

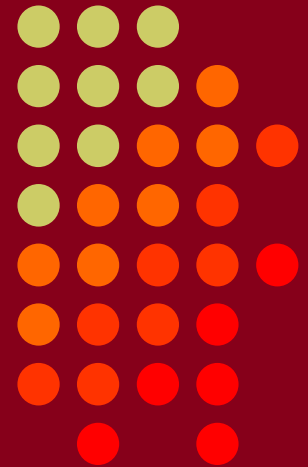
CTU Presents

Simple & Effective Low Band Antennas for Contesting

Joel Harrison, W5ZN

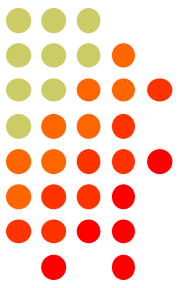
• CTU •
CONTEST
UNIVERSITY

ICOM®



Objectives

Transmit Antennas



- **Simple transmit antenna solutions to improve your signal**
- **Shunt feeding your tower**
- **Understanding radials for transmit antennas**

Objectives

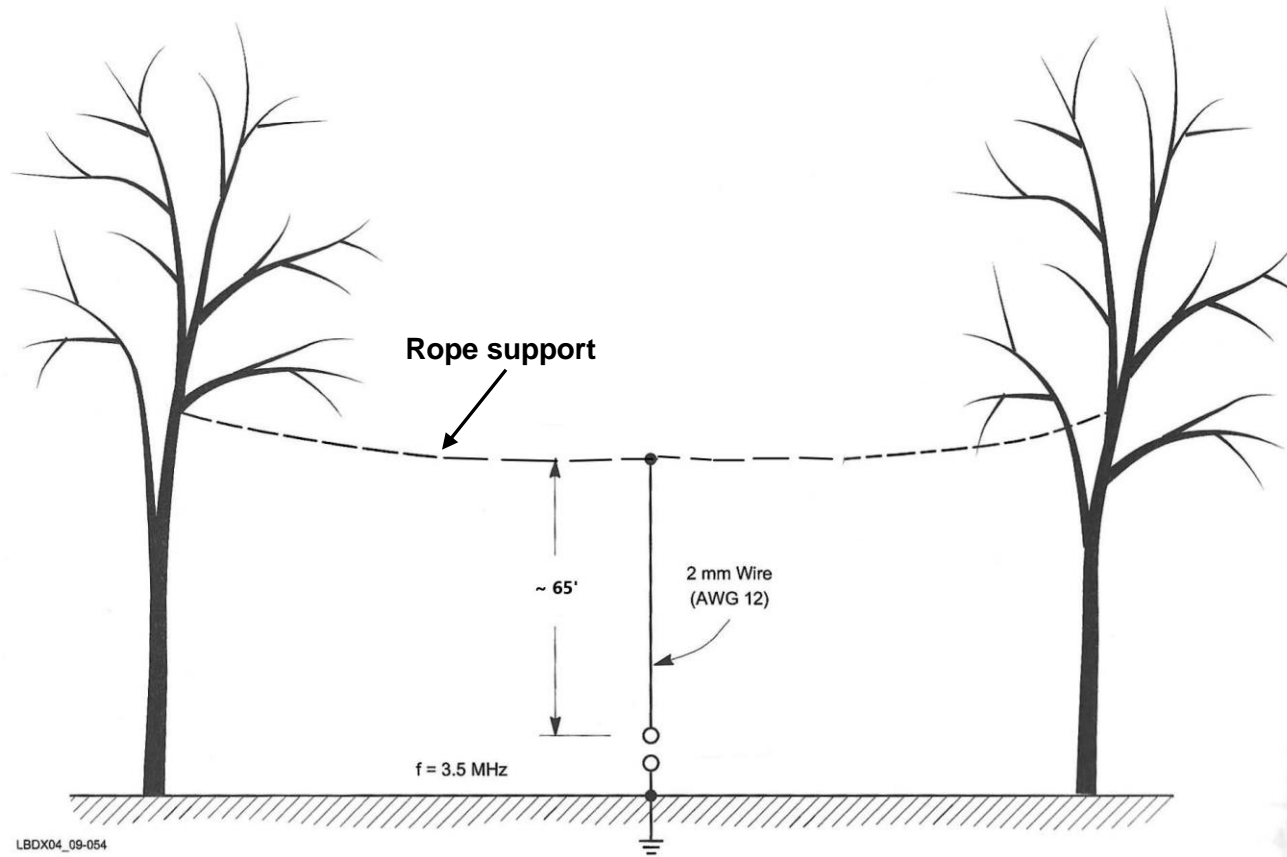
Receive Antennas



- **What you should expect from a receive antenna based on station location**
- **Understand why we use receive antennas**
- **Understand the difference between receive antennas types**

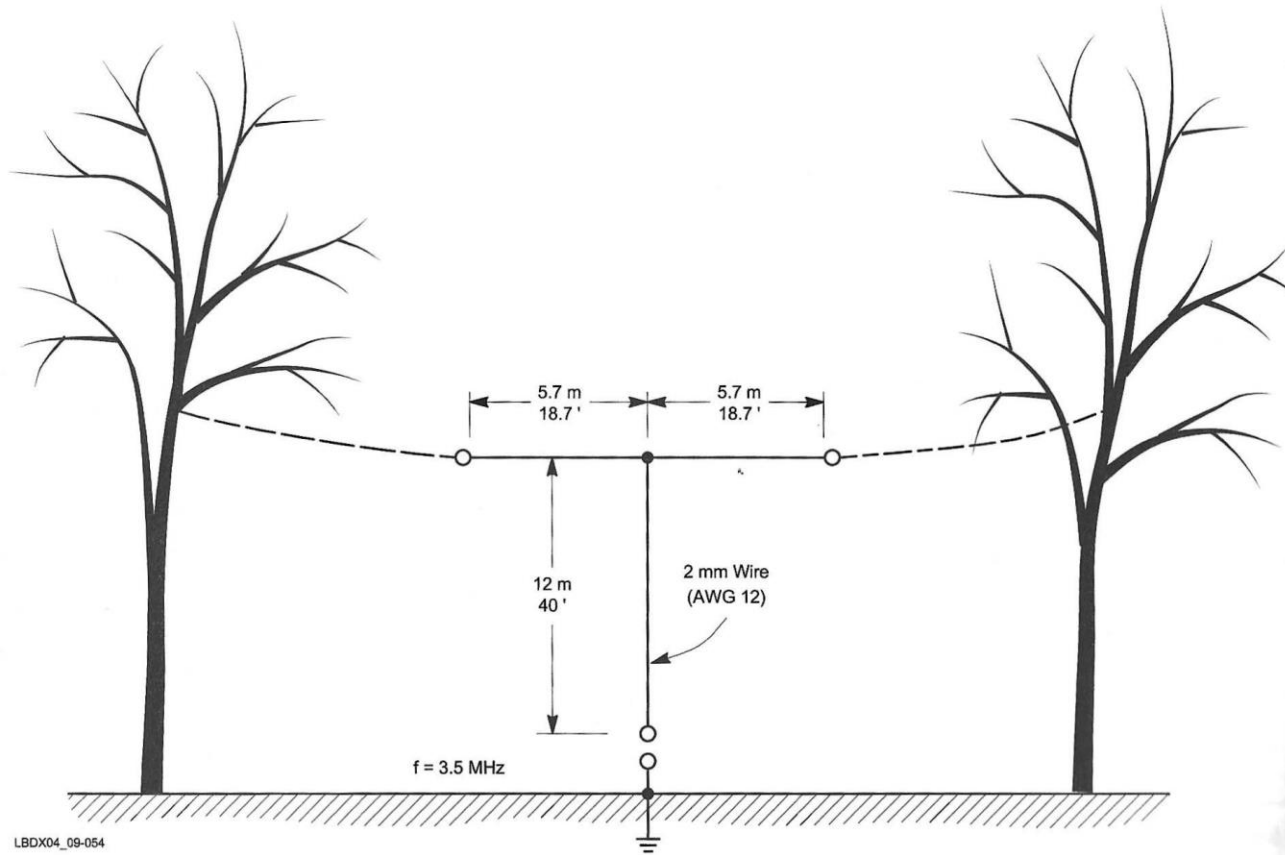
Simple Transmit Antennas

80 Meters - Vertical



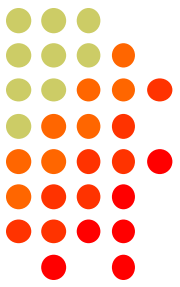
Simple Transmit Antennas

80 Meters - T Vertical



Simple Transmit Antennas

160 Meters - Inverted L



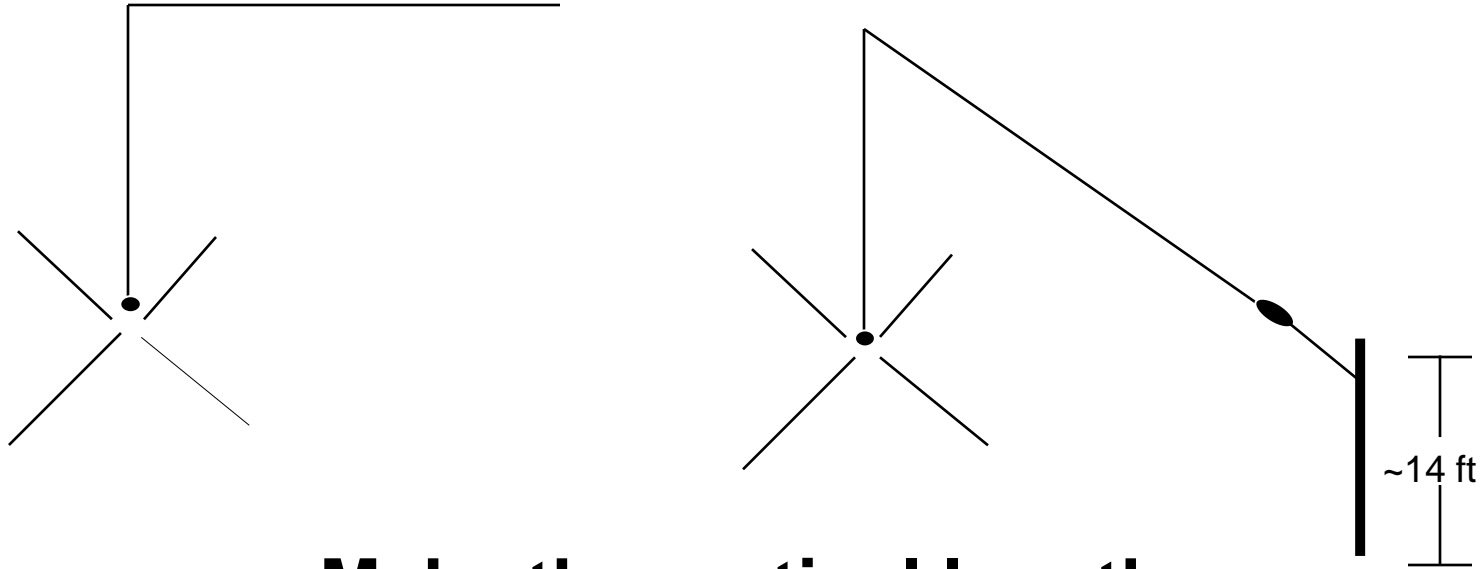
- **Popular for 160 meters**
- **Not truly vertical as the horizontal section radiates also**
 - Vertical element should be as tall as possible
- **Can use a tower as the vertical support**
 - Make sure tower/antennas are NOT resonant on 160 meters!

Simple Transmit Antennas

160 Meters - Inverted L



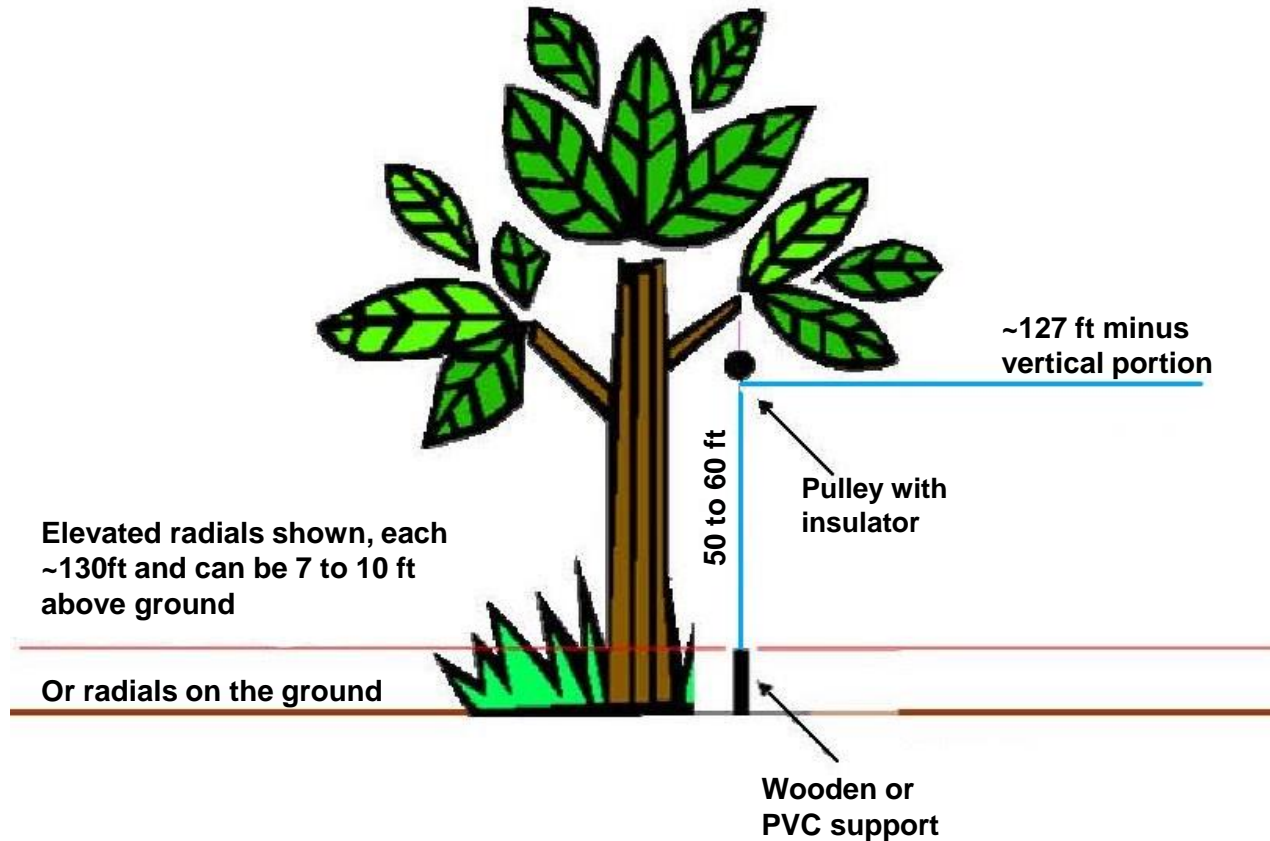
Total Length = $\geq 1/4\lambda$



**Make the vertical length
as long as possible**

Simple Transmit Antennas

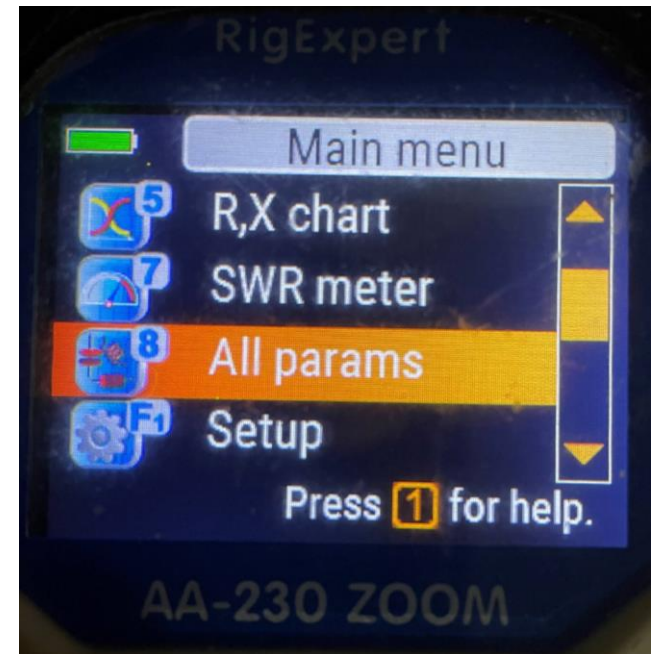
160 Meters - Inverted L



Simple Transmit Antennas Tuning for Resonance



- **Use an antenna analyzer**
 - Don't look at SWR
 - Select "All Parameters"



Simple Transmit Antennas Tuning for Resonance



- Adjust antenna length for zero reactance

Impedance

19 Ω →

Resonant →

(No reactance)



**Not Resonant
reactance 52 Ω**

Simple Transmit Antennas Vertical & Inverted L



- **Feed point impedance will vary and may need matching**

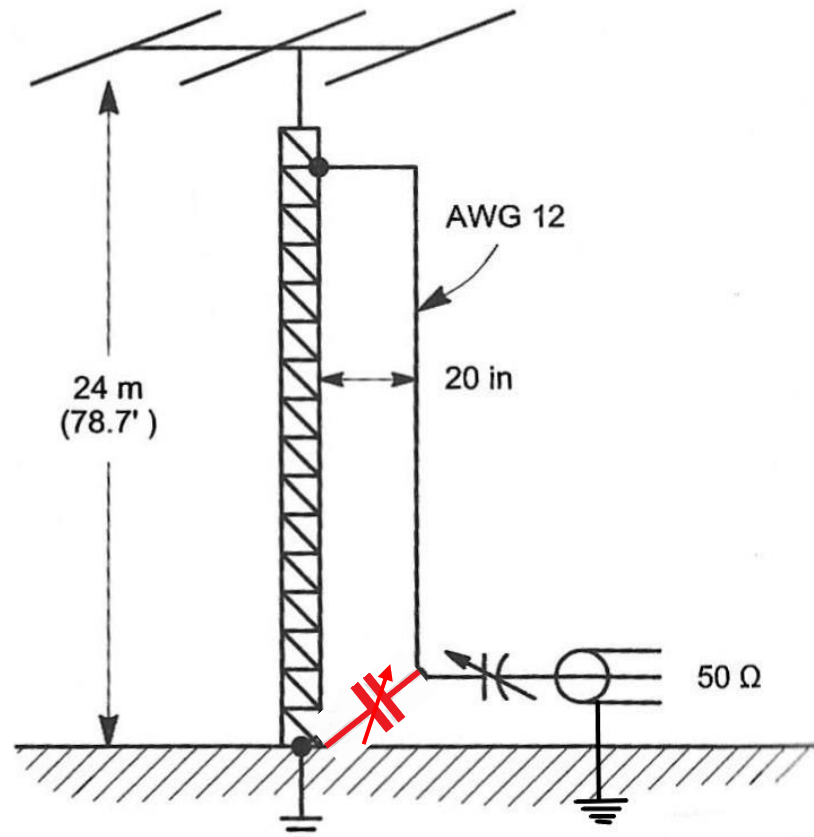
Simple L Network
can provide an
excellent match to
 50Ω



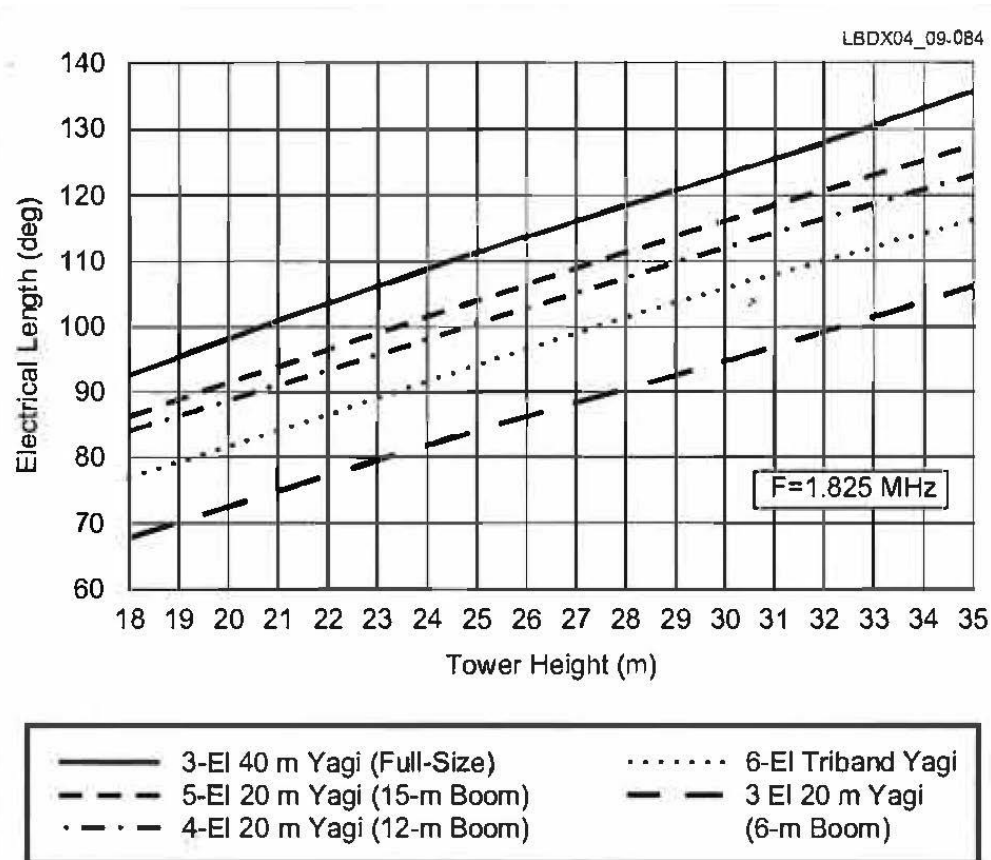
Simple Transmit Antennas Shunt Fed Tower



Very effective on 160 & 80 meters

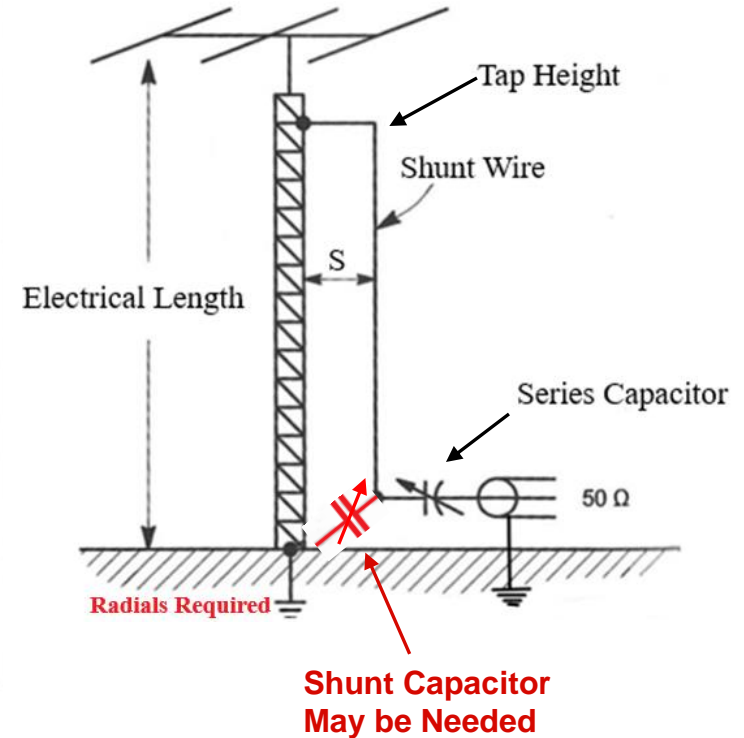
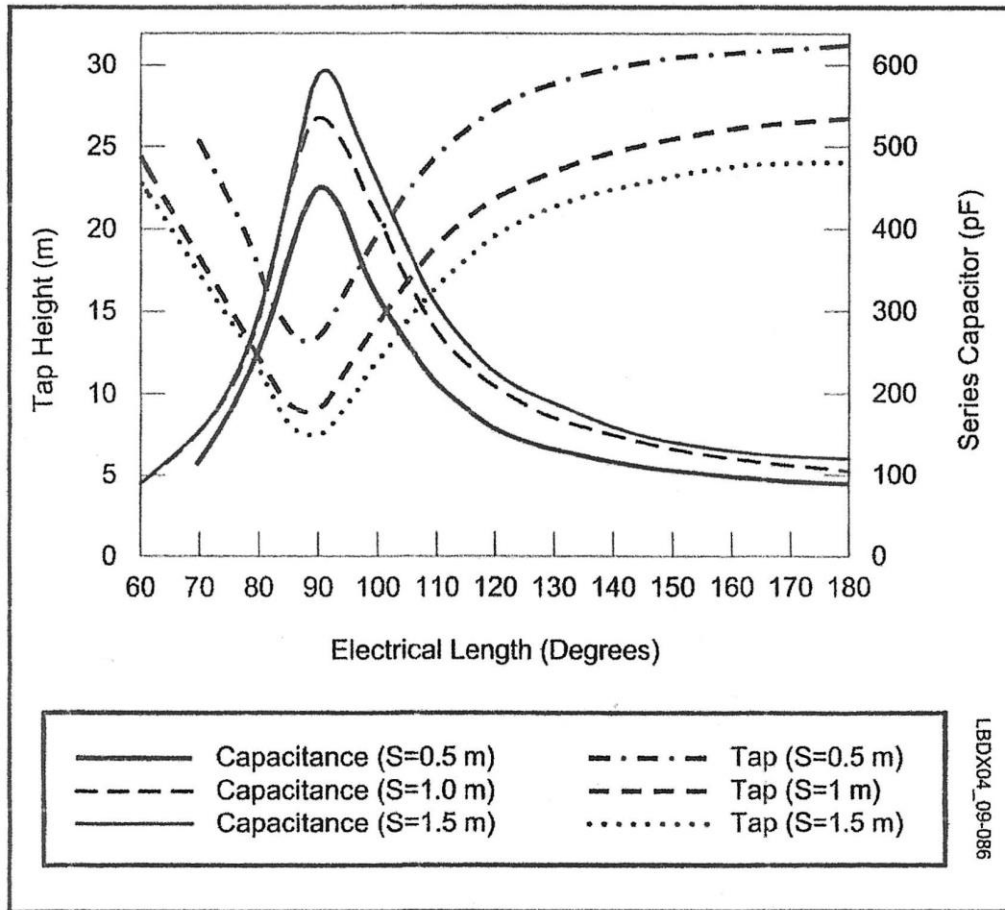


Simple Transmit Antennas Shunt Fed Tower



Simple Transmit Antennas

Shunt Fed Tower



Simple Transmit Antennas

Radials



- **How many radials do I need?**
 - Install as many as possible, as symmetrical as possible (try for 16 minimum. Less may work)
- **Do I have to bury them**
 - No but if you do don't bury them too deep (>6")
 - Laying them on the ground works fine
 - I can't leave radials in the yard year round!
 - Just roll them up in the spring/summer months
 - Don't lay them under fresh water!!
- **Elevated radials?**

Simple Receive Antennas For the Low Bands



- **If you're going to put up an effective TX antenna, you'll want to improve your receive capability also!**

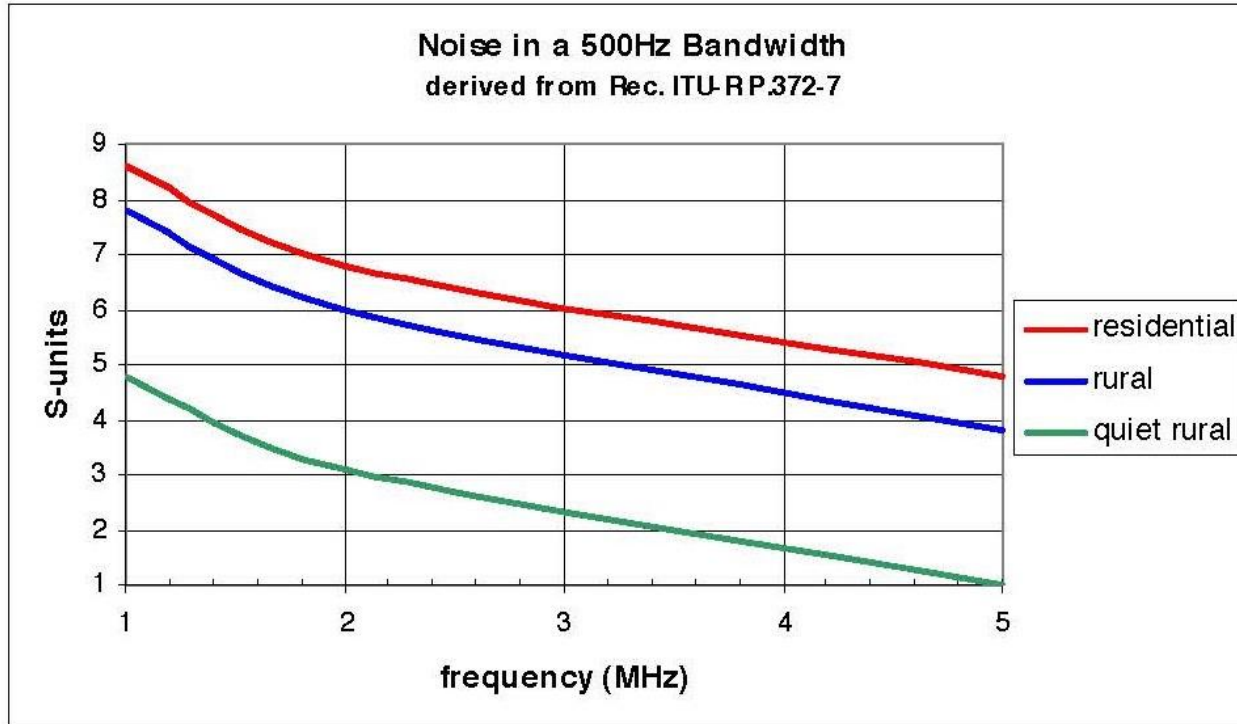
Low Band Receive Antennas

Why Do We Use Them?



- **Reduce receive noise (Improve SNR)**
- **Improve the forward pattern in the desired direction**
 - Provide directivity away from noise sources
- **Transmit antennas aren't necessarily good receive antennas**
 - Usually omni-directional & receives noise from 360°
 - W5ZN's 160 meter transmit array has 5 dB forward gain and >20 dB F/B – isn't it great for receiving??

Why Do We Use Receive Antennas?



Prepared by K9LA

W5ZN is in a “rural” area. Without receive antennas my 160 meter noise is just above S6 (-88 dBm) in line with the ITU data

With receive antennas it is S1 (-120 dBm)

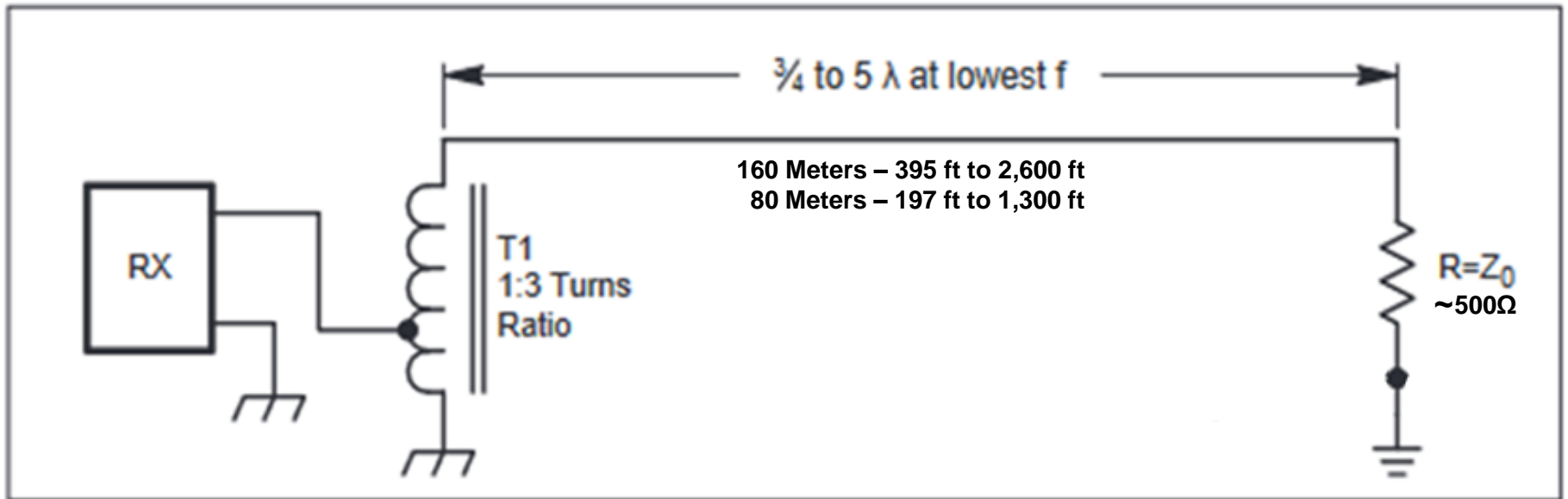
Simple Receive Antennas

Beverage – Yes its simple!



- **The Benchmark for receive antennas**
 - The Beverage Antenna Handbook – W1WCR
 - “The Benchmark Beverage” – W8WWV
- **Very simple to build and install**
- **Many different versions and lengths**
 - 2-direction, phased, Beverage on Ground (BOG), etc.

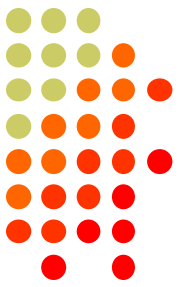
Simple Receive Antennas - Beverage



The Benchmark Beverage Antenna

<http://www.seed-solutions.com/gregordy/Amateur%20Radio/Experimentation/Beverage.htm>

Simple Receive Antennas - Beverage



Suggested Beverage Lengths (160 meters)		
WIWCR	ON4UN	W8WWV
290'	286'	335'
581'	563'	710'
887'	853'	990'
1183'	1122'	1225'
-----	1378'	1515'
-----	-----	1765'

From W8WWV "The Benchmark Beverage"

Simple Receive Antennas Beverage



**Beverage Supports are
1/2" PVC Cut to 7 ft**

**Cut a slit in a 1/2" T coupling to place
Beverage wire in on top of PVC support**

**PVC
support is
3/8"x18"
Rebar about
9 inches in
ground.
Slide PVC
over rebar**



**Easy installation & take down (if needed). Four 500 ft
Beverages can be easily installed in one day by one person**

Simple Receive Antennas

Beverage



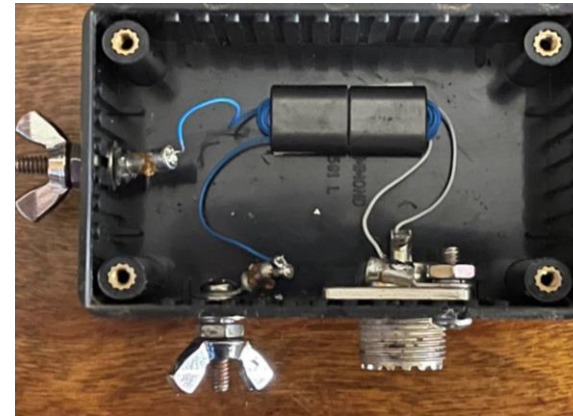
Termination End – Two 1000 Ω
2 Watt Carbon Resistors in
parallel = 500 Ω

Neon bulb across resistors for
lightning protection



Plastic enclosures are Hammond
1591LSBK Available from Mouser

Feed point End – Matching
transformer #73 Binocular core
(only one required)



Binocular Cores are Fair-Rite 2873000202
available from Mouser.

Wire is #28 wire wrap wire available from
DigiKey W28-6H-ND (select your favorite color!!)

Winding details – ON4UN's "Low Band Dx'ing",
fifth edition, Table 7-28, page 7-69

Simple Receive Antennas Other Than Beverage



- **Loops**

- K9AY
- VE3DO
- Double Half Delta Loop (DHDL)
- Flag
- EWE

- **Vertical Arrays**

- Active
 - HiZ, YCCC-9
- Passive
 - Broadside/Endfire (BSEF)

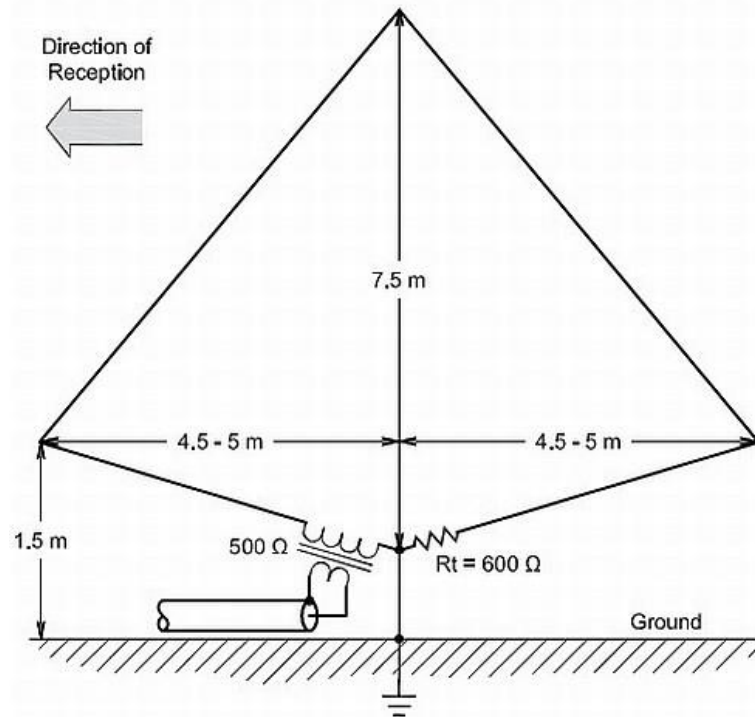
Simple Receive Antennas Loops – General Info



- **Terminated for directional pattern**
 - Cardioid pattern with one deep null
- **Some designs provides up to 4 directions**
- **Can fit in a small yard**
- **Will need a preamp**
- **All small loop designs produce similar results**

Simple Receive Antennas

Loops – K9AY



- <https://www.aytechnologies.com/TechData/HowToBuild.pdf>
- <http://www.k9ay.com/TechData/K9AYLoopArrays.pdf>

Simple Receive Antennas

Loops – K9AY



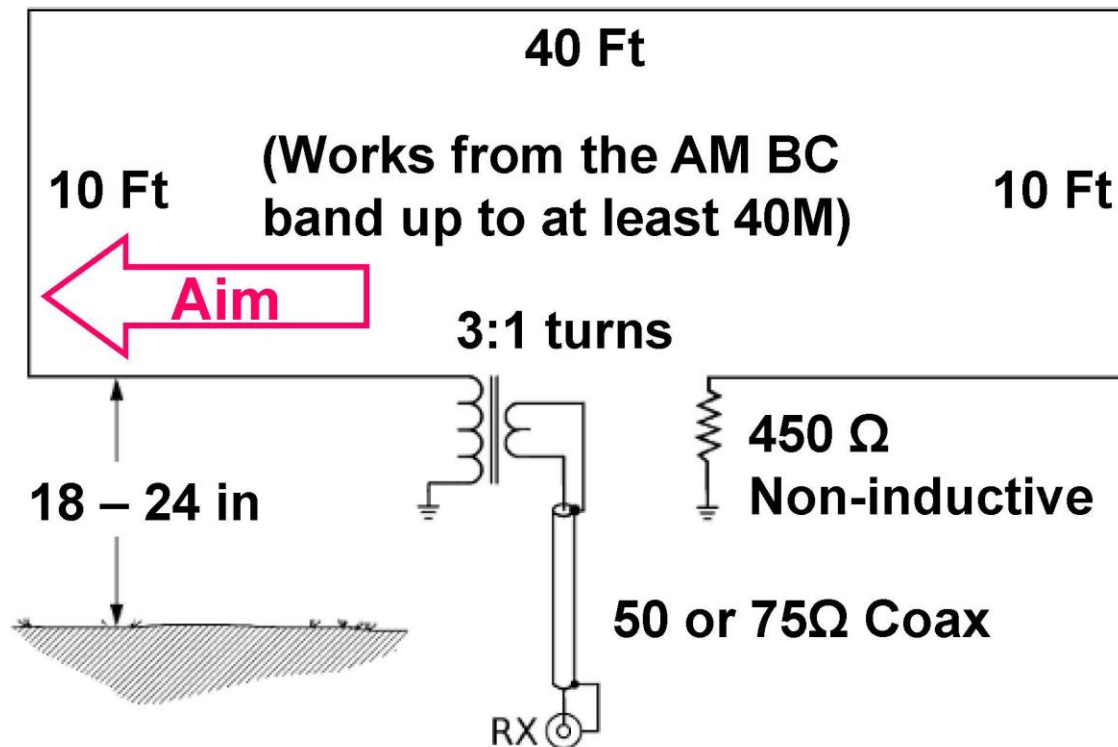
- **Feed point and termination are at the same location**
- **Simple switching can instantly reverse the pattern direction by exchanging the feed and termination**
- **When using two crossed loops, 4 different directions can be selected**

Simple Receive Antennas

Loops – VE3DO

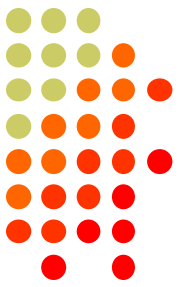


VE3DO Loop Optimized For 160M

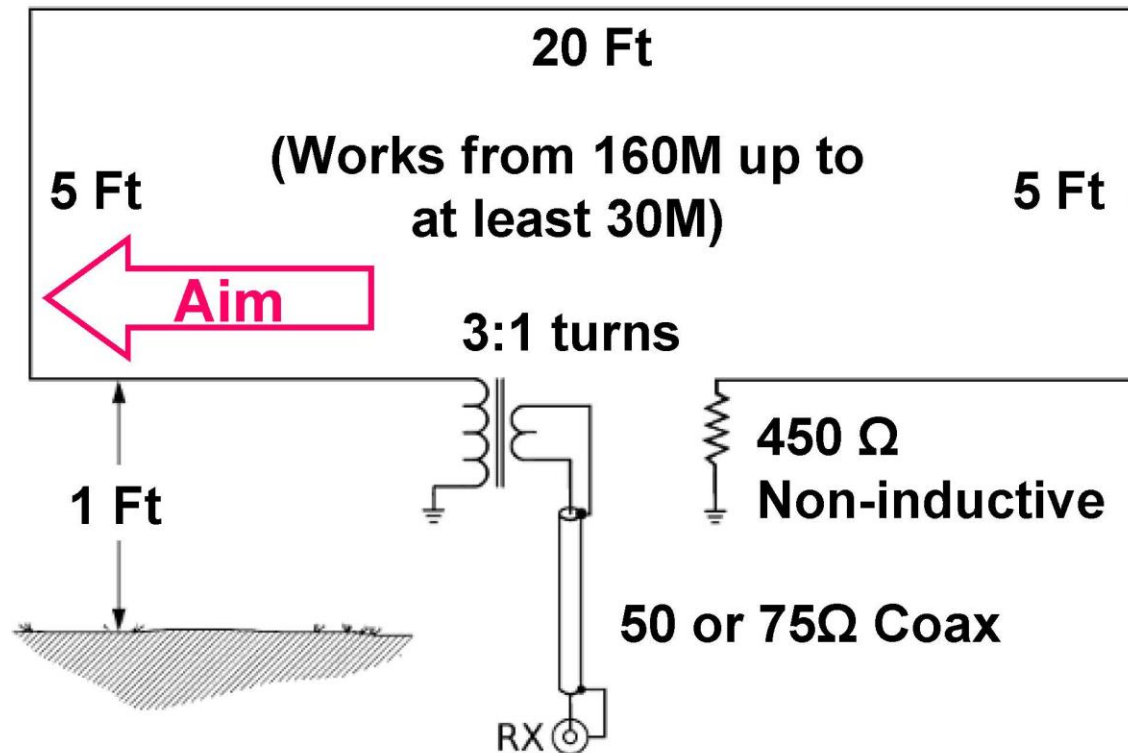


Simple Receive Antennas

Loops – VE3DO



VE3DO Loop Optimized For 80M



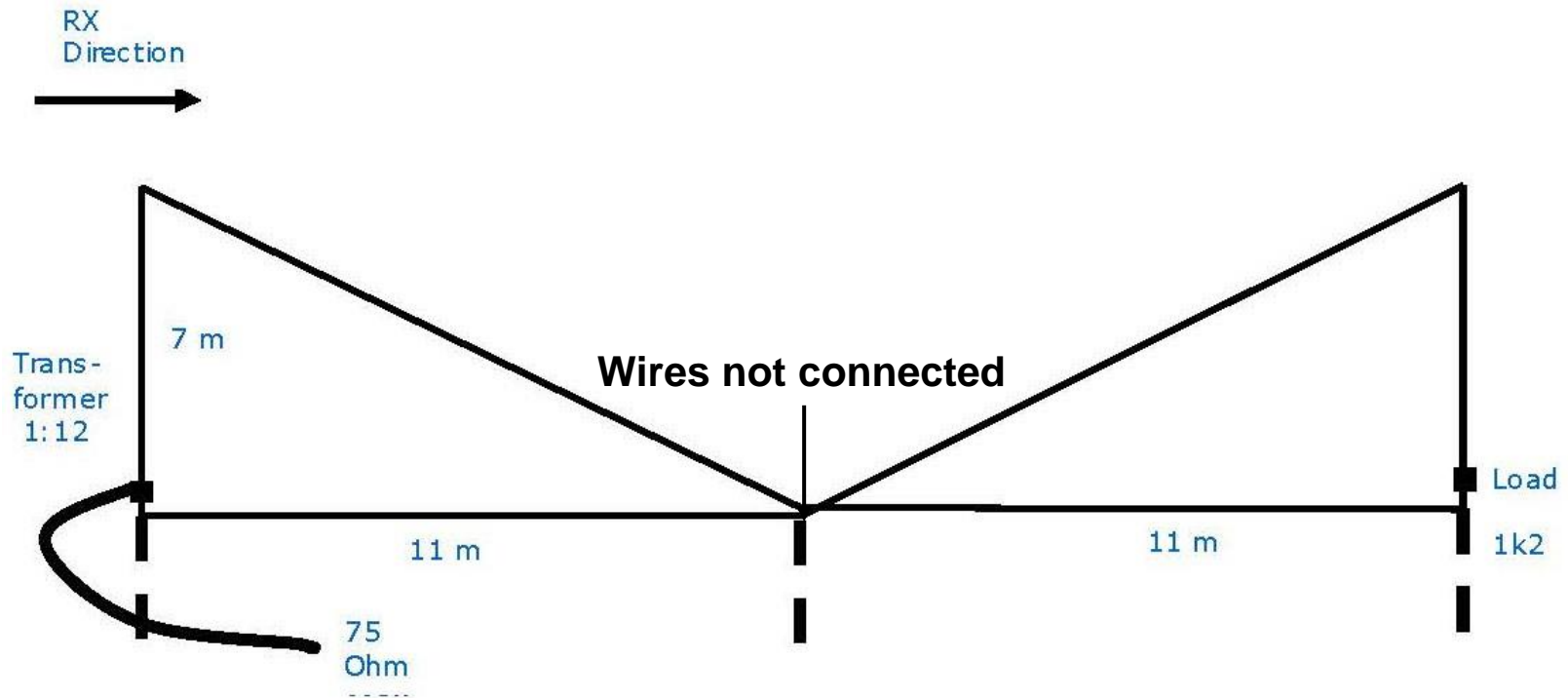
Simple Receive Antennas

Loops – DHDL



- **Designed by George, AA7JV**
- **Not dependent on ground**
- **Essentially two half delta loops interconnected to create a single antenna**
- **Improved performance over a single flag**
- **Wire diameter not critical**

Simple Receive Antennas Loops – DHDL



The Double Half-Delta Loop.

<https://tx3a.org/documents/TX3Astory.pdf>

Simple Receive Antennas

Loops – DHDL



- **Use #31 ferrite cores with several turns of coax for common mode choke**
- **Keep antenna away from resonant verticals and large metal objects (such as metal roof)**
 - May need to “Detune” xmit antenna during receive
- **“This ain’t no Beverage, but its better than a single flav or EWE and almost as good as two phased EWE’s!” – George AA7JV**

Simple Receive Antennas

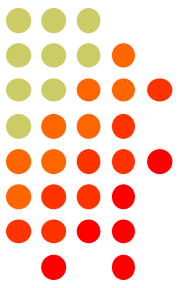
Vertical Arrays



- **Several different types and level of complexity. The following are not considered “simple” and will not be reviewed:**
 - **HiZ Antennas**
 - Several different configurations and switching schemes
 - Special electronic phasing and control system
 - **Broad Side/End Fire (BSEF) Array**
 - Relatively simple but requires 375 ft diameter circle for 160!
- **We will review the YCCC-9 vertical array**

Simple Receive Antennas

Vertical Arrays – YCCC-9



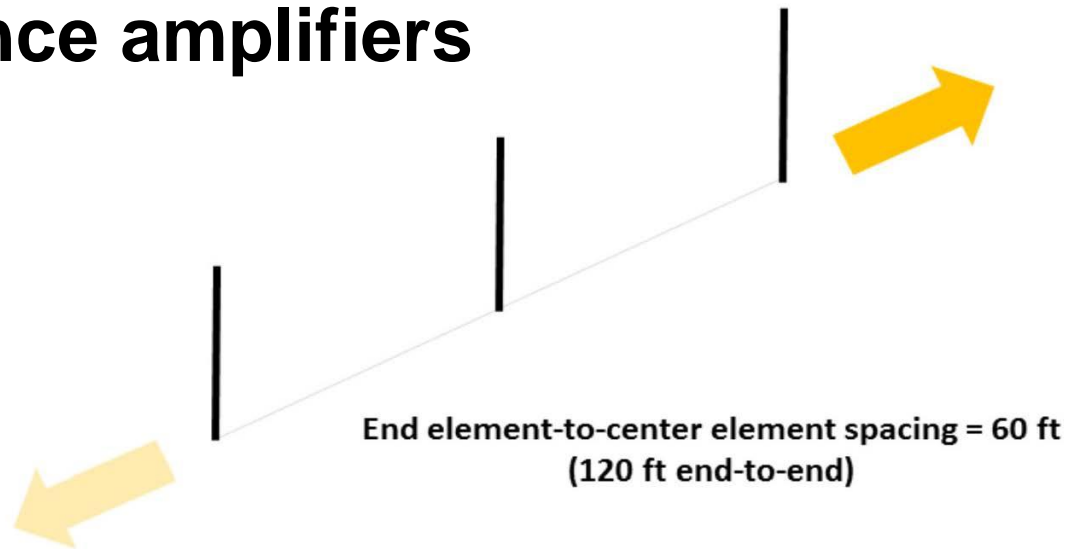
- **Designed by John Kaufmann, W1FV**
- **Uses 15' to 25' vertical elements**
 - No top hat wires or radials required
 - Uses high impedance amplifier at each element
 - Requires a preamp on output of combiner
- **Requires an amplifier at each element and a main combiner unit**
 - Parts & instructions available
- **Requires only 120' diameter for 8 directions**
 - Covers 160-80-40 meters

◦ CTU ◦

Simple Receive Antennas Vertical Arrays – YCCC-9



Uses 3 inline verticals with active high impedance amplifiers



Designed details in QEX
Part 1 Sept/Oct 2011 Part 2 Nov/Dec 2011

VE6WZ YouTube Videos on YCCC-9:

<https://www.youtube.com/watch?v=DLdcR4Qr9Fg>

<https://www.youtube.com/watch?v=IVW1CmrzP7c>

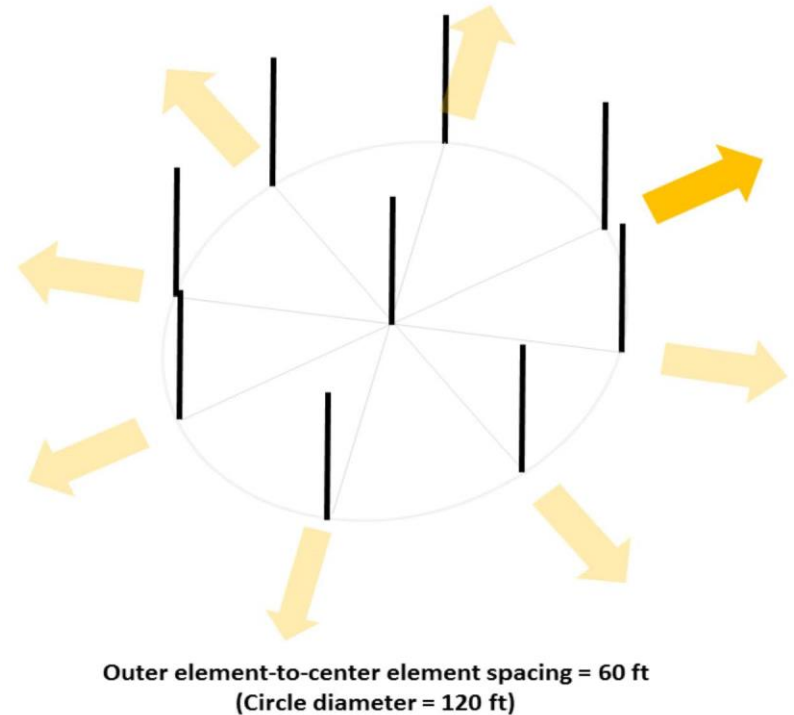
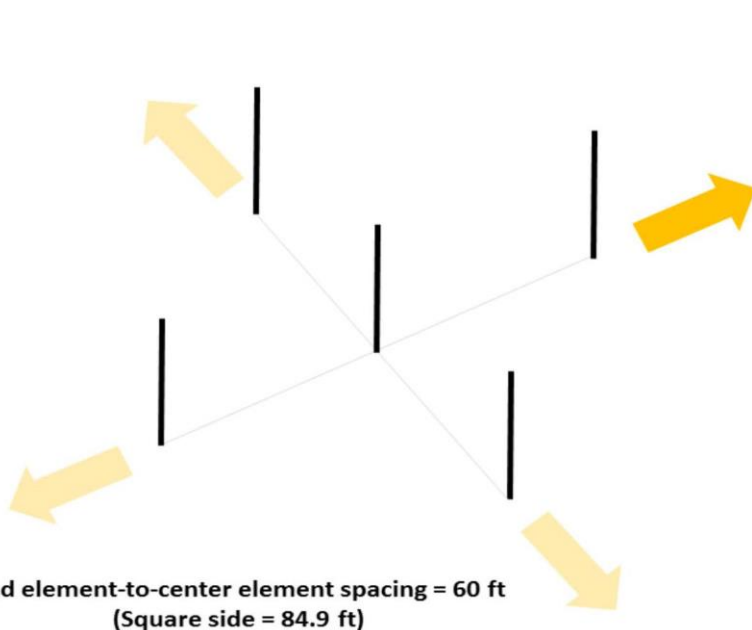
<https://www.youtube.com/watch?v=dl-crM5Kb6A>

Simple Receive Antennas

Vertical Arrays – YCCC-9



Can be configured with up to 9 verticals for eight direction coverage



Simple Station Improvements Eliminating Noise!



**Noise is the
Grim Reaper of
Weak Signal
Reception**



Simple Station Improvements

Noise - Worst Generators



- **Several years ago the only noise threat to your station was line noise**
 - Amateur radio was viewed as the noise & interference threat to consumer electronics
- **Today, consumer electronics generate significant noise and interference to amateur radio reception**

Simple Station Improvements

Noise - Worst Generators



#1 Offender



#2 Offender



Simple Station Improvements Noise - Worst Generators



- **Others include:**
 - Switching power supplies
 - Plasma TV's
 - Medical devices
 - LED lights, outside light & dimmer controls
 - The list is endless and they are everywhere!
- **So what can a little old meek and mild ham do to “GET IN THERE AND WORK ‘EM” if he can’t hear them over the noise?**

Simple Station Improvements

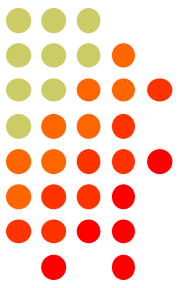
Clean Up Your Station First!



- **Cleaning up your station is Rule #1.**
- **Here are some guidelines:**
 - Unplug all unused wall warts, better yet, don't use them but that's a tall order
 - If you must use a switching power supply, be very selective on what you purchase/use
 - Use high quality cables and connectors to interconnect all of your equipment.

Simple Station Improvements

Clean Up Your Station First!



- If you are using a 12 Vdc wall wart, cut the cable off and connect it to a 12 Vdc power supply. Throw the wart in the trash
- Can't live without it? Here's how to neuter a wall wart



Simple Station Improvements

Toroids



- **Extremely effective – but MUST use the right ones**
 - Do NOT buy something out of a tray at a hamfest or order one that simply advertises “Excellent RFI suppression”
- **Use a #31 mix toroid**
 - Mouser # 623-2631803802**
 - Fair-Rite Part No:2631803802**
 - If it’s a DC voltage or control cable – WRAP IT!

Simple Station Improvements Study K9YC's Paper



<http://www.k9yc.com/RFI-Ham.pdf>



Simple Station Improvements Internet Modems & Routers



- **Even if you're all wireless, you can still have noise issues**
 - Any power or other cable connected to these devices is an antenna!
 - For CAT5 or 6, wrap several turns of the cable in a #31 toroid. Also use the DX Engineering DXE-ISO-Plus in-line filters



Simple Station Improvements Power Supplies



- If you must use a switching power supply instead of a linear supply, purchase one that is designed to filter out the noise

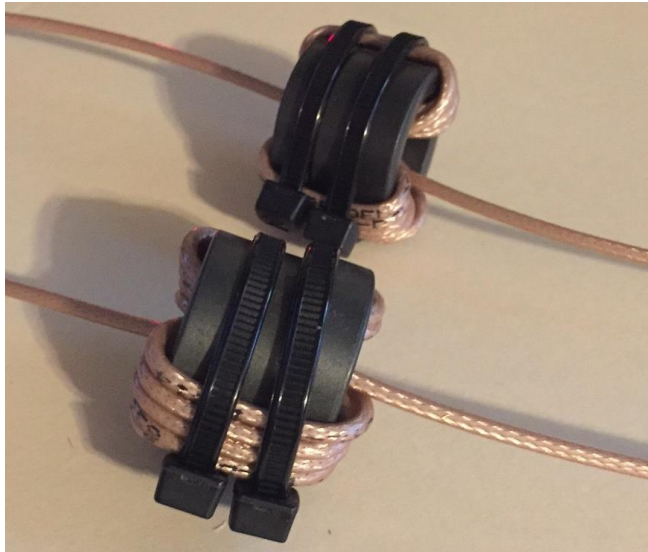
MFJ switching power supplies were designed to properly filter the output



Simple Station Improvements For Receive Antennas

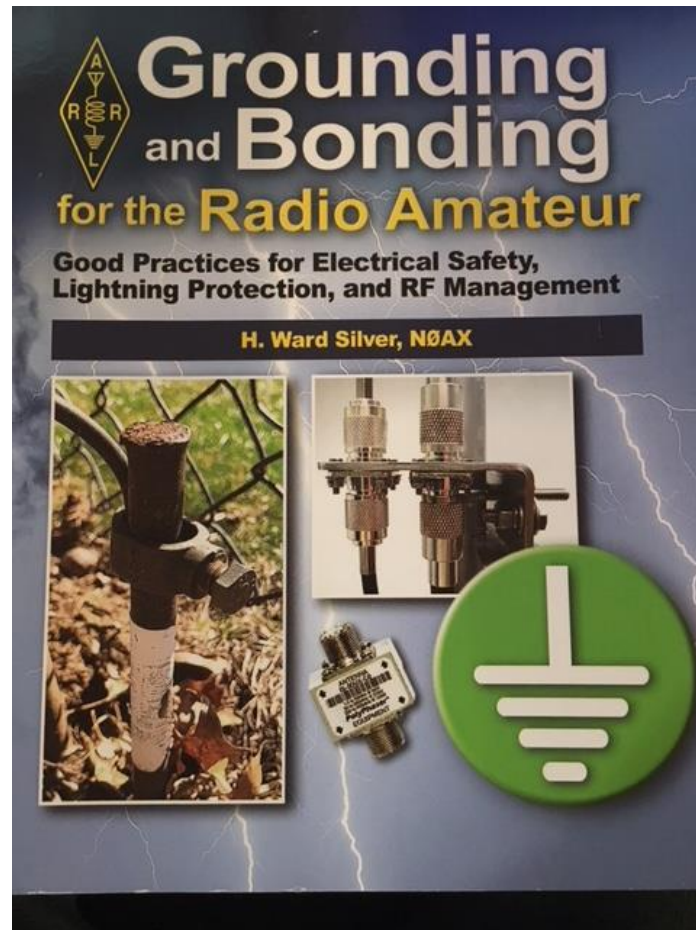


To eliminate common mode noise on the shield



See ON4UN's "Low Band DXing" Fifth Edition
for specific details

Simple Station Improvements Other Action to Take

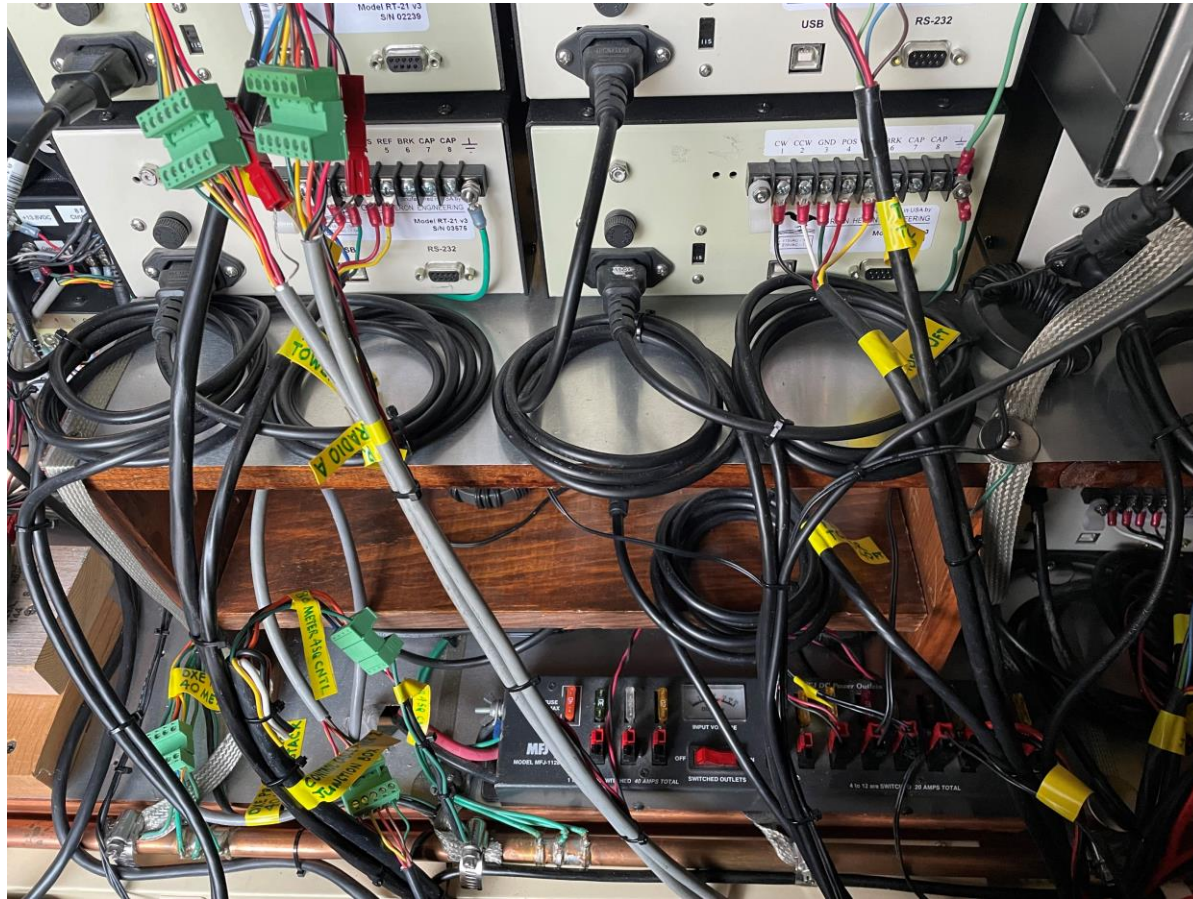


Simple Station Improvements

Other Action to Take



Simple Station Improvements Other Action to Take



Simple Station Improvements Now What?

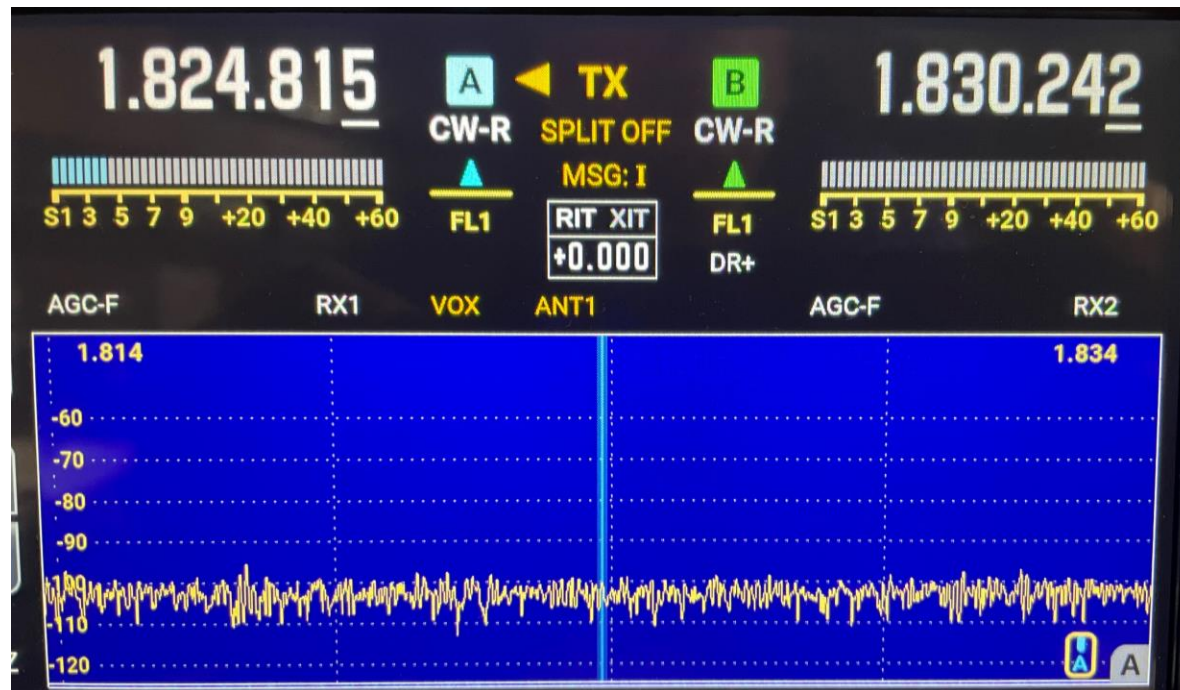


- **Your station is clean, but you have noise from somewhere**
 - Not much you can do with noise that comes from a neighbor.
- **At W5ZN there is a horrible noise to the east only on 160 meters.**
 - Thought it was line noise until we cleared all power line noise
 - Generated from a house $>1/4$ mile away

Simple Station Improvements Now What?



- Concluded it is a medical device or a grow lamp



Simple Station Improvements

Noise Cancelling Devices



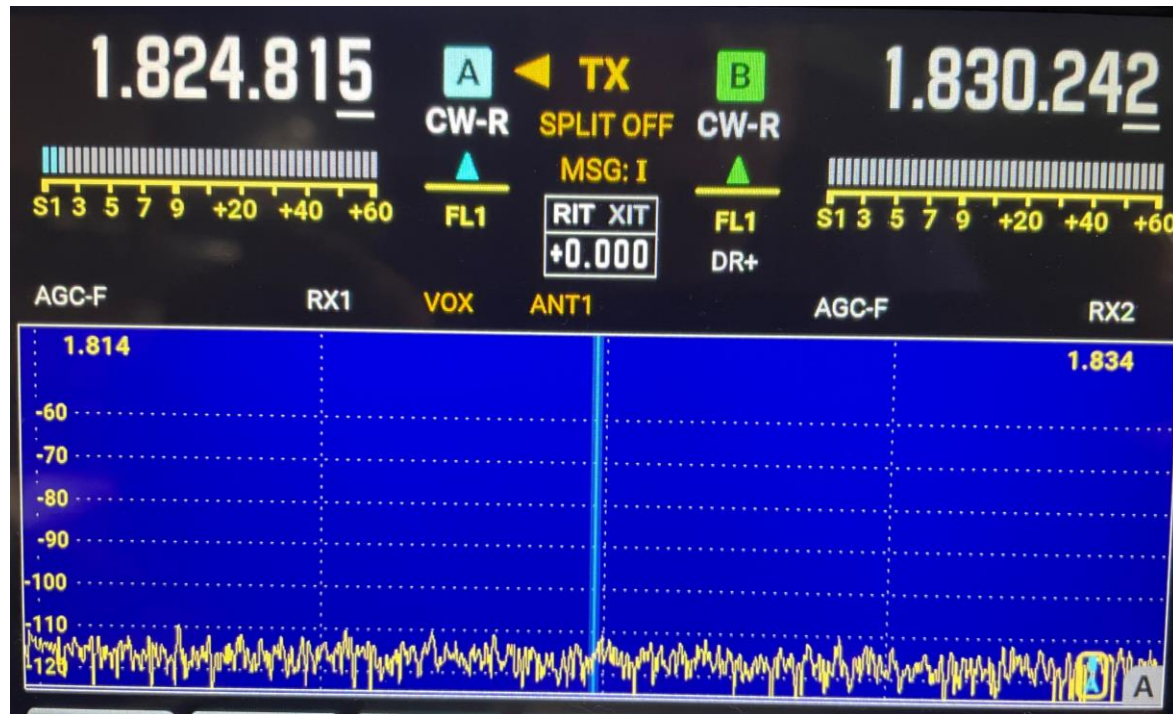
- **Different models available**
 - Timewave ANC-4+
 - MFJ 1026
 - DX Engineering NCC-2



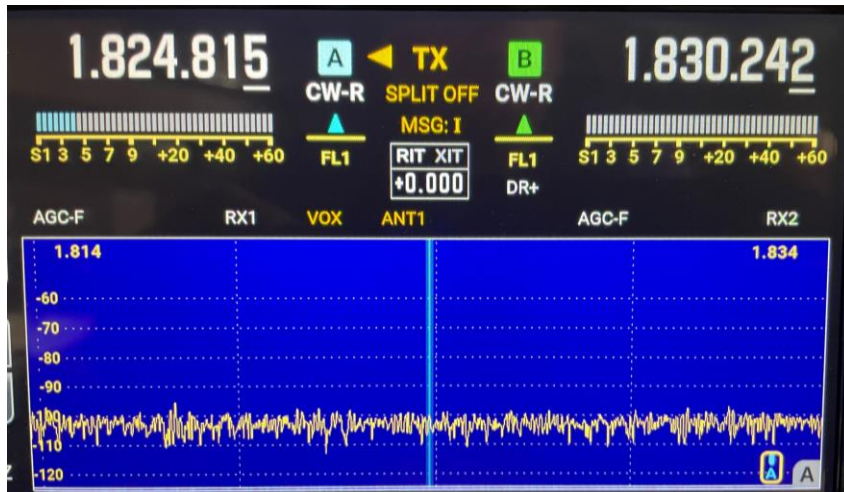
Simple Station Improvements Noise Cancelling Result



20 dB null in noise



Simple Station Improvements Noise Cancelling Result



Steve VE6WZ has an excellent instruction on using a noise cancelling unit:

https://www.youtube.com/watch?v=Gt0Hokz_m3w&t=46s

Simple Station Improvements Test Equipment



Test Equipment – the two most valuable instruments beyond a VOM



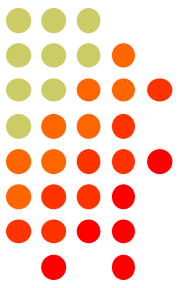
Simple Station Improvements

Final Thoughts



- **Determine the array that fits your need**
- **Build it**
- **Test it**
- **“GET IN THERE AND WORK ‘EM !!!!”**

Simply Outstanding Additional References



- **An Introduction to Operating on 160m – K9LA**
https://k9la.us/An_Introduction_to_Operating_on_160m.pdf
- **Working 160m From A Small Lot (and Larger Ones Too)**
<http://k9yc.com/publish.htm>
- **W3LPL – Anything antennas - READ IT & LEARN!**



Thank You

