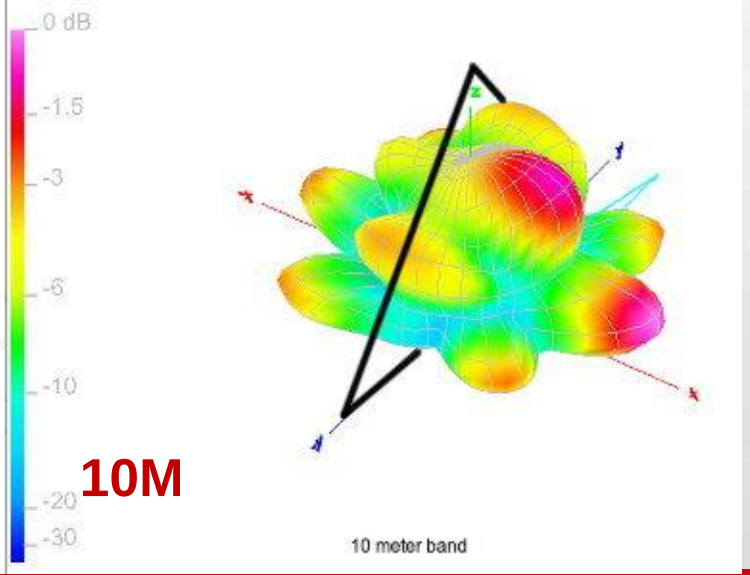
DELTA LOOP

VERTICAL FED









Radiation pattern from https://0x9900.com/building-a-delta-loop/

THE FAN DIPOLE

The design of the multi-band fan/parallel dipole is very simple. Fundamentally, it's just separate dipoles fed from the same point. The different elements interact with each other a bit, so if you have the space and don't really care where the radiation is directed, you can orient the elements 90 degrees from each other to reduce coupling. Here is the description from the 2008 ARRL Handbook:

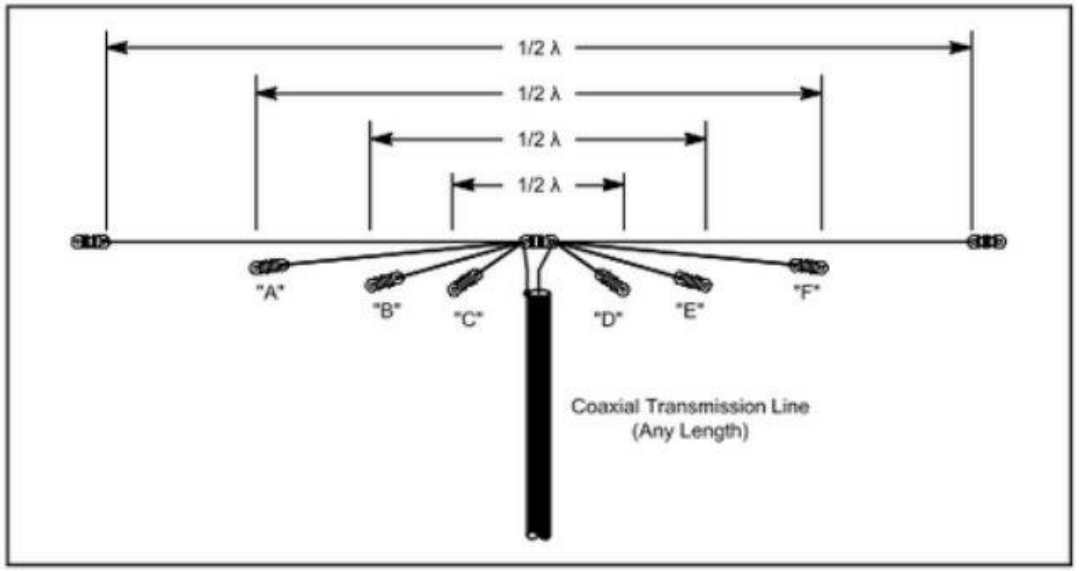
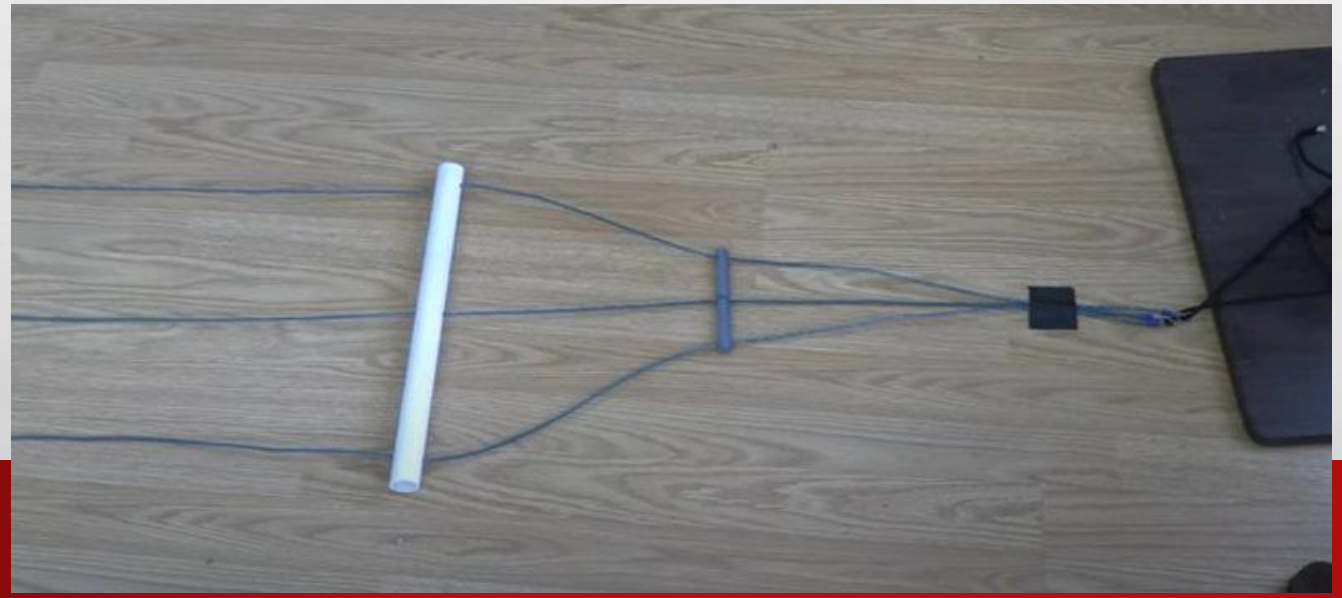


Fig 22.19 — Multiband antenna using paralleled dipoles, all connected to a common 50 or 75-Ω coax line. The half-wave dimensions may be either for the centers of the various bands or selected for favorite frequencies in each band. The length of a half wave in feet is 468/frequency in MHz, but because of interaction among the various elements, some pruning for resonance may be needed on each band.

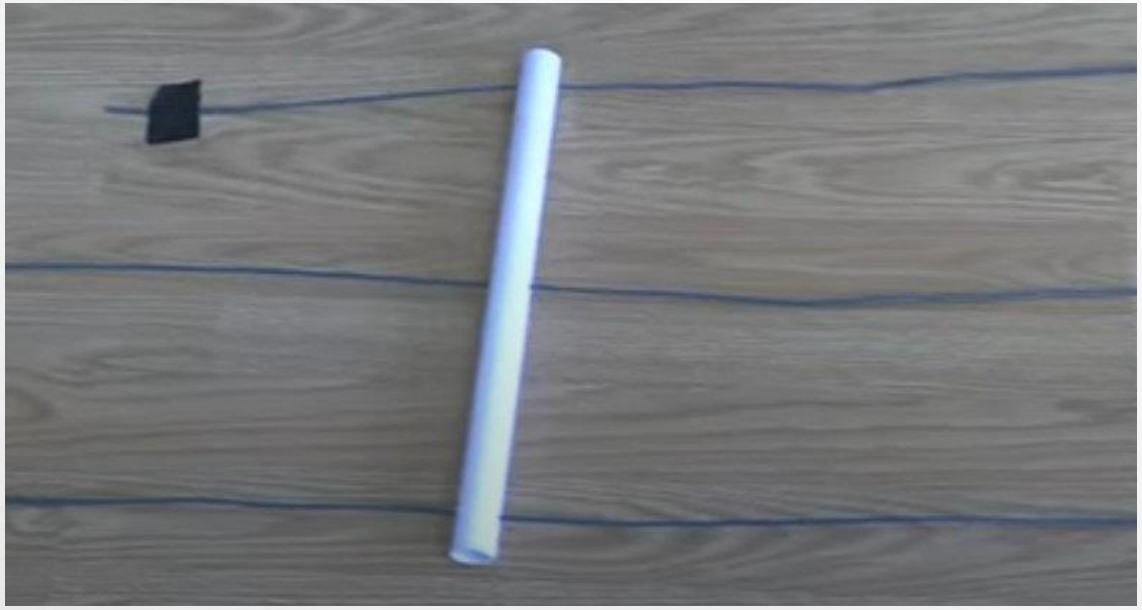
MAKING THE SPREADERS

NEED 4 LONG (3 WIRE) SPREADERS AND TWO SHORT (2 WIRE) SPREADERS

USE A 1:1 BALUN AT FEEDPOINT



3 BAND FAN

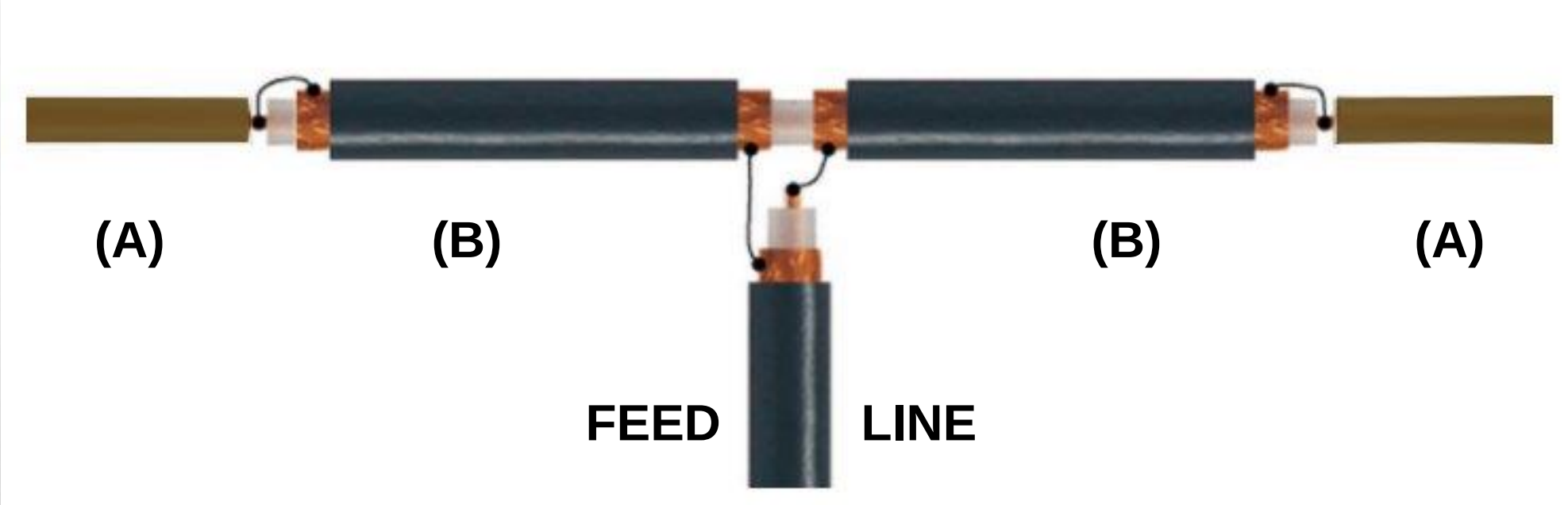


USE WIRE TIES AND THEN A HOT MELT GLUE GUN TO HOLD WIRE IN PLACE ON SPREADERS.

4 BAND FAN DIPOLE AT K3MV

Photo courtesy of K3MV

THE DOUBLE BAZOOKA DIPOLE



A = 300 OHM TWINLEAD OR 450 OHM LADDER LINE
B = 50 OHM COAX, RG8X RG8 RG213 FEED LINE = 50 OHM COAX

The Double-Bazooka

The Bazooka was designed for the military. During WW2, MIT came up with it for use as a radar antenna. By the way, in its infancy, radar used frequencies much lower than those used today.

Pros:

*The advantage that a bazooka has over other wire antennas is its band-width. You can cover all of 40-meters with a decent SWR but it won't cover all of 80 or 10 meters without a tuner. If I remember correctly, back in the late 80's I built one for resonance at 3.8mhz and it worked great from 3.7 to 3.9mhz. Using an external tuner, it covered the entire band 3.5 to 4.0mhz.

*Experienced users say it's "Quieter" than a dipole. Depending on your QTH's RFI environment, that can be a big plus.

*It can be fed directly with 50 or 75 ohm coax. No balun is needed since its feedpoint is 50 ohms.

Although I have researched and built many Double Bazooka Dipoles over the last 40 years I found K3DAV's article couldn't tell it's story any better. Check it out at https://www.kapstadt.de/DF1KW-ZS1AI/build-double-bazooka.pdf

The Double-Bazooka

Cons:

*The biggest one is weight. It's a lot heavier than a standard half-wave dipole because a large portion of the antenna is made of coax. If you're making one for ten meters, the weight isn't a big factor but an 80M one could be VERY heavy, especially if you are using ½ inch coax to build the antenna. A good ¼ inch uv resistant rope can be used to help support the antenna in this case.

*It's a tad complicated to build. A simple dipole can be built in a few minutes but the bazooka family of antennas can't. There are commercially built ones available.

*It's a single-band antenna

NOT THE NORMAL FORMULA FOR A ½ WAVE DIPOLE
468 / F (MHZ)

460 / F (MHZ) = TOTAL LENGTH (TL)

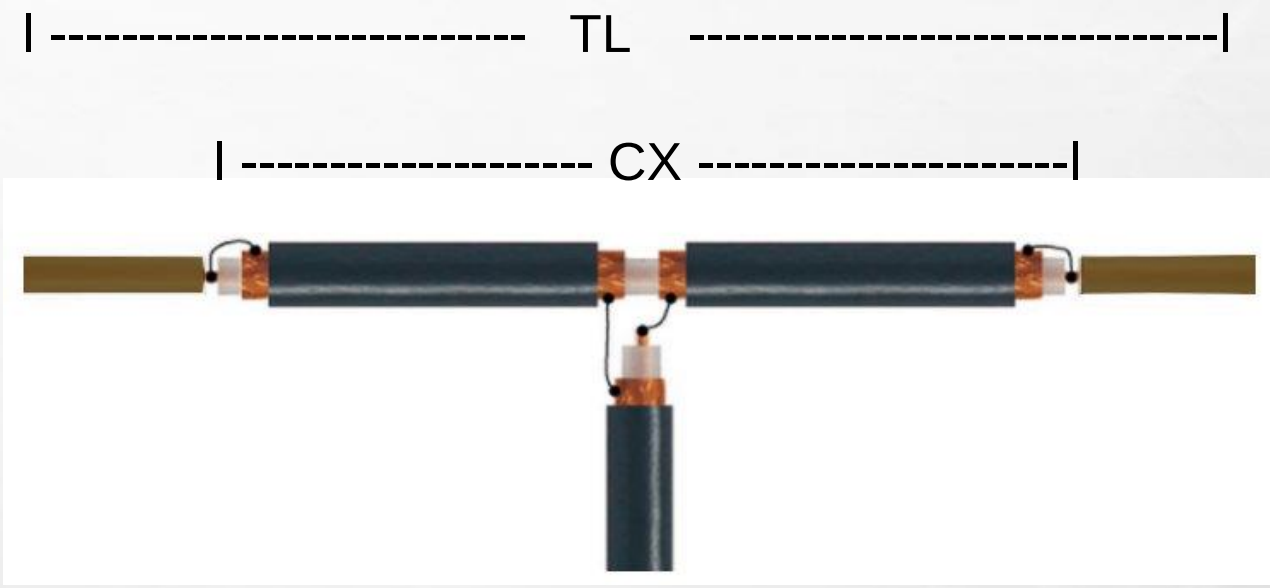
325 / F = LENGTH OF COAX (CX)

LENGTH OF TWINLEAD

TL – CX / 2 FOR EACH END

CENTER OF ANTENNA (FEED POINT)

CX / 2

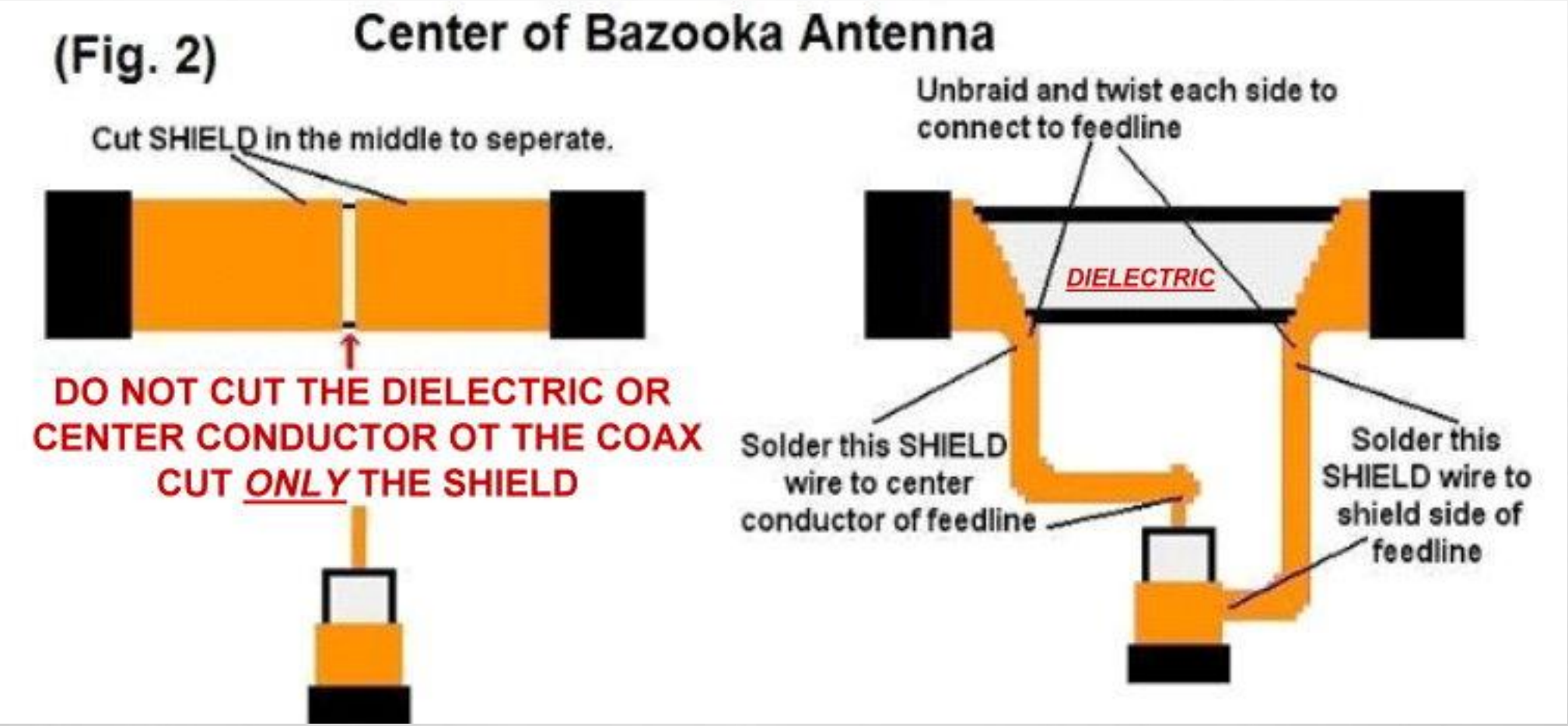


40M DB DIPOLE
460 / 7.15 MHZ = 64’4” TL
325 / 7.15 MHZ = 45’5.5” CX
TWINLEAD = TL – CX / 2 = 18’ 10.5”/ 2
9’ 5 ¼” EACH SIDE
FEED POINT 45’5.5” / 2 = 22’ 8 ¾” FROM END OF COAX TO CENTER

BUILDING THE DB DIPOLE

NOTES: *Do not use thin RG-58 coax. It won't be any better than a basic 2 wire dipole. The severe thinness of the braided shield of RG-58 will allow the Bazooka to perform no better than a basic straight wire dipole.
*And DO NOT worry about the Velocity Factor of the coax you use to build this antenna. It does not matter and will have no effect on the length calculating formulae.
*RG8X, RG8, OR RG213 Will work fine for building the antenna. DO NOT use LMR400 or any other coax that uses a foil and braid for the shield of the coax. The foil will render the antenna to act as a simple two wire dipole. The Bazooka is designed to work best with a leaky type of coax.
*RG-8 and RG213 have a larger diameter radiator which makes the antenna a little more broadbanded.

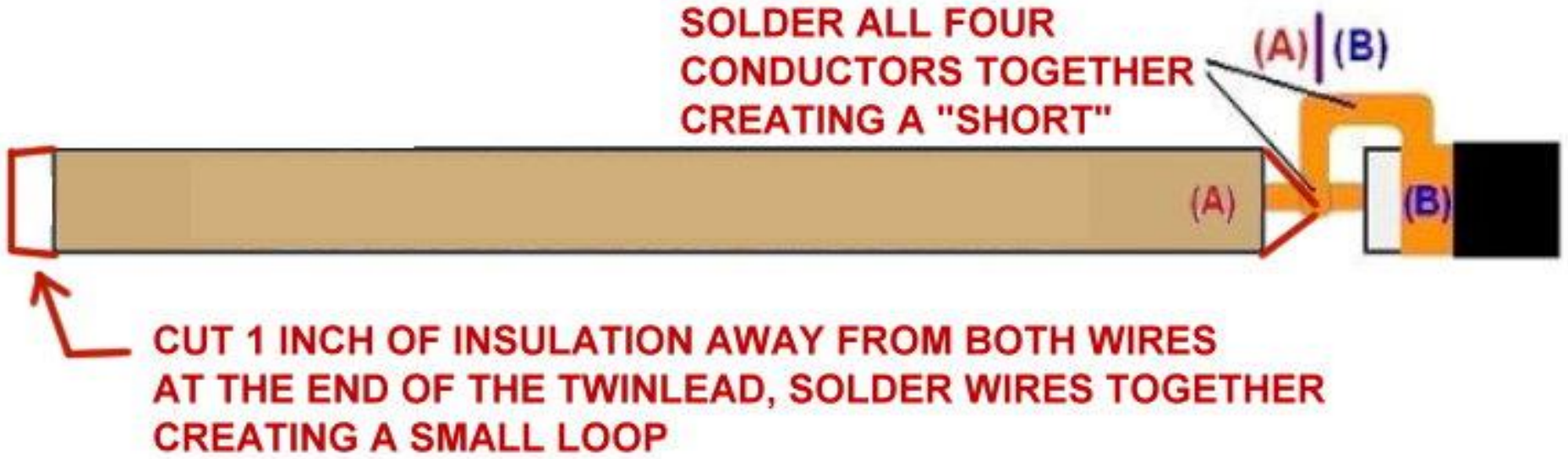
FEEDING THE DOUBLE BAZOOKA



THANKS TO K3DAV FOR THIS IMAGE revised for presentation

Bazooka Tuning Tails

WHERE (A) MEETS (B), CUT 1" OF COAX INSULATION/DIELECTRIC AWAY TO EXPOSE THE SHIELD AND CENTER CONDUCTOR. CUT 1.5" OF INSULATION FROM BOTH WIRES IN THE TWINLEAD TO EXPOSE THEM.



THANKS TO K3DAV FOR THIS IMAGE revised for presentation

This is an alternative for making the tails.

Leave the shield and jacket on the tails but still make the shield to center conductor connection at the same calculated point. Also be sure to connect the shield and center on the tip end as well.

This method uses the shield wire only as the tail section, but has no effect on measurements or performance.

THANKS TO K3DAV FOR THIS IMAGE
FOR HIS GREAT ARTICLE ON THE DB ANTENNA, GO TO:
https://www.kapstadt.de/DF1KW-ZS1AI/build-double-bazooka.pdf

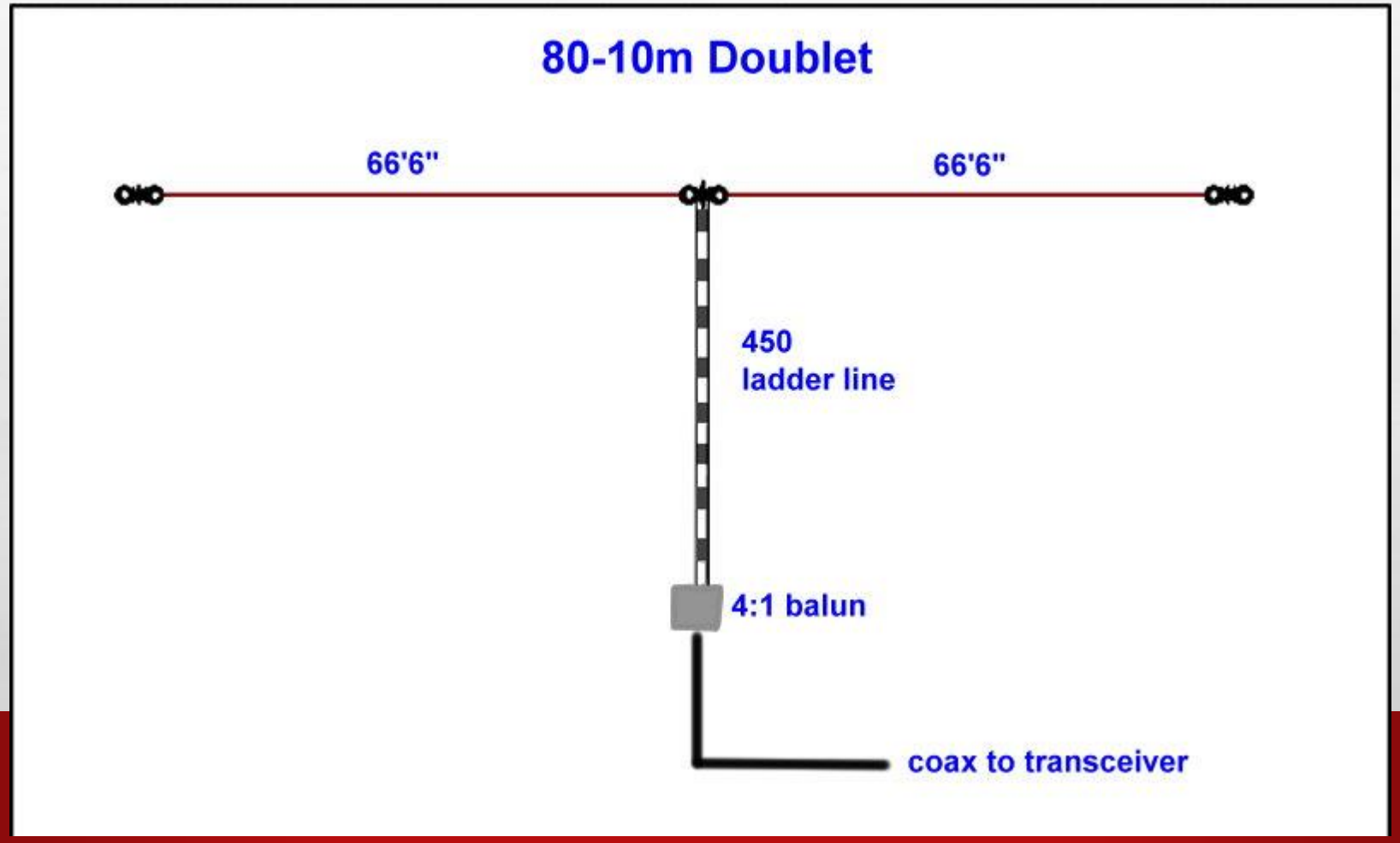
Radiation pattern of a double bazooka antenna

During research, I found many conflicting claims of the DB antennas patterns.

Some claim the antenna is more omnidirectional with a few lobes extending at various degrees.

Some claim it’s patterns are the same as a ordinary wire dipole, broadside to the antenna.

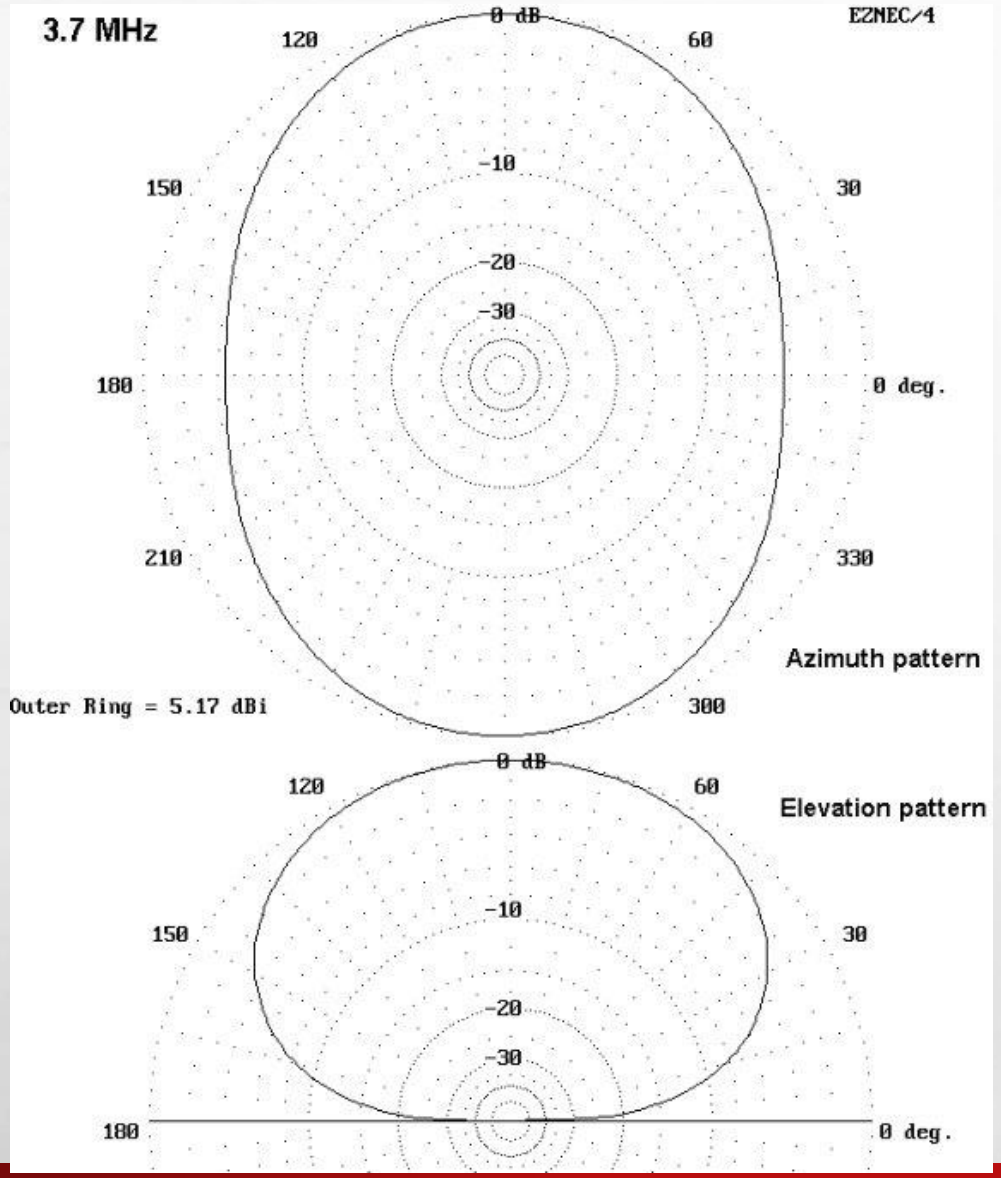
THE 80M DOUBLET OR ALL BAND DIPOLE

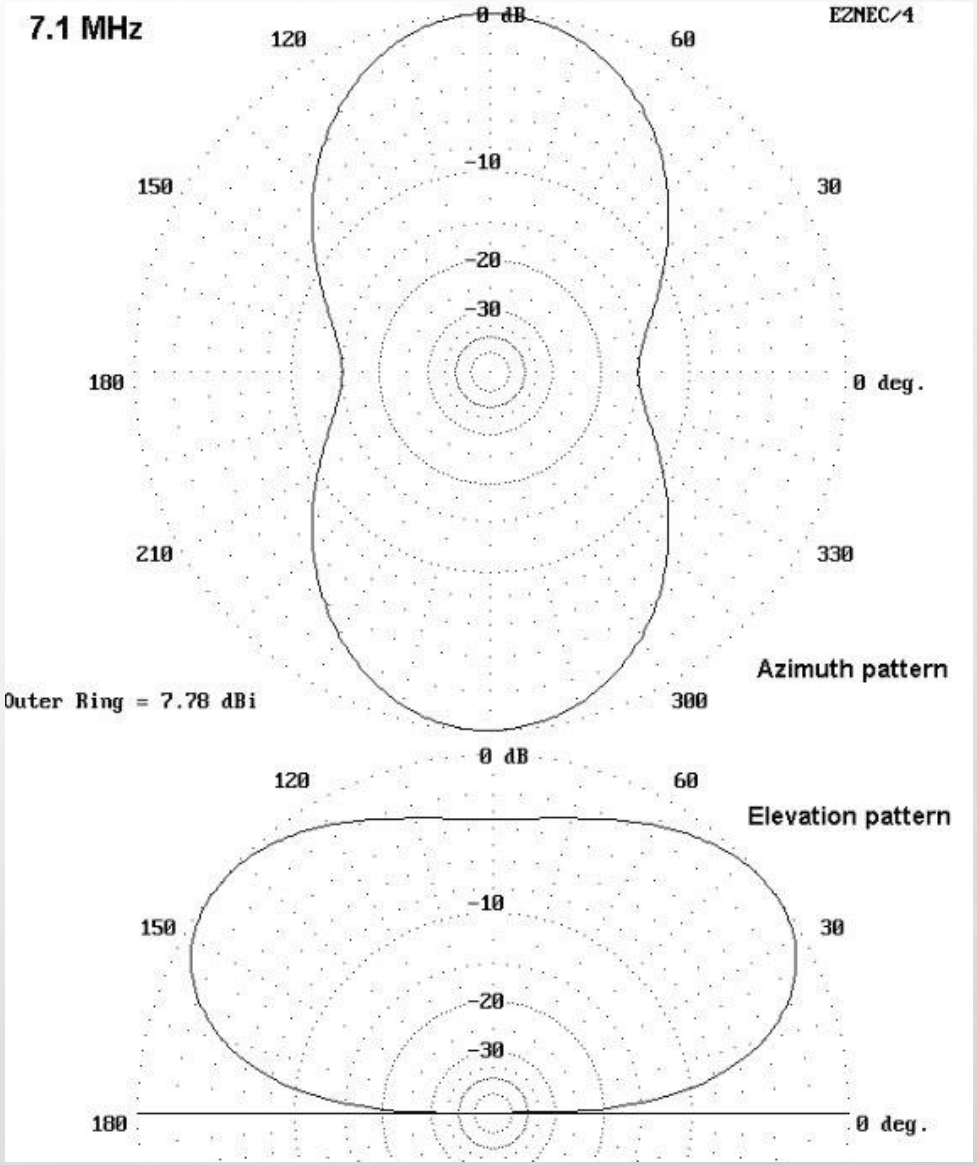


A Doublet antenna for 80-10m

When building this antenna do not use a length of ladder line that when added to one sides radiator length equals an odd multiple of an eighth wavelength. 66.5 feet plus ladder line length should not = the odd multiple of an eighth WL of the antenna.
Thus, if my math is correct, lengths to stay away from are 37’ 6” and 107’ 6” for the ladder line.

Use a 4:1 current balun at the end of the ladder line near your house. Run a short piece of RG213 or LMR 400 to your feedline lightning protection bulkhead.

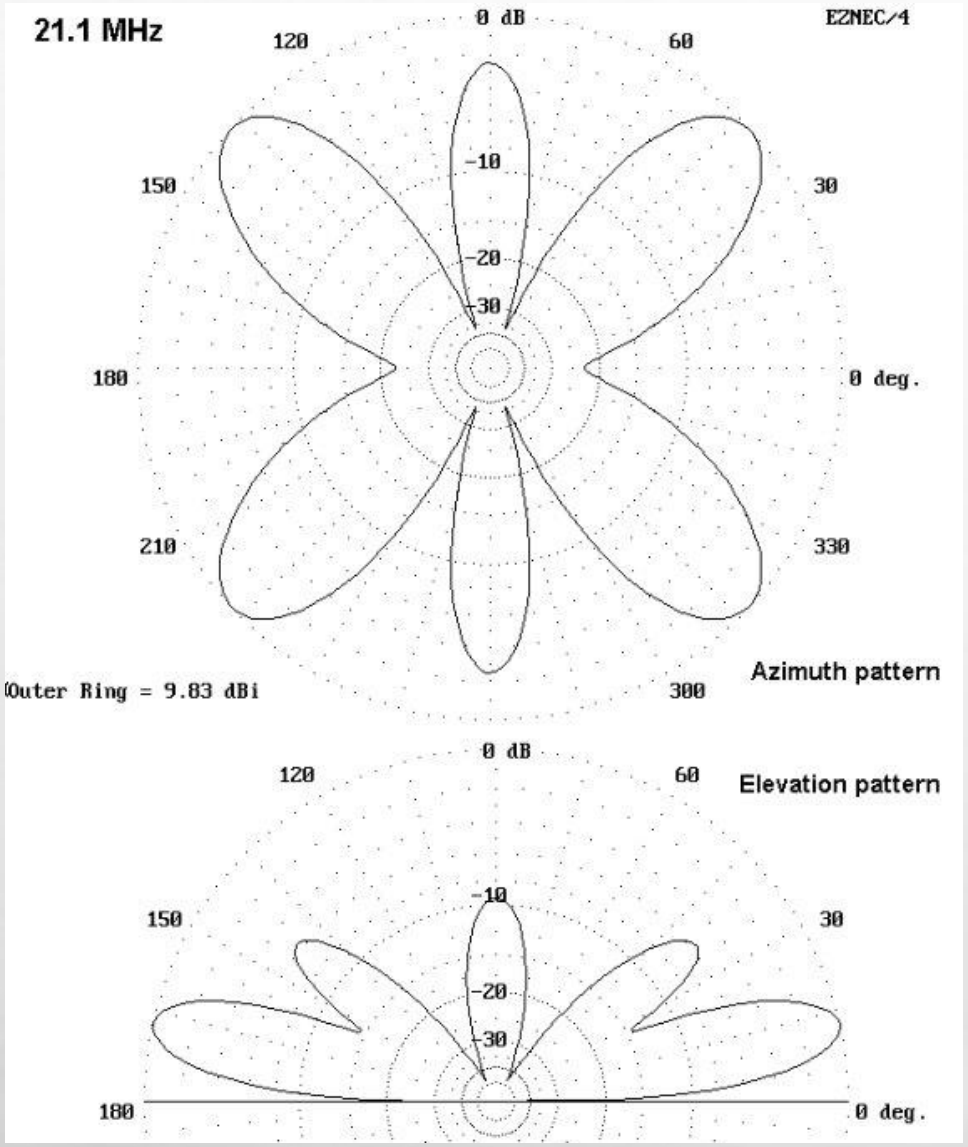


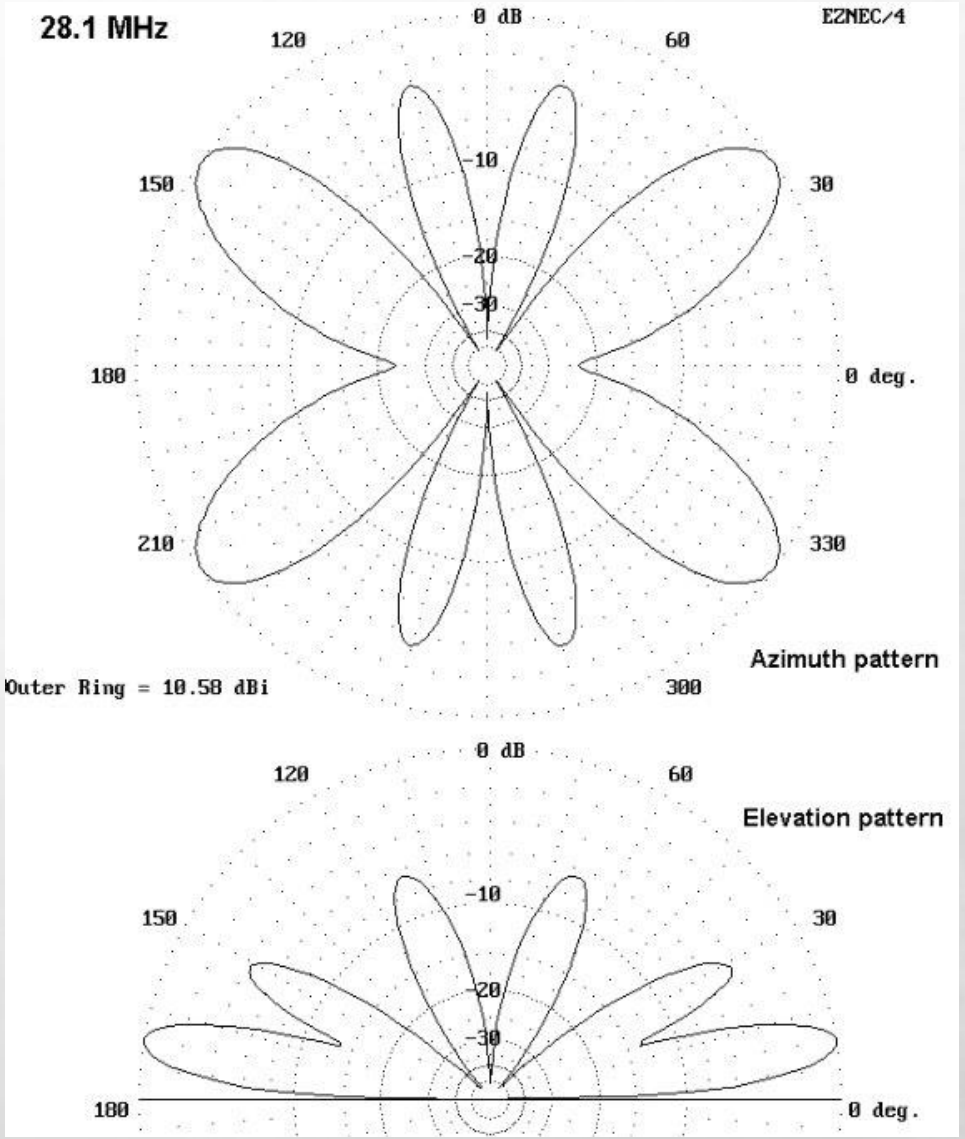


Doublet 80m pattern

40m pattern

Patterns found in an article by L. B. Cebik, W4RNL "Introducing the All Band Doublet"

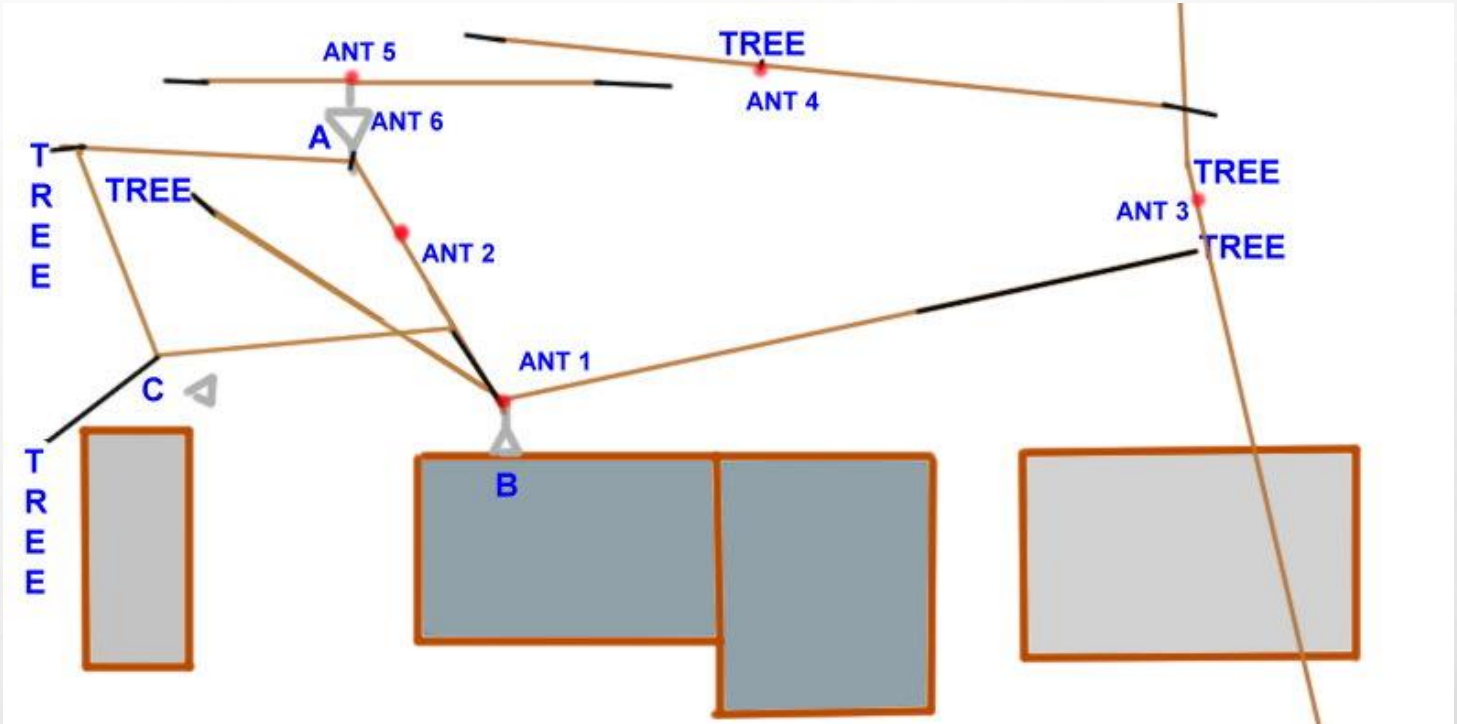




Doublet 15m pattern

10m pattern

MY ANTENNA FARM



A = 36' TAPERED TOWER
B = 40' GUYED TOWER (MOSTLY TV ANTENNAS)
C = 40' GUYED TOWER (WORK IN PROGRESS)

ANT 1 = 75M NVIS, 30M, 20M FAN DIPOLE AT 30 ' INV V 1:1B 75, 30, 20M
ANT 2 = 40-6M FULL WAVE LOOP SKYWIRE AT 33' FLAT 1:1B 40, 20, 15, 10, 6M
ANT 3 = 160-6M OCF DIPOLE AT 60' 120 DEG INV V 4:1/1:1B 160, 80, 40, 12, 10, 6M
ANT 4 = 80-10M OCF DIPOLE AT 35' INV V 4:1B 80, 40, 17M
ANT 5 = 60,30M OCF DIPOLE AT 30' INV V 4:1B 60M AND 30M
ANT 6 = 4 ELEMENT 10M QUAGI ON TOWER A 10M AND 12M
FUTURE ON TOWER C = 10-15-20M TRIBANDER, 10H + 10V 2M YAGI, 10 ELE 432 H YAGI, 36 ELE 1.2GZ H YAGI

TIPS

WHEN USING MATH FORMULAS FOR WIRE ANTENNAS, FIND A GOOD ONLINE DECIMAL FEET TO FRACTION CONVERTER. 44.5 FEET IS NOT 44’5”, ITS 44’ 6”. 132.38 FEET IS 132’ 4 & 9/16”, ETC IF A FOOT WAS ONLY 10 INCHES ALL OUR PROBLEMS WOULD BE SOLVED !

BEFORE MAKING AN ANTENNA, CHECK YOUR PROPERTY, MAKE SURE IT WILL FIT, LOOK OVER SUPPORT STRUCTURES LIKE TREES, POLES, BUILDINGS, ETC. COME UP WITH A GAME PLAN.

YOU SHOULD ALWAYS INSTALL A LIGHTNING PROTECTION BULKHEAD OR GROUND ROD WITH POLYPHAZER TYPE UNITS FOR EACH ANTENNA.

WHEN INSTALLING ANTENNAS NEVER PUT ANYTHING OVER, UNDER, OR NEAR POWER LINES. YOU CAN BE KILLED IF A WIRE COMES IN CONTACT WITH A POWER LINE !!!

DANGER!
Don't be STUPID and DEAD!

WHERE TO GET MATERIALS

- DX ENGINEERING
- HAM RADIO OUTLET
- R&L ELECTRONICS
- LOWES
- HOME DEPOT
- ACE HARDWARE

FIRST WRAP YOUR CONNECTION WITH TEMFLEX TAPE FOR WATER RESISTANCE. THEN WRAP THE TEMFLEX WITH SCOTCH 33 FOR UV PROTECTION.

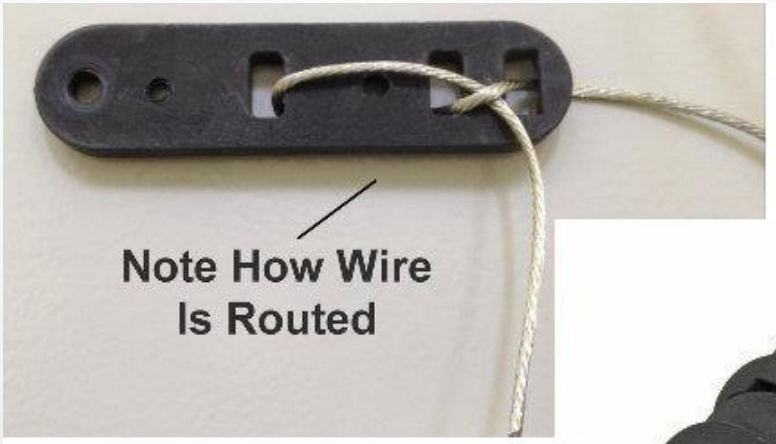
Coax connections can be weatherproofed using **Temflex** Rubber Splicing Tape which is a conformable self-fusing rubber electrical insulating tape. For outdoor use, the Rubber Splicing Tape should be protected from UV deterioration with an overwrap of **Scotch 33+**, a highly conformable super stretchy tape for all weather applications.

Peel back the protective covering.
Tightly wrap the **Temflex**.
When wrapping, stretch the rubber splicing tape up to twice its normal length. Wrap tightly around the coaxial cable and connectors - overlap each wind of the tape by about 50%.

Use the **Scotch 33+** as an overwrap to give the assembly UV protection. Cover the **Temflex** Splicing Tape completely.

DXE

DOGBONE AND MORE



SOLD BY DX ENGINEERING

Longer insulators make good center or feed point insulators for attaching feed line to the antenna wire.

DX Engineering Premium Antenna Wire DXE-ANTW-150

Antenna Wire, Premium, 14 AWG Stranded Copper, UV Resistant Black PVC Insulation, 150 ft. Length, Each

$49.99

Part Number: DXE-ANTW-150

★★★★★ (56)

In Stock (more than 10 available)

1 Add T

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Estimated Ship Date: Today

DX Engineering Premium Antenna Wire DXE-ANTW-300

Antenna Wire, Premium, 14 AWG Stranded Copper, UV Resistant Black PVC Insulation, 300 ft. Length, Each

$94.99

Part Number: DXE-ANTW-300

★★★★★ (24)

In Stock (more than 10 available)

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Compare

DX Engineering Premium Antenna Wire DXE-ANTW-75

Antenna Wire, Premium, 14 AWG Stranded Copper, UV Resistant Black PVC Insulation, 75 ft. Length, Each

$22.49

Part Number: DXE-ANTW-75

★★★★★ (17)

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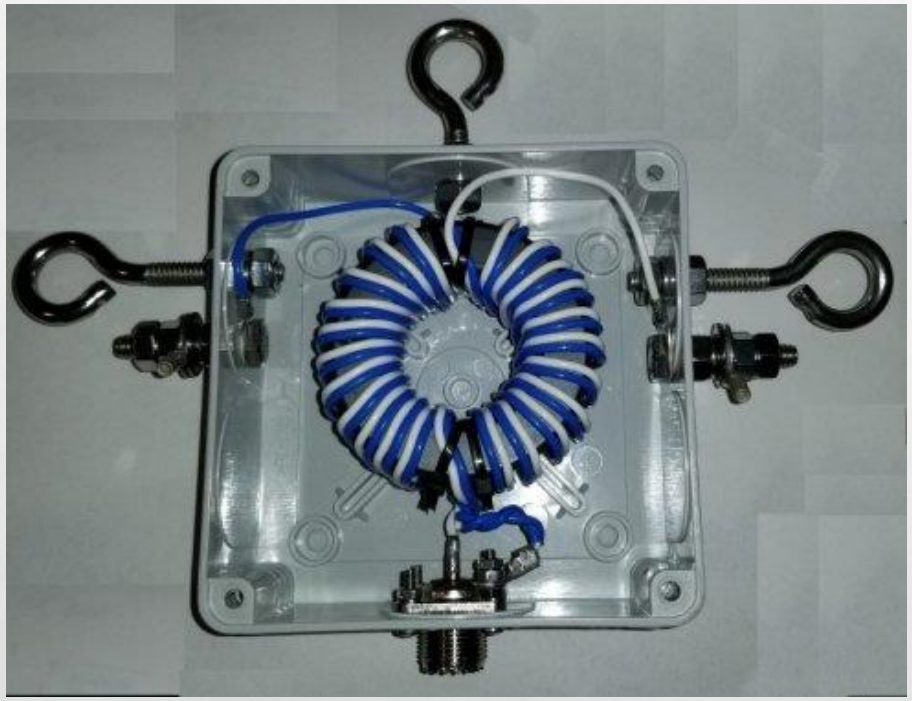
USED OUTSIDE, AFTER 3 OR 4 YEARS THIS WIRE CAN STRETCH AND IT'S INSULATION CAN DETERIORATE

Baluns and Ununs



4:1 CURRENT BALUN

49:1 UNUN TRANSFORMER EFHW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1.8 to 54 MHz


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ANY QUESTIONS ?

THANK YOU FOR LISTENING

NWS NEXT WEEK !