

Practical Considerations



SFTARC

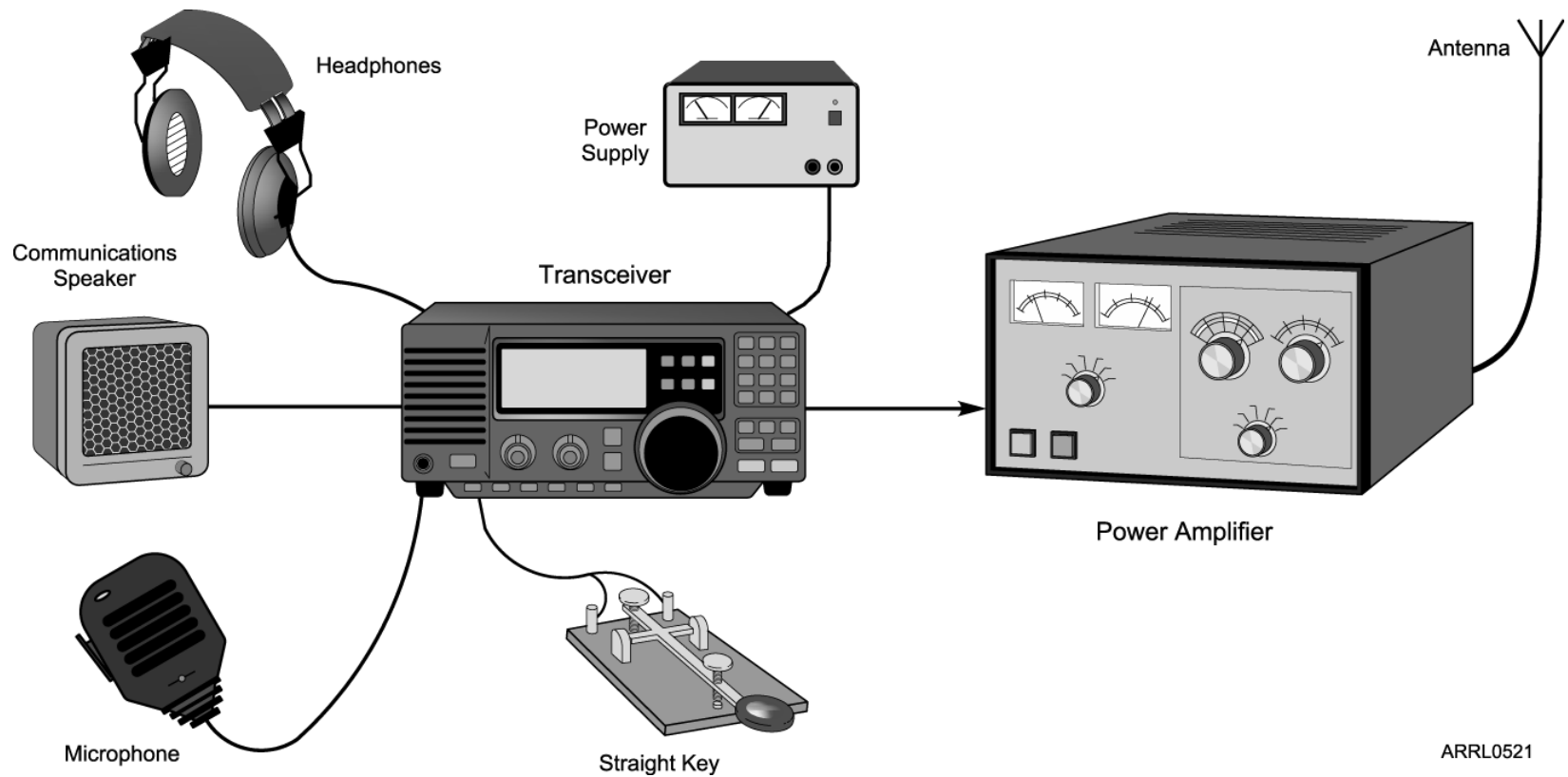
2026 Extra License Class



Topics

- HF Transceivers
- Power Supplies and Accessories
- Antennas, Towers, Coax & Rotors
- Safety, Grid Squares, Zones, QSL cards
- Operating and DXing
- Building and Testing
- Area Hamfests
- Vanity call signs

The Complete HF Station



HF Transceivers



Icom
Kenwood
Yaesu
Elecraft

Typical HF Transceivers

- Often covers 160, 80, 40, 30, 20, 17, 15, 12 & 10 meter bands. (WARC Bands;
 - World Administrative Radio Conference – 1979)
- 60 m Band; 4 Channels; 5330–5403 kHz +15 kHz
 - Established 2002; Modified 2011 and 2025
- May also cover 6m, 2m and 70 cm bands
 - Consider separate radios for 2m/70cm
- SSB, and CW modes; maybe FM, AM and RTTY also



Typical HF Transceivers

- 100 W on transmit power
- Newer “*rigs*” have “general coverage” receivers
- Older rigs may be ham-band-only receive
- Many HF radio operate off of 12 VDC power, others operate off of 115 VAC
- Software Defined Radios (SDR) are becoming more common

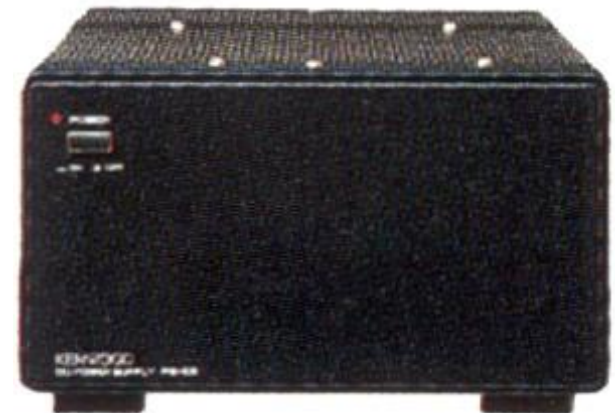
QRP radios are also an option

- QRP = Low power (typically 1W - 5W)
- You will work harder to make “contacts”
- Voice QRP radios can be almost as expensive as a 100W radio



Power Supplies

- 12 V (really 13.8 V typical)
- Current rating:
 - HT: 2 – 3 A
 - VHF/UHF Mobile: 10 – 12 A
 - HF radio or high-power VHF/UHF mobile: 20 + A
- Linear (heavy) or Switching

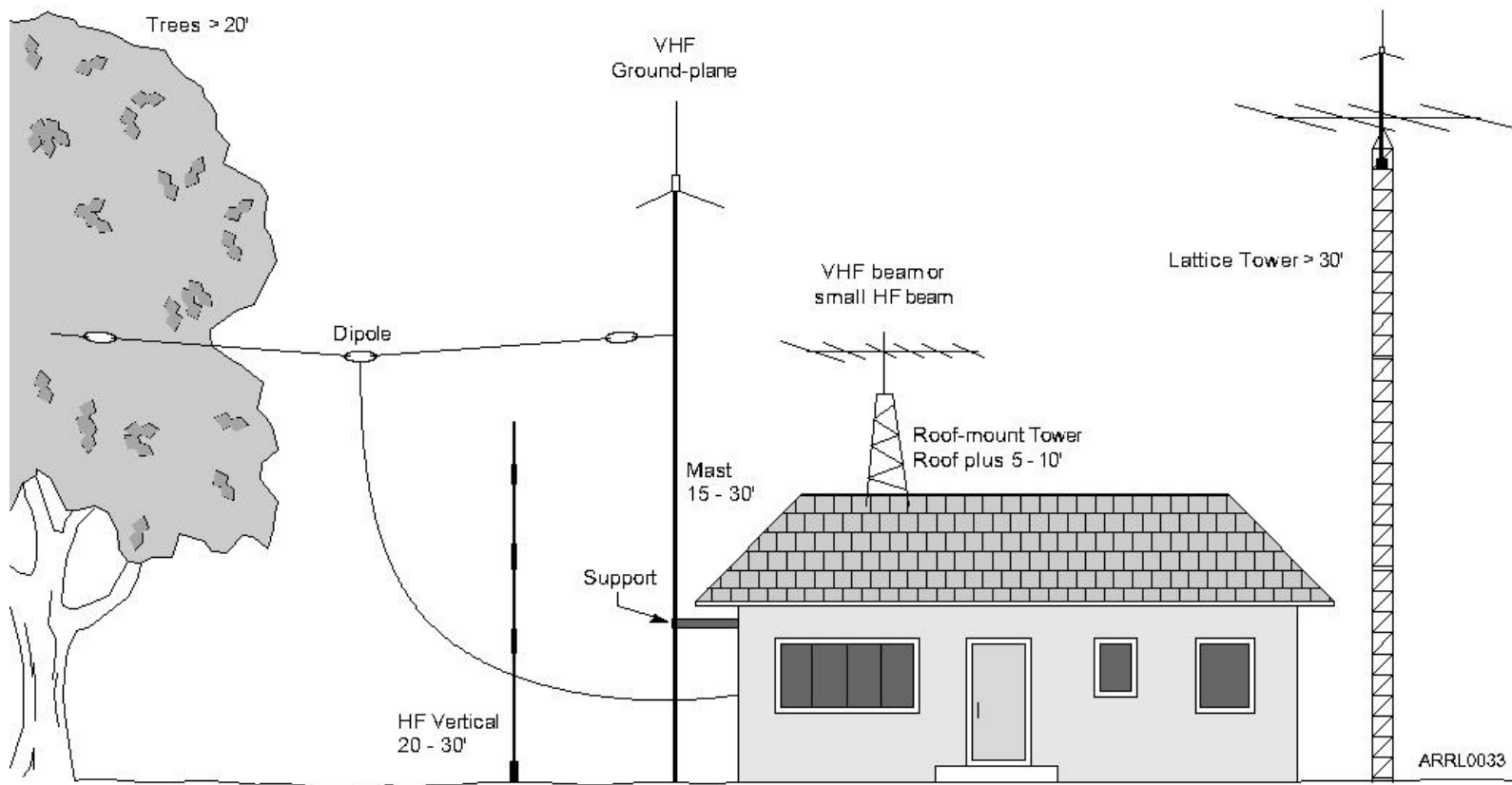


Other Accessories

- External speaker
- Headphones
- Hand mic vs. desk mic
 - A handheld mic is normally supplied with the radio
- SWR meter (may be built into the radio)
- Dummy load
- Linear amplifier – very optional
- Code key or keyer and paddles



Base Station Antennas





Simple HF Antennas

- Dipoles

- ☐ Single band
- ☐ Trapped or fan multiband
- ☐ Multiband with tuner
- ☐ Multiband Off-Center Fed Dipole (Windom)

- Multiband loop

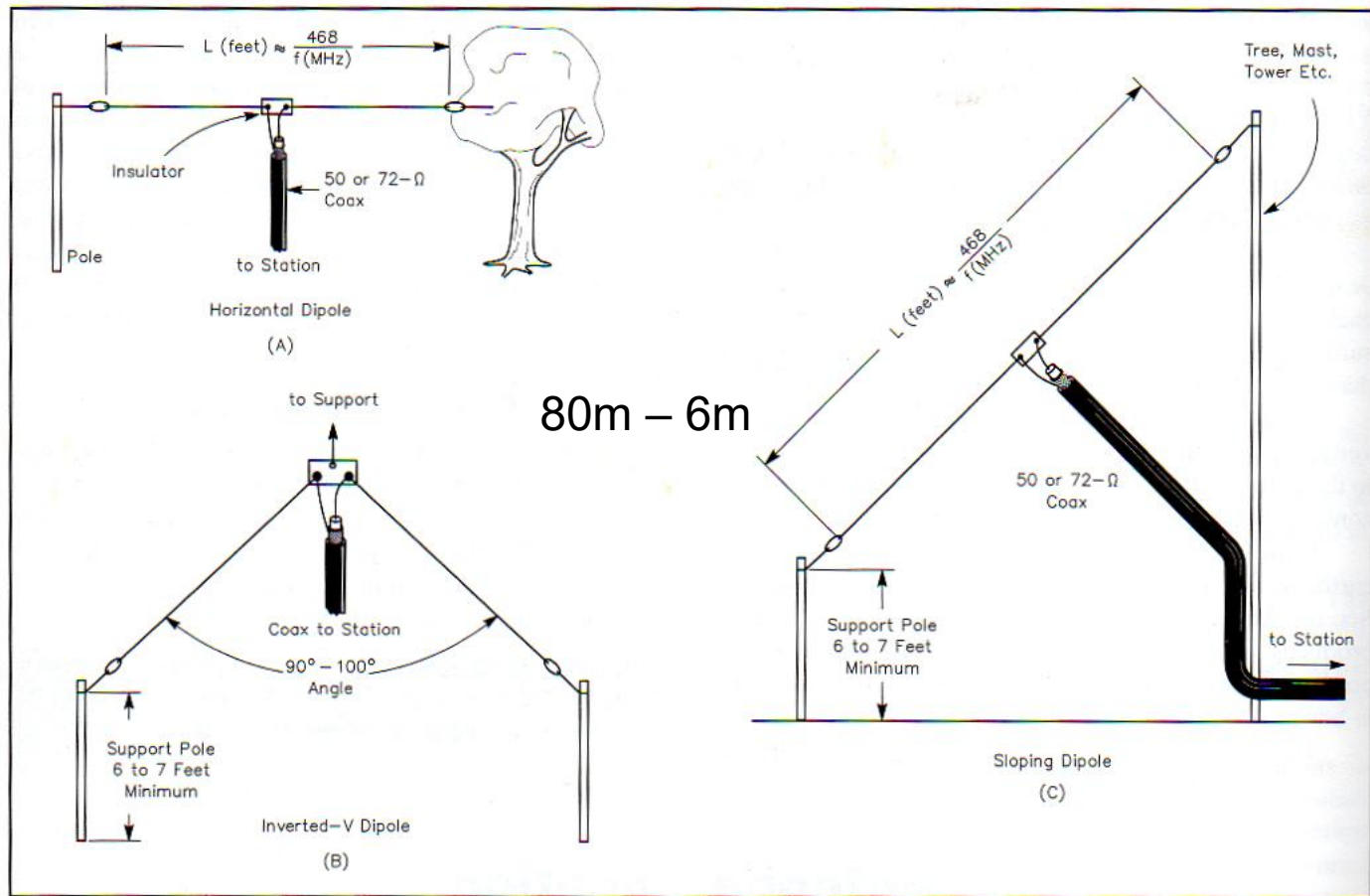
- End Fed Halfwave (EFHW)

- Vertical

- ☐ Trapped multiband
- ☐ Multiband with tuner at the base

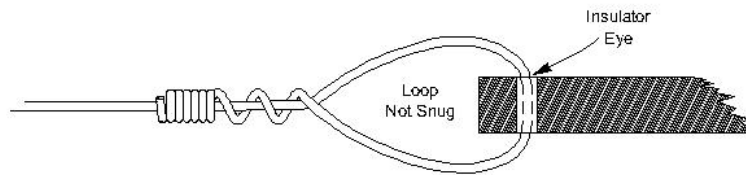
- Random Wire with a tuner

Dipole Variations



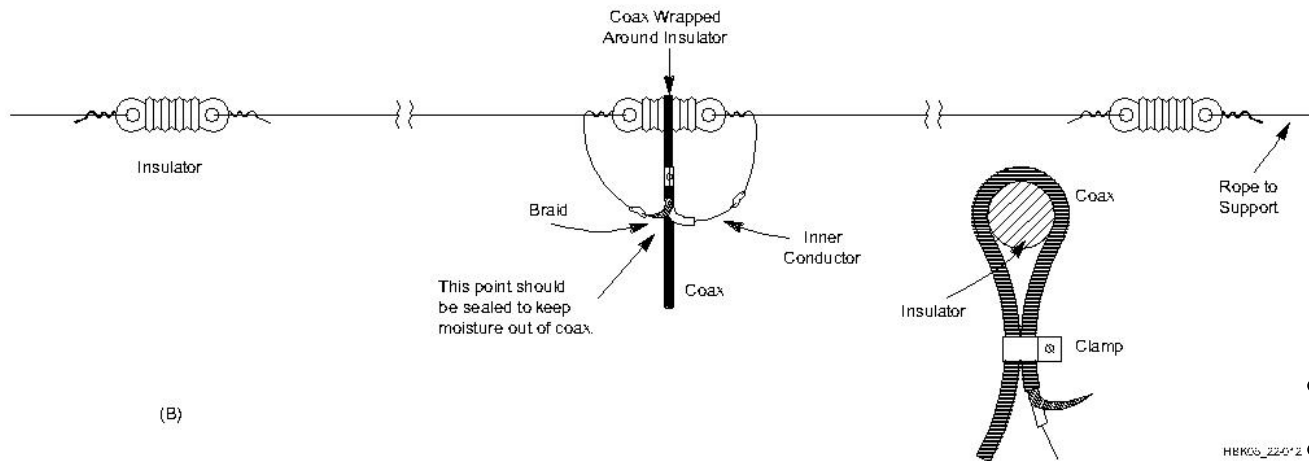
- **The efficiency of a simple dipole is hard to beat.**
- **Most simple dipoles work only one band, however a 40m dipole will tend to also work on 15m.**

A single-band dipole is simple to build and low cost



(A)

An eye-hook can be added to a plastic center insulator to support the center insulator for an inverted Vee antenna



(B)

Special black Dacron rope is often used for the support ropes

$$L = 468/f \text{ MHz}$$

- 80m = 135 ft
- 10m = 18 ft

HEKOS_ZZCZ

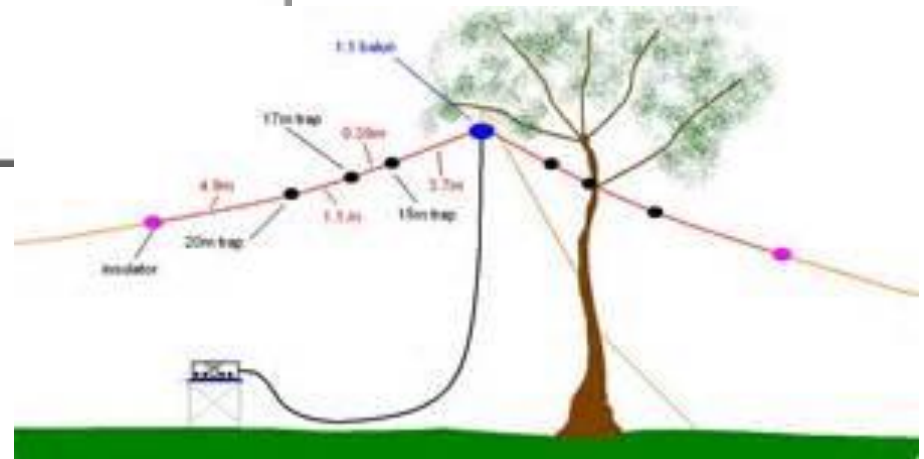
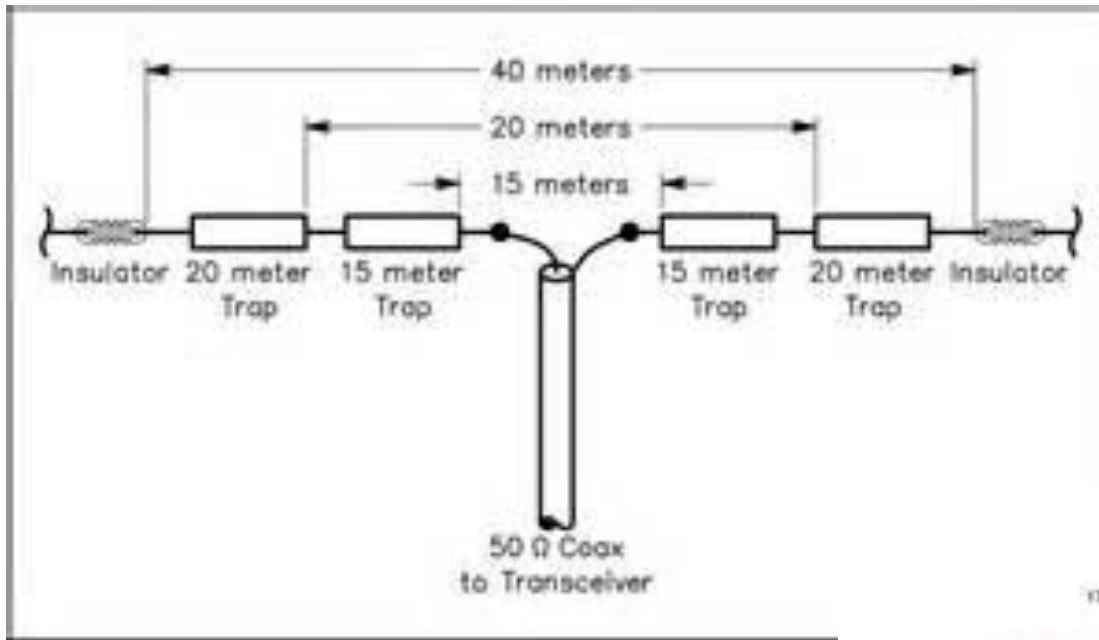
Dipole Length

- Typical lengths for common ham bands

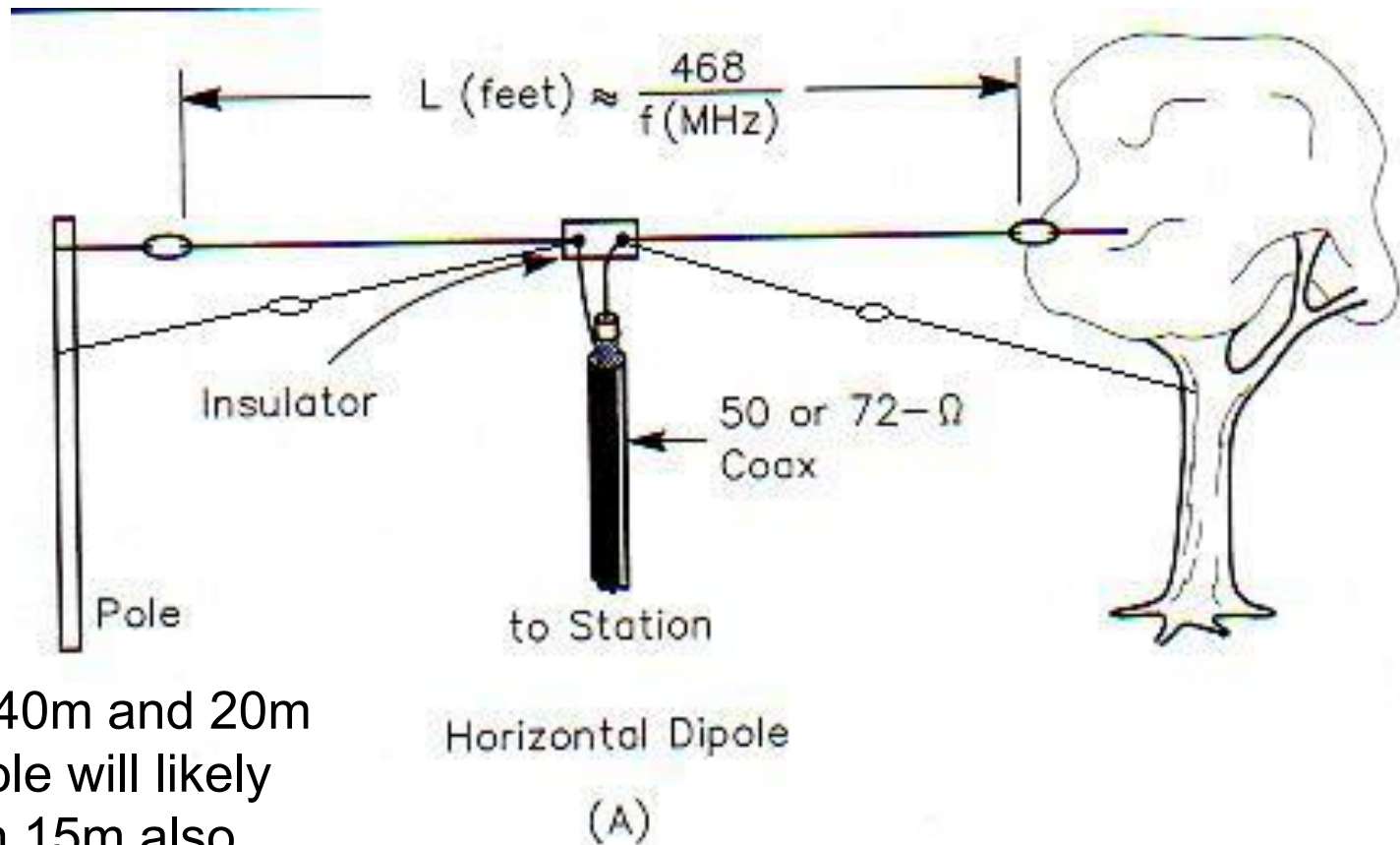
Wavelength	Frequency	Length
80 meters	3.725 MHz	125.6 ft
40 meters	7.125 MHz	65.7 ft
20 meters	14.2 MHz	32.9 ft
30 meters	10.12 MHz	46.2 ft
17 meters	18.1 MHz	25.8 ft
15 meters	21.2 MHz	22.1 ft
17 meters	24.93 MHz	18.8 ft
10 meters	28.3 MHz	16.5 ft
2 meters	146 MHz	3.2 ft

We shorten the antenna to raise the frequency

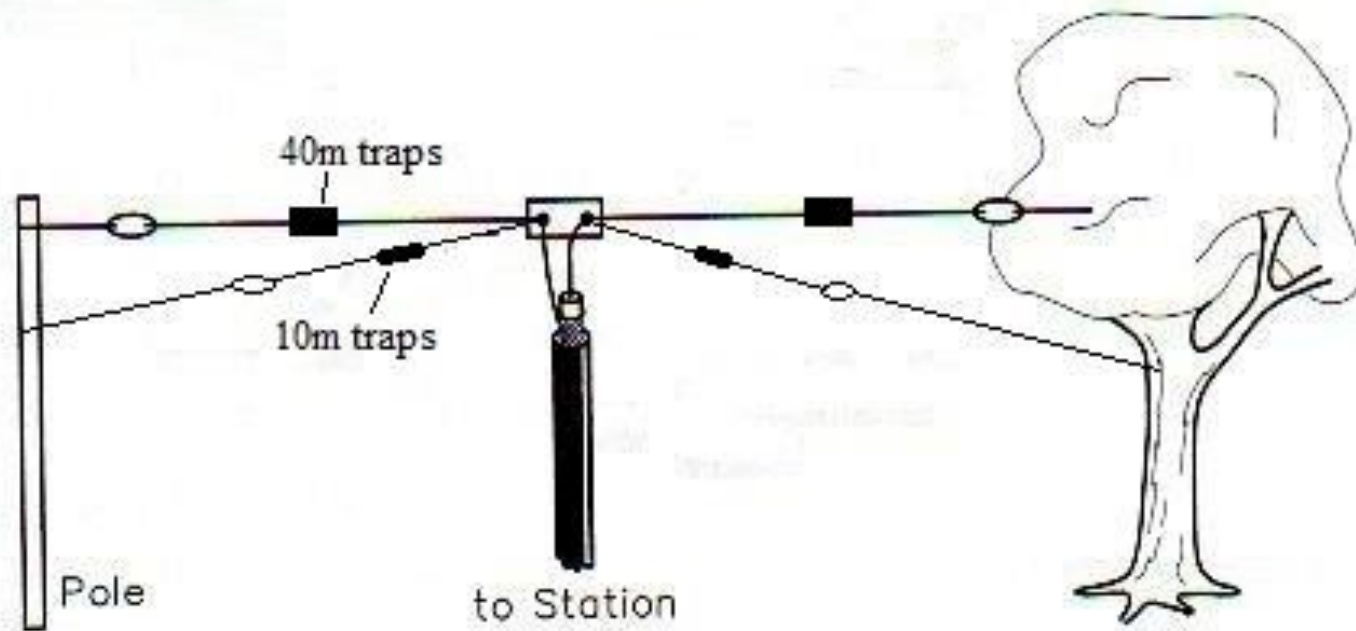
Trap Dipole – Multiband



Fan Dipole – Multiband



Fan-Trap Dipole – Multiband

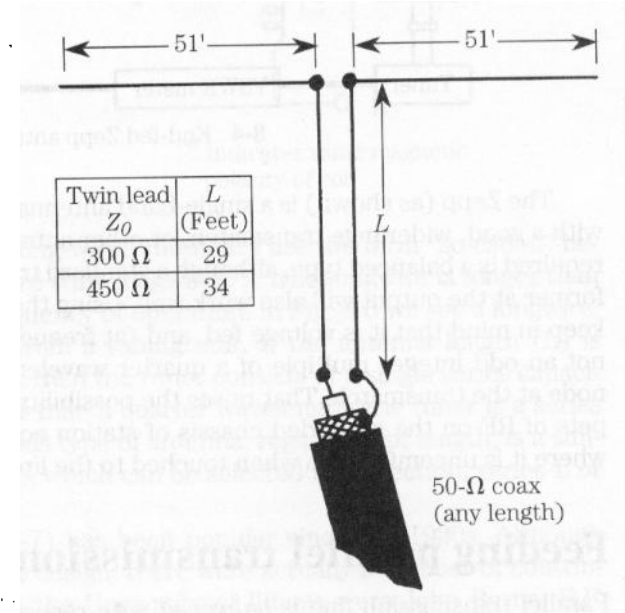
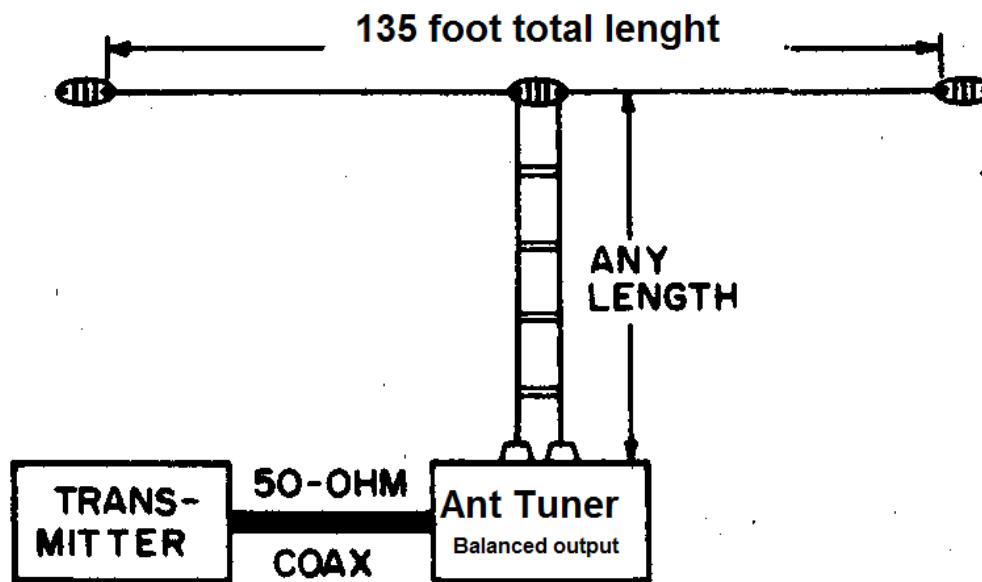


10/20/40/80 Fan Trap Dipole
Not to Scale

The 40/80 m section will be about 110 ft end-to-end.

All-band Antennas that Require Antenna Tuners

80 – 10 m coverage



—A center-fed antenna system for multiband use.

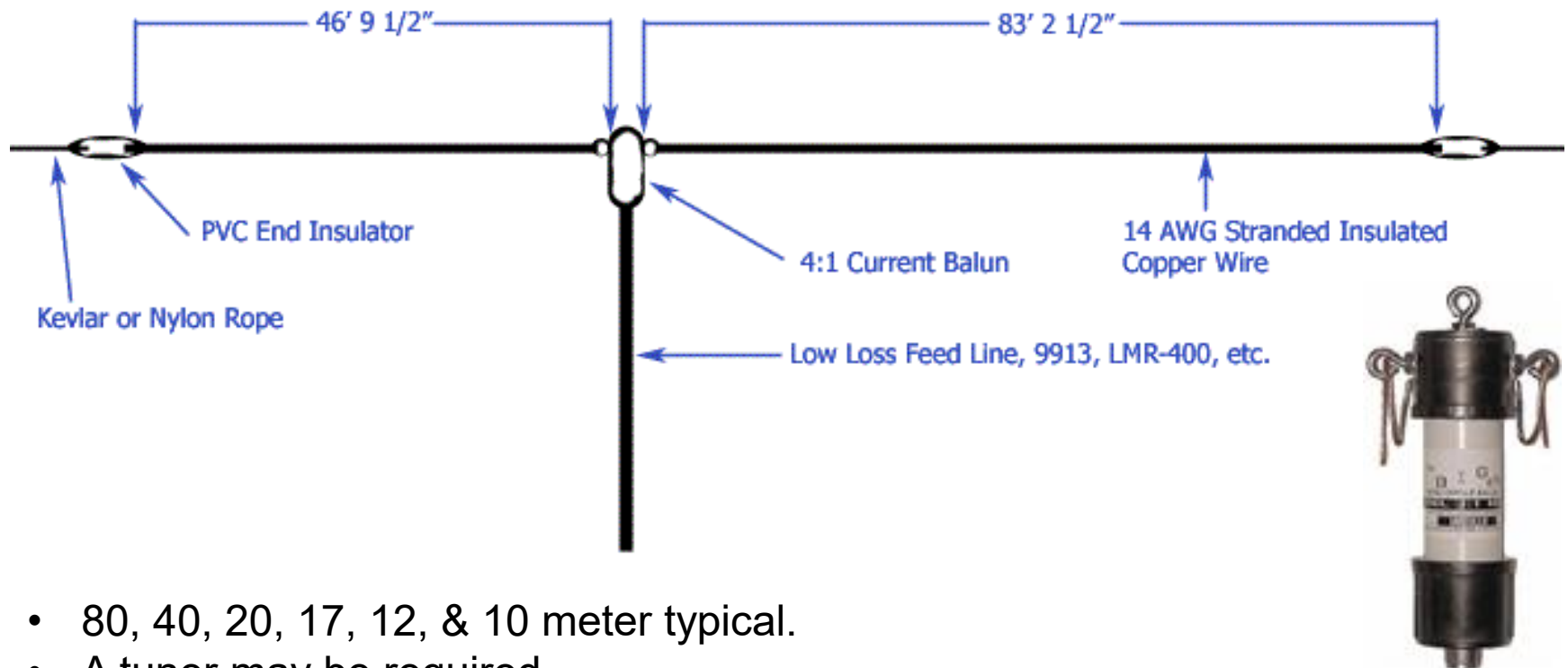
80m Dipole fed with ladder line (Double Zepp)

G5RV

Antenna Tuners



Off-Center-Fed Dipole (Windom)

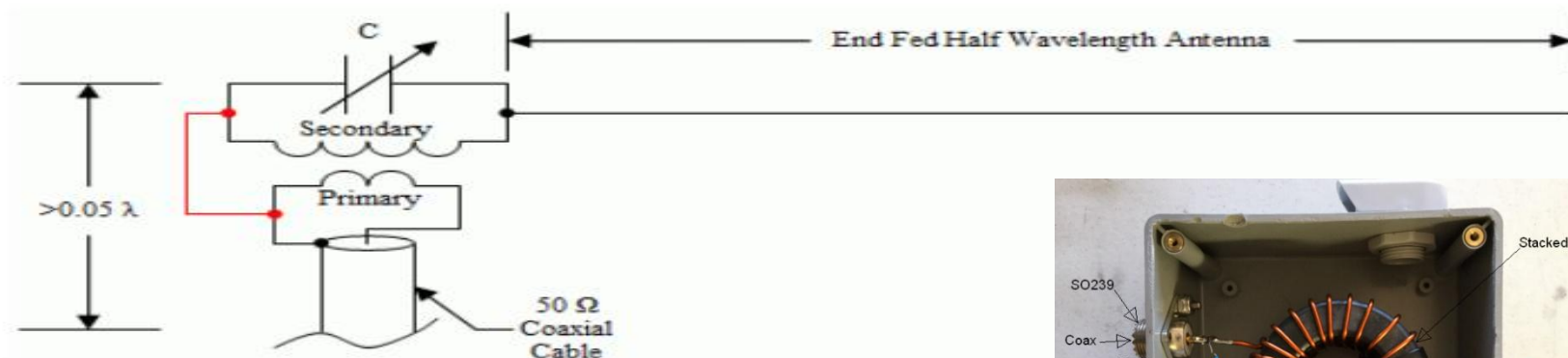


- 80, 40, 20, 17, 12, & 10 meter typical.
- A tuner may be required.

Baluns are often used as the center insulator and to provide both impedance matching and balance

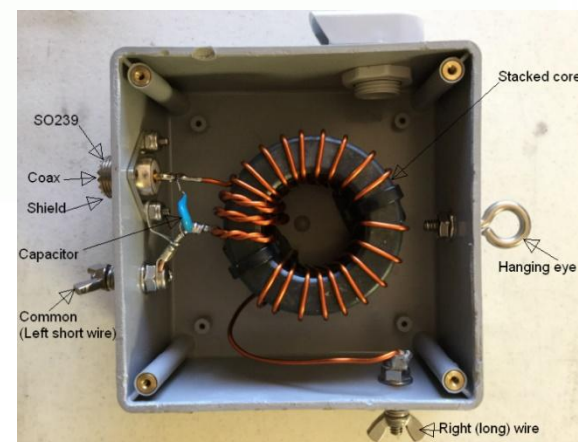
End Fed Halfwave (EFHW)

G0KYA's HF End Fed Half Wave (EFHW) antenna – construction details



- An end-fed half wave antenna can be thought of as being like a dipole, only fed at one end.

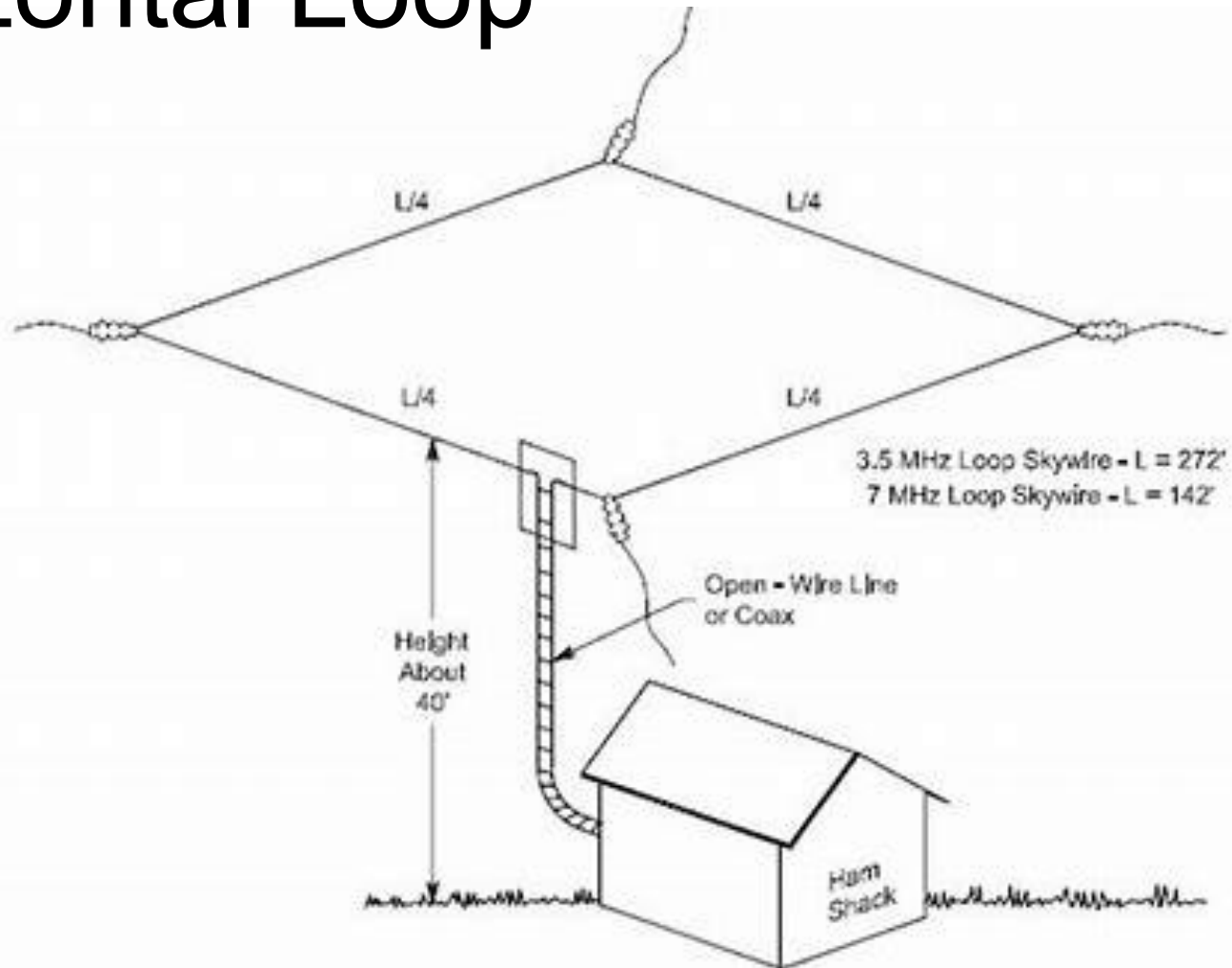
- <http://hamfest.w7ycr.org/wp-content/uploads/2019/06/EFHWslides.pdf>
- <https://www.norfolkamateurradio.org/pdf/G0KYA%20EFHW%20Ant%20+%20shopping%20list.pdf>
- <https://www.hfkits.com/end-fed-antennas-a-critical-view/>



49:1 Impedance Ratio

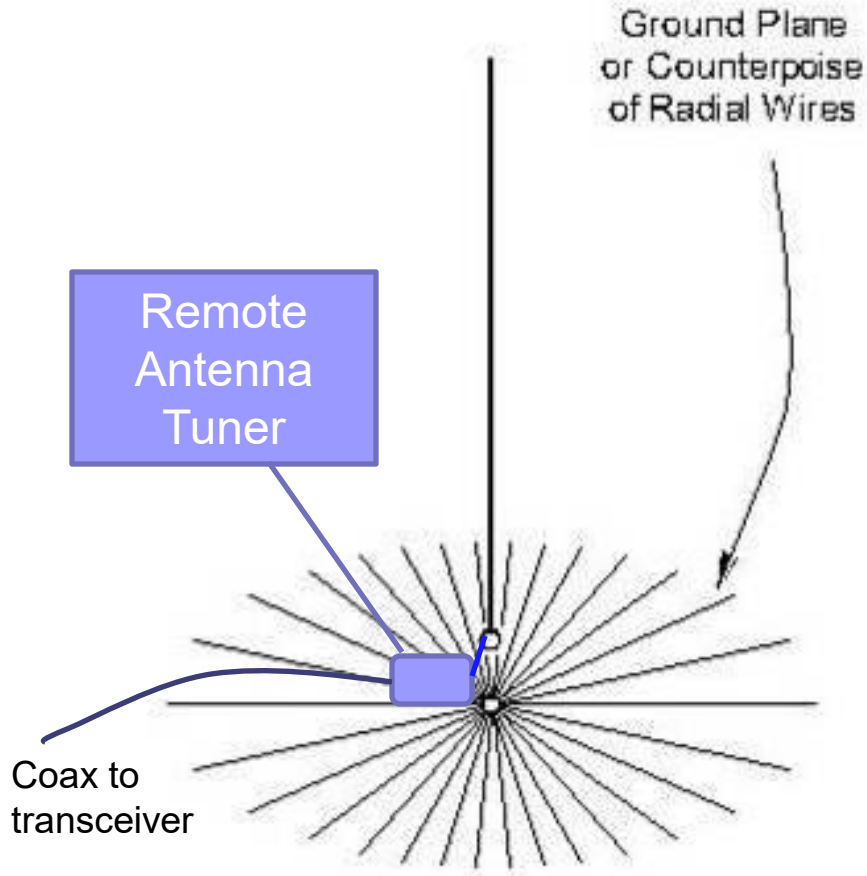
40 -10m 66 ft 250W EFHW
MFJ: \$84; ARRL \$70
80 – 10m 130 ft 1 kW EFHW
EFHW-8010 130 ft 1 kW
MyAntennas \$200

Full Wavelength Horizontal Loop



Multiband Verticals

Typically Ground-mounted



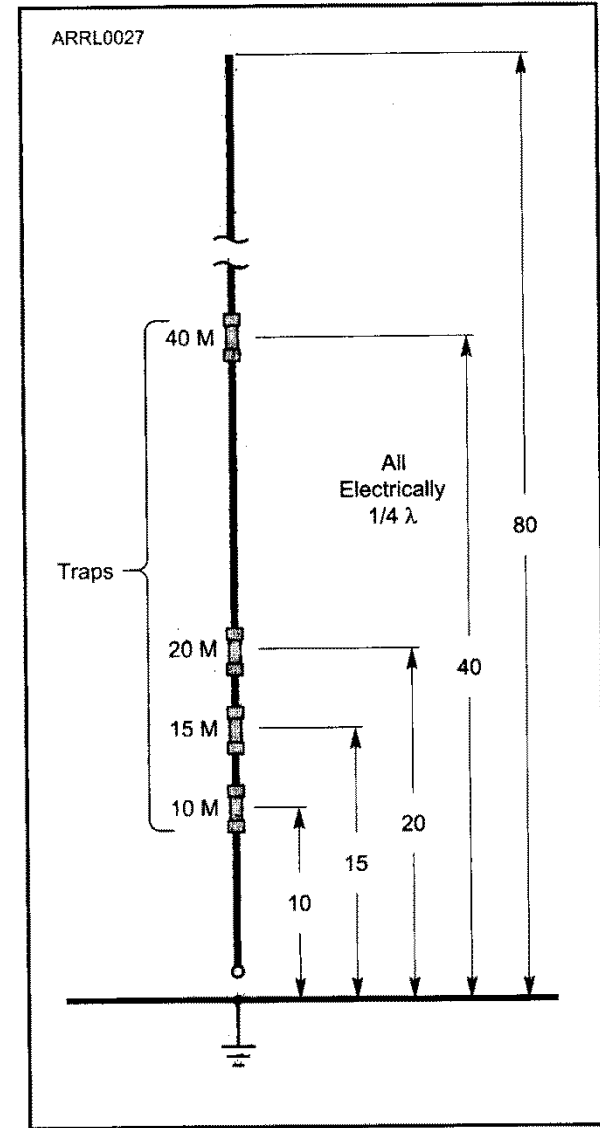
Vertical with a Tuner

Hustler

- 4BTV
- 5BTV
- 6BTV
- \$ 370-500

Butternut

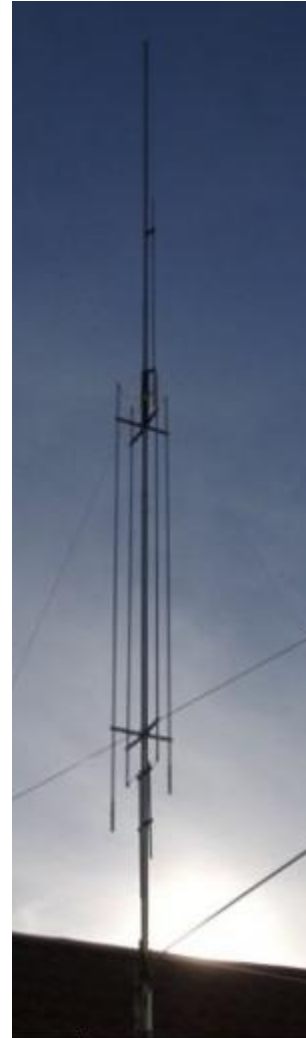
- HF6V
- HF9V
- \$900 – \$1.1K



Trap Vertical

□ Elevated Verticals

- Small Footprint
- Wind & ice survival risks
- Cushcraft R9 -- **Obsolete**
 - 9 HF bands: 6,10,12,15,17, 20, 30, 40, 80M
 - Built-in 4-ft radials
 - 31.5 ft tall
 - \$700
- GAP Eagle DX
 - 10 – 40m
 - Vertical Dipoles
 - Built-in 6.6 ft radials
 - 21 ft tall
 - \$500

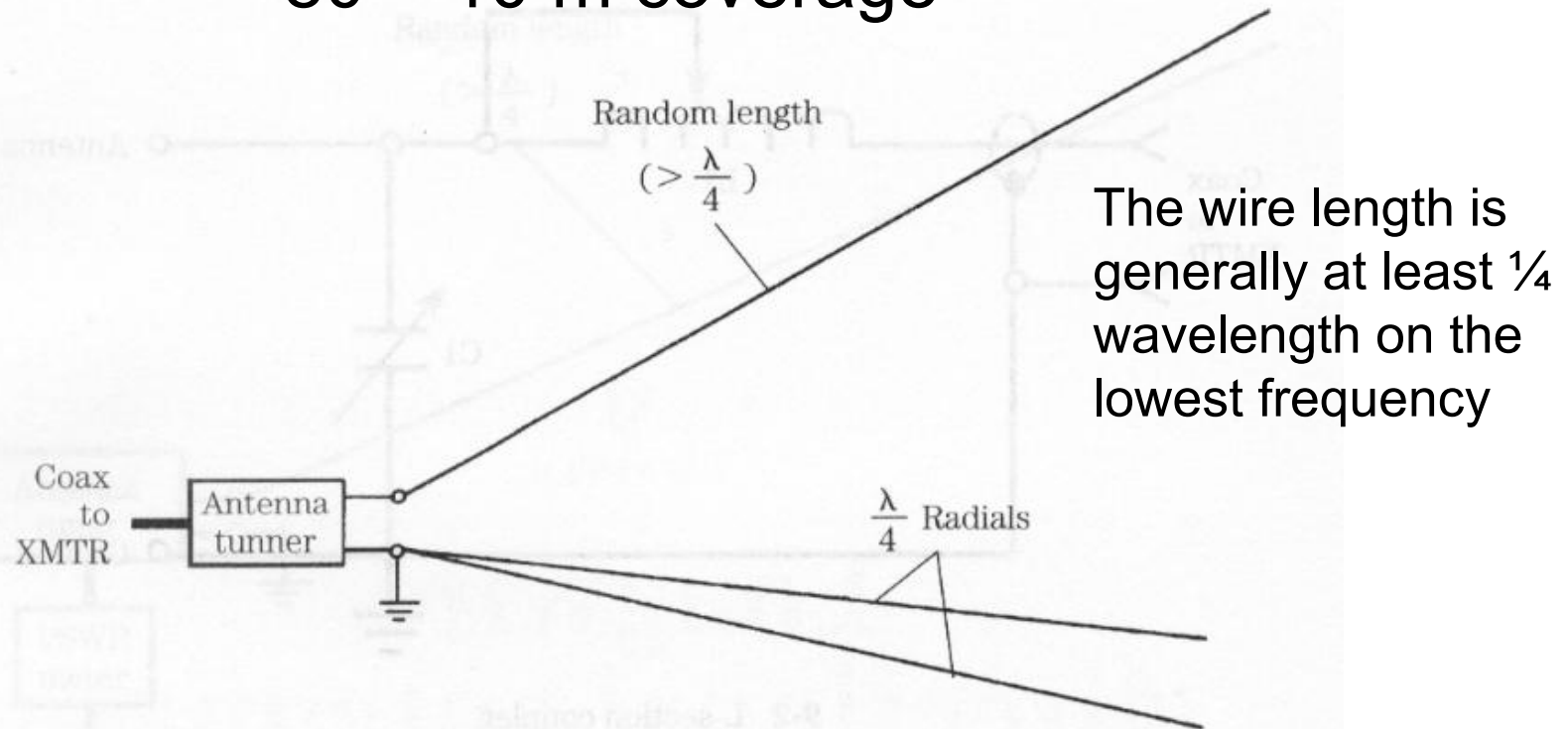


R9



Random-Wire All Band

80 – 10 m coverage



9-3 Radials improves the "ground" of random length antenna.



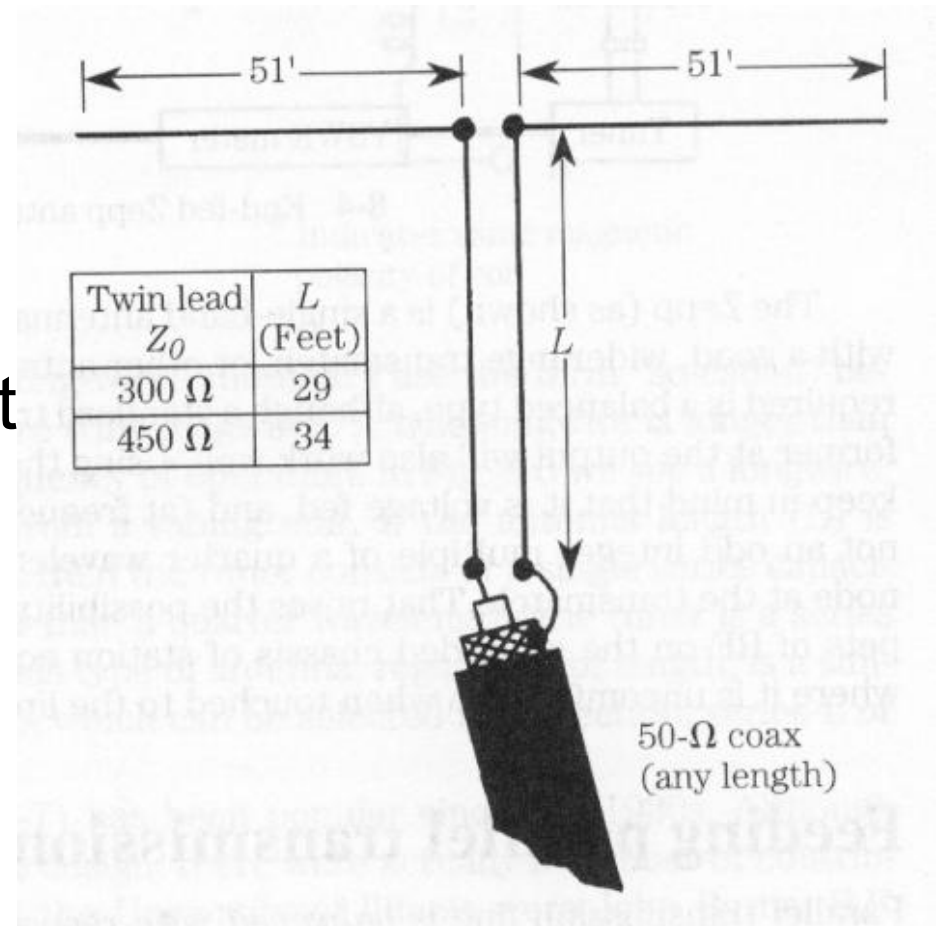
Compromise HF Antennas

Sometimes we have to make compromises to make our HF antennas fit into our life.

- G5RV
- All-band random end-fed
- All-band Vertical
- Attic Antennas
- Mobile Antennas
- Any antenna shorter than $\frac{1}{4}$ wavelength

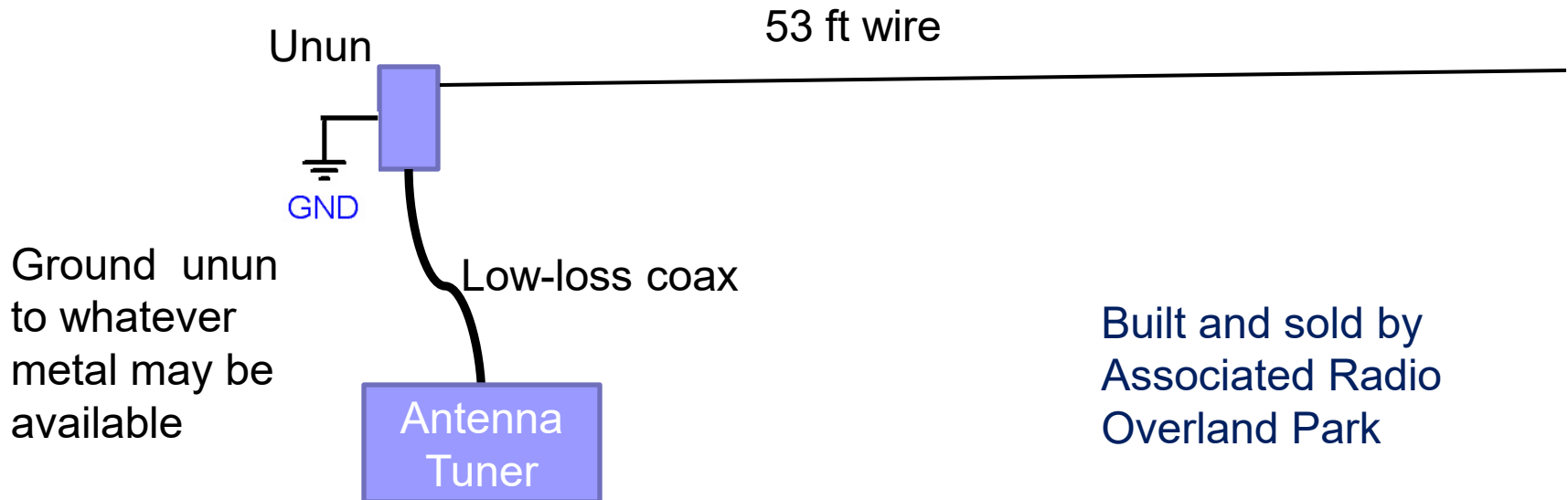
G5RV

- Although a very popular antenna, the performance of a G5RV has been shown to be below that of a dipole on most bands
- An inherent mismatch exists between the coax and the twin lead



Random End Fed Wire w/Unun

- The Princeton EF53 is a form of random-wire antenna that uses an unun for part of the impedance matching.



- Provides 80m through 6m operation
- Moderate SWR on most bands; high SWR on 40m

Broadband Vertical

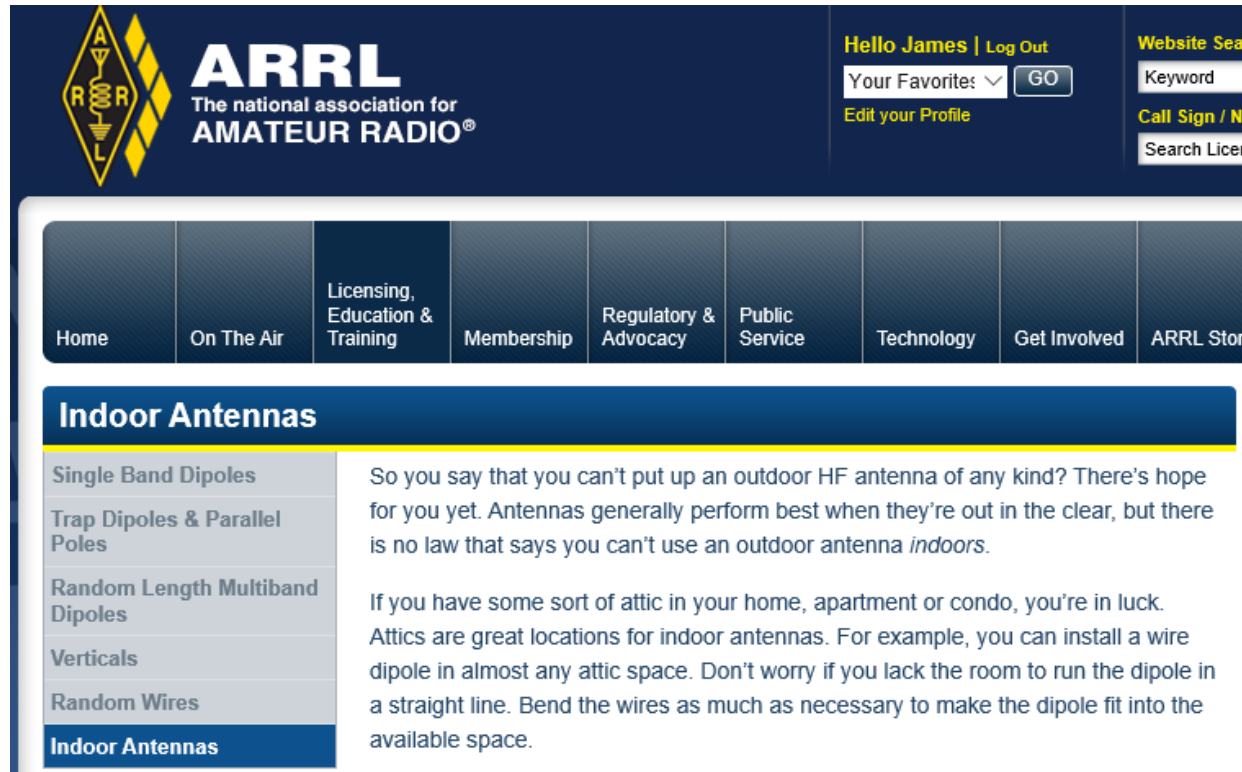
Comet CHA-250

- 80 – 10m coverage
- No antenna tuner needed
- 23.6 ft long
- Broadband Matching at the base
- 250 Watt max power
- Mixed reviews



Attic & Other Stealth Antennas

- HF Antennas Especially stealth models for those in an HOA
 - [HF Antennas Especially stealth models for those in an HOA](#)
- Attic Antennas
 - [Hidden and stealth antennas - IW5EDI Simone - Ham-Radio](#)



The screenshot shows the ARRL (American Radio Relay League) website. The header features the ARRL logo and the text "The national association for AMATEUR RADIO®". On the right, there is a user greeting "Hello James | Log Out", a "Your Favorites" dropdown menu with a "GO" button, and a link to "Edit your Profile". Below the header is a navigation bar with links: Home, On The Air, Licensing, Education & Training, Membership, Regulatory & Advocacy, Public Service, Technology, Get Involved, and ARRL Store. The main content area is titled "Indoor Antennas" and contains a sidebar with a list of antenna types: Single Band Dipoles, Trap Dipoles & Parallel Poles, Random Length Multiband Dipoles, Verticals, Random Wires, and Indoor Antennas (which is highlighted). The main text area discusses the challenges of using outdoor HF antennas indoors and provides a solution using attic space for indoor antennas.

ARRL
The national association for
AMATEUR RADIO®

Hello James | Log Out
Your Favorites:
Edit your Profile

Website Search
Keyword
Call Sign / Name
Search Licenses

Home On The Air Licensing, Education & Training Membership Regulatory & Advocacy Public Service Technology Get Involved ARRL Store

Indoor Antennas

Single Band Dipoles

Trap Dipoles & Parallel Poles

Random Length Multiband Dipoles

Verticals

Random Wires

Indoor Antennas

So you say that you can't put up an outdoor HF antenna of any kind? There's hope for you yet. Antennas generally perform best when they're out in the clear, but there is no law that says you can't use an outdoor antenna *indoors*.

If you have some sort of attic in your home, apartment or condo, you're in luck. Attics are great locations for indoor antennas. For example, you can install a wire dipole in almost any attic space. Don't worry if you lack the room to run the dipole in a straight line. Bend the wires as much as necessary to make the dipole fit into the available space.

Attic HF Antennas

- Many wire antennas can be adapted for attic use—but this should not be your first choice!
 - Watch out for metalized roofing materials
 - Keep the antenna as far as possible from metal objects, including house wiring
 - Antenna elements can be zig-zagged or bent at ends
- Consider resonant dipoles, including trap and fan
- Longest practical dipole, fed with ladder line to a balanced tuner
 - Use a 1:1 Current balun if using ladder line to an attic-mounted auto tuner



Attic and Stealth Antennas

More Attic Ideas:

- Horizontal loop in the attic with an antenna tuner
- Mobile “Hamstick” used to form a dipole
 - Viable for 20m and higher bands
 - Narrow bandwidth
- Random wire with attic-mounted automatic antenna tuner.
 - Let the HVAC ducts serve as the “ground radials”

Yard Ideas:

- Wire antennas using 18 AWG wire
- Verticals (with an antenna tuner at the base)
 - Wire running up along the fireplace chimney
 - Front-yard metal flagpole
- Mobile antennas that are taken down when not in use

Mobile HF Antennas

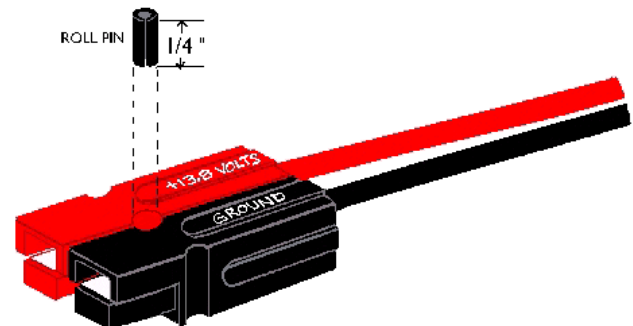
- The lower the operating frequency, the poorer the efficiency
- On 10 and 15 m, the efficiency can be fairly good.
- Center loading is generally more effective than base loading

Yaesu ATAS-120A
Motorized Tuning



Making DC Power Connection in Cars.

- Accessory/Lighter Plug
 - Inadequate for higher power radios
- Tap into fuse block
 - Tap accessory available at auto-supply stores
- Go direct to battery (Essential for a HF install)
 - Requires going through the firewall.
 - Don't forget to turn the radio off!
- Consider adding Anderson Power-pole connectors



Directional Yagi



Monoband Beam



Multiband Beam

HF Tri-band Beams

Cushcraft A3S - Cushcraft HF Beam Antennas -- Obsolete --



Antenna, Beam, HF, Tri-Band, Yagi, 3 Elements,
1,500 W, 20, 15, 10 meters, 14.0 ft. Boom Length,
Each

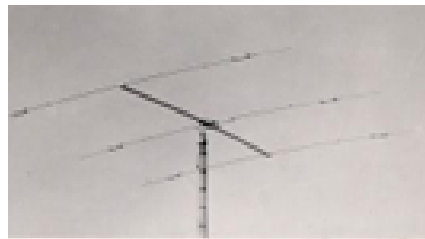
\$649.95

1

Not Yet Reviewed

Part Number: CSH-A3S [More Detail...](#)

■ Mosely



CLASSIC "CL" SERIES

CL-33-M \$1,214.95

CL-33-M-WARC \$1,451.95

CL-36-M \$1,698.95

CL-39-M [QUOTE](#)

Model	Band Coverage MHz	Description
CL-33-M	28, 21, 14	Tri-band , 3 element beam, <u>18 foot</u> boom.
CL-33-M WARC	28, 24, 21, 18, 14	5-band, 4 element beam, 18 foot boom.
CL-36-M	28, 21, 14	Tri- band, 6 element beam, 24 foot boom.
CL-39-M	28, 21, 14	Tri-band, 9 element beam, <u>40 foot</u> boom.

From Tri-banders to Log Periodics



Diex Antennas DXW Series Tri-Band 3 Element Yagi Antennas DXW3-30

Antenna, Directional, Tri-band, 3 EL, 12/17/30M, +30 Meters Kit, Each

\$1,319.99

Part Number: DXA-DXW3-30

Not Yet Reviewed

Only 1 left in stock - order soon

1

Add

☐ Compare

Estimated Ship Date from Ohio: **Tomorrow**



Telrex® Log Periodic Antennas 143042-135

Log Periodic Antenna, 14-30 MHz, 16 el., 42 ft. x 3 in. Boom, HD 120 mph Wind Survival, 350 lbs., Each

\$10,000.00

Part Number: TEL-143042-135

Not Yet Reviewed

Ships Directly From Supplier

Estimated Ship Date: **Aug 31, 2026** (if ordered today)

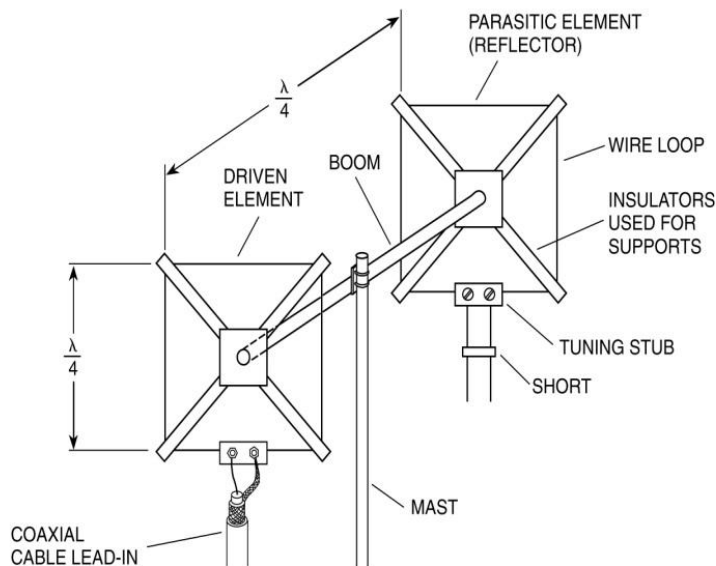
From the DX Engineering Site

Wire Beams - Spiderbeams

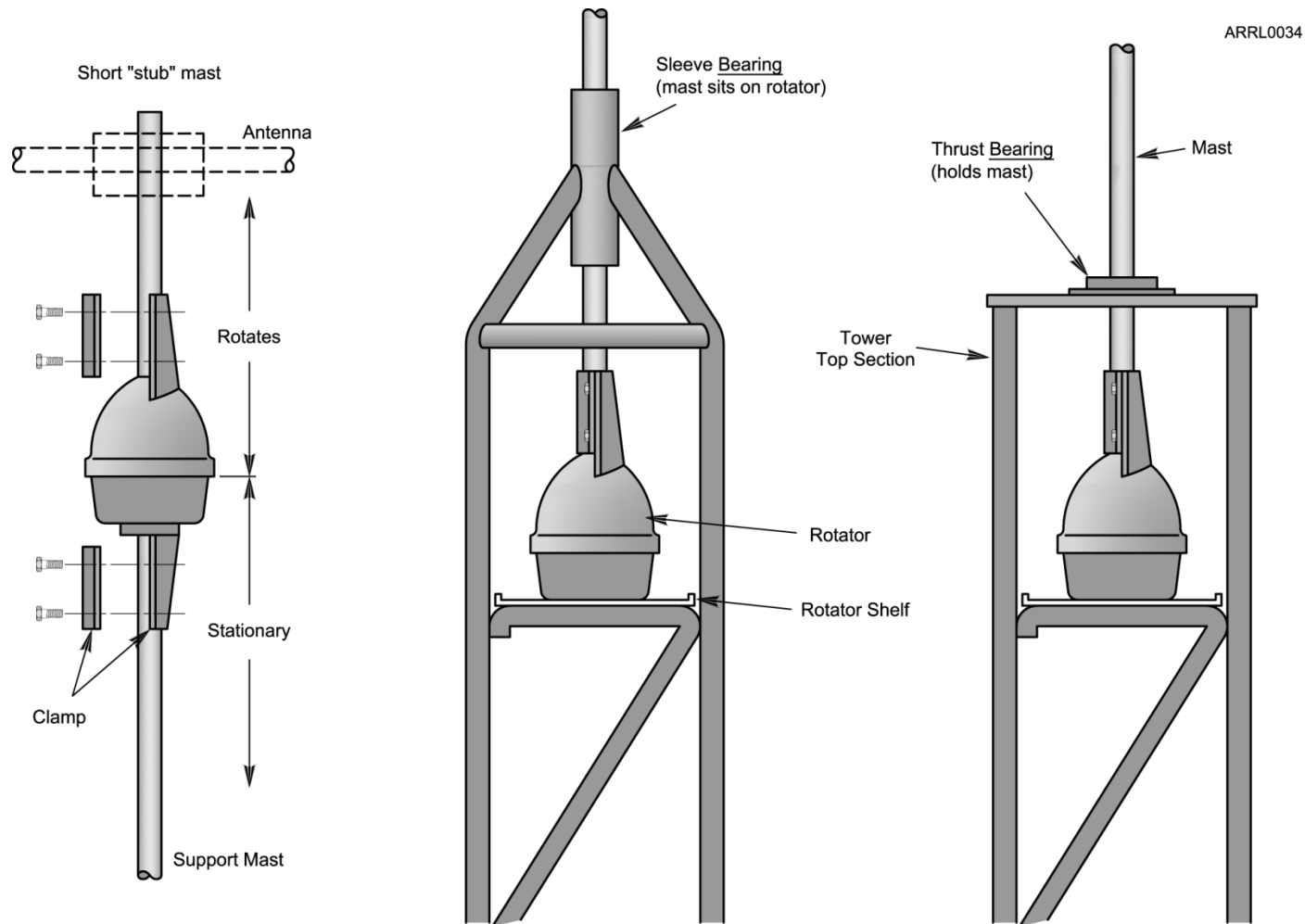
■ Spiderbeams

<https://www.spiderbeam.com/>

■ Cubical Quads



Antenna Rotor Mounting



Rotors do the Heavy Turning

- Select a rotor that exceeds the antenna's wind-loading spec.



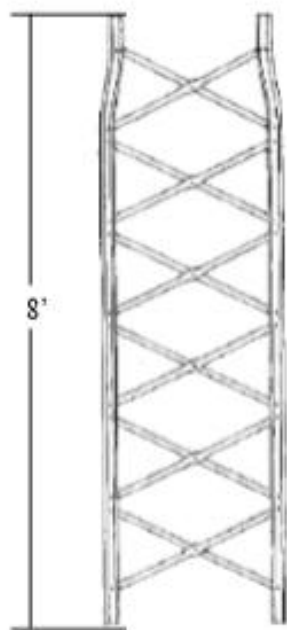
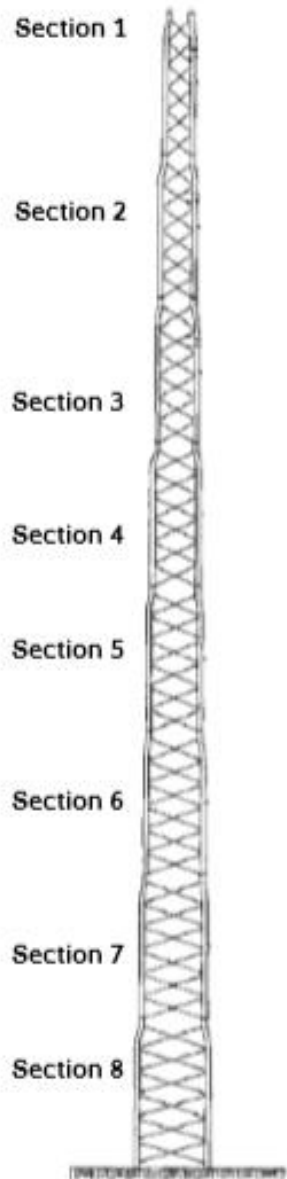
**Yaesu
D-800DXA
21.5 sq ft
\$490**

Obsolete Hy-gain

Model Chart

Feature	AR-500	AR-40	CD-45II
Wind Load:		3.0 Sq.Ft.	8.5 Sq.Ft.
Turning Power:		350 Lbs.	600 Lbs.
Brake Power:		450 Lbs.	800 Lbs.
Brake Type		Disc Brake	Disc Brake
Bearing Type		Dual race	Dual race
Ball Bearings		12	48
Control Conductors	3	5	8
Information	INFO	INFO	INFO
Order #	#6909	#2394	#2393
List Price	\$169.95	\$399.95	\$499.95
Your Price	\$159.95	\$369.95	\$469.95
Order	Order	Order	Order

Towers



← Self-Supporting
← tbxtower.com

Guyed →
(Building Supported)
rohnnet.com →

ROHN 25G
The first. The original.



New Towers = \$\$\$

From the DX
Engineering
website



ROHN 25G Tower Sections 25G

Tower Section, Straight, 25G Series, Leg 1.25 in. Diameter, 11.25 in. O.C. Spacing, 10 ft. Height, Each

Part Number: ROH-25G

★★★★★ (14)

[In Stock at Select Locations](#) (more than 10 available)

Estimated Ship Date from Ohio: [Tomorrow](#)

 [Freight Charge](#)  [Charts & Guides](#)  [Video](#)

\$195.99

1

\$323.99



TBX Tower

6 sq ft
10 sq ft
18 sq ft



Up to 64 ft tall

\$4,402.00

[TBX Tower Packaged Tower Kits >](#)

Tower, 48 ft., Extra-Heavy Duty Package, 18 sq. ft. Wind Load,
Requires Base, Kit
[See More Specifications](#)

[Ships Directly From Supplier](#)

Other Variants:

- Crank-up
- Tilt-over Base

Concrete Bases = \$\$\$

- Bledsoe's Rental
- Commercial Truck



Safety

- Use a safety belt when climbing towers or poles
- Stay clear of power lines
- Mount antennas so others cannot touch the antenna when you're transmitting
- Lightning arrestors help protect you and your equipment



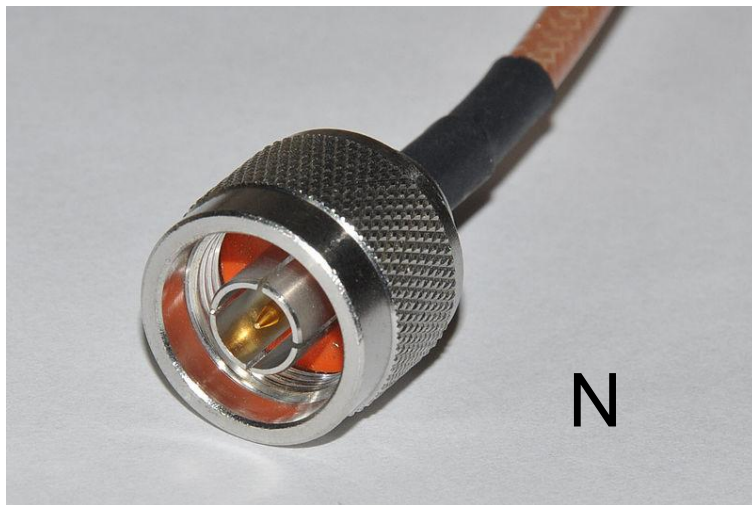
Antenna Connectors



UHF or
PL-259



BNC



N

Shield Connection:

- Solder
- Crimp-on
- Clamp



SMA

Coax Loss

Tech Pg 4-16

Gen Pg 7-19

Extra Pg 9-33

- Remember: 3 dB of loss = $\frac{1}{2}$ of your power is lost
- Goals: ≤ 1 dB loss preferred; Do not exceed 3 dB

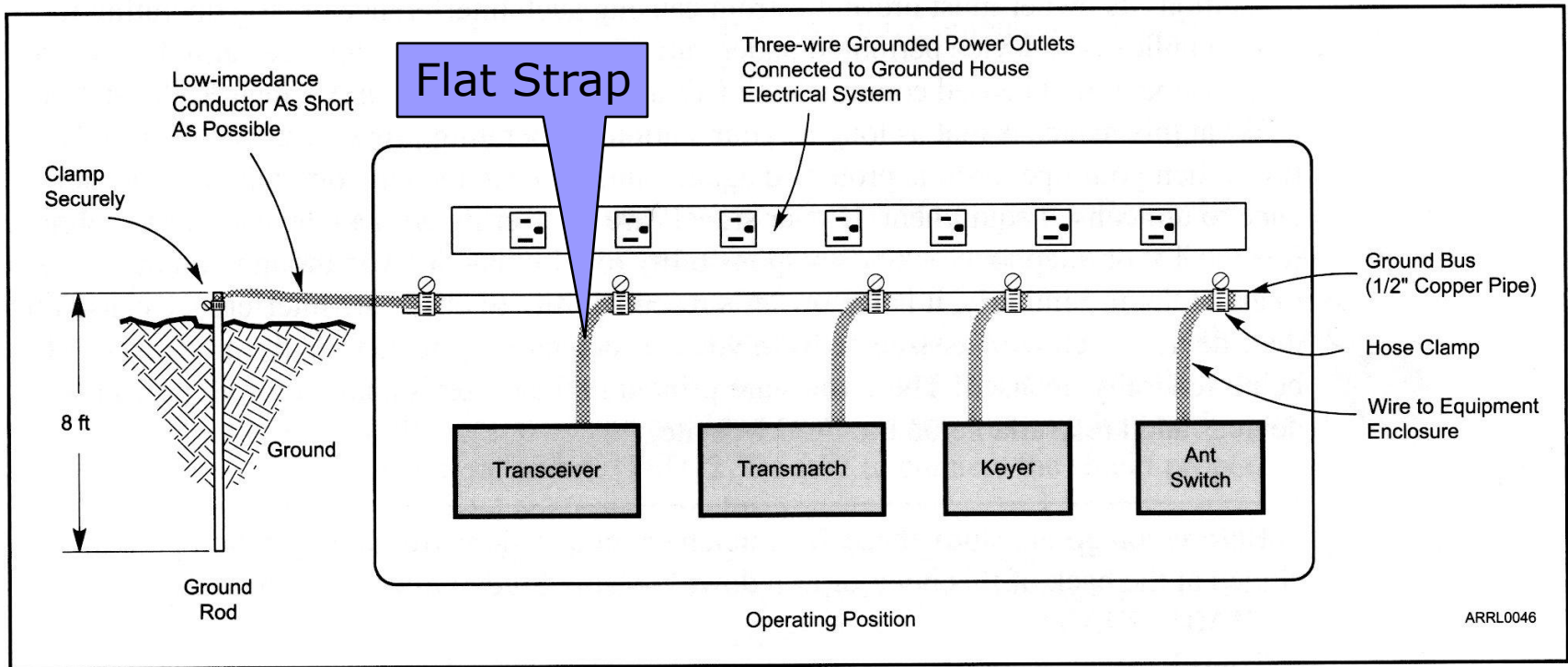
Loss in dB (decibels) per 100 feet of cable.

Cable Type	Diameter Inches	3.9 MHz 80m	30 MHz 10m	144 MHz 2m	222 MHz 1.25m	440 MHz 70cm	1 GHz
RG-174	.101	2.2	5.6	10.5	13.5	20	30
RG-58A	.193	0.8	2.6	6.1	8	12.3	21.4
RG-8X (mini 8 foam)	.242	0.7	2	4.5	5.7	8.4	13.5
RG-8 or RG-213	.405	0.4	1.3	2.7	3.4	5	8.5
RG-8 foam	.405	0.3	.9	2.2	2.9	4.4	7
9913	.405	0.26	.8	1.6	1.9	2.7	4.5

LMR-400

RG-8 will have lower loss than the smaller RG-58

Grounding



If you cannot drive a ground rod, consider grounding to a metal water pipe

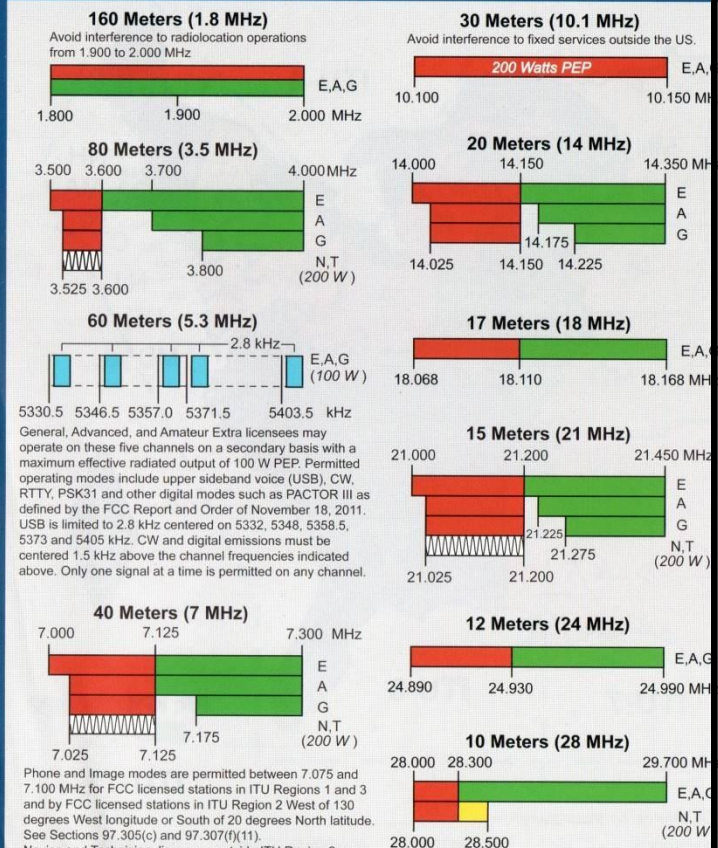
HF (High Frequency)

VHF / UHF

US Amateur Radio Bands

US AMATEUR POWER LIMITS

FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.



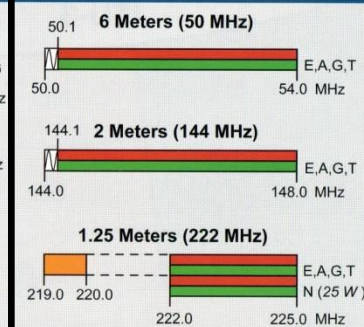
General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5358.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.

Phone and image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11).

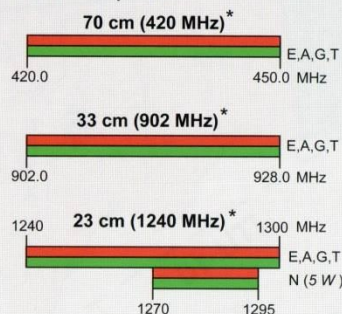
Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental U.S.

Effective Date
March 5, 2012

Published by:
ARRL The national association for
AMATEUR RADIO®
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494



*Geographical and power restrictions may apply to all bands above 420 MHz. See The ARRL Operating Manual for information about your area.



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz *	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

* No pulse emissions

KEY

Note:
CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz. Test transmissions are authorized above 51 MHz, except for 219-220 MHz.

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See ARRLWeb at www.arrl.org for detailed band plans.

ARRL
We're At Your Service

ARRL Headquarters:
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Exams: 860-594-0300 email: vec@arrl.org

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Grid Squares Popular on 6m (EM28)

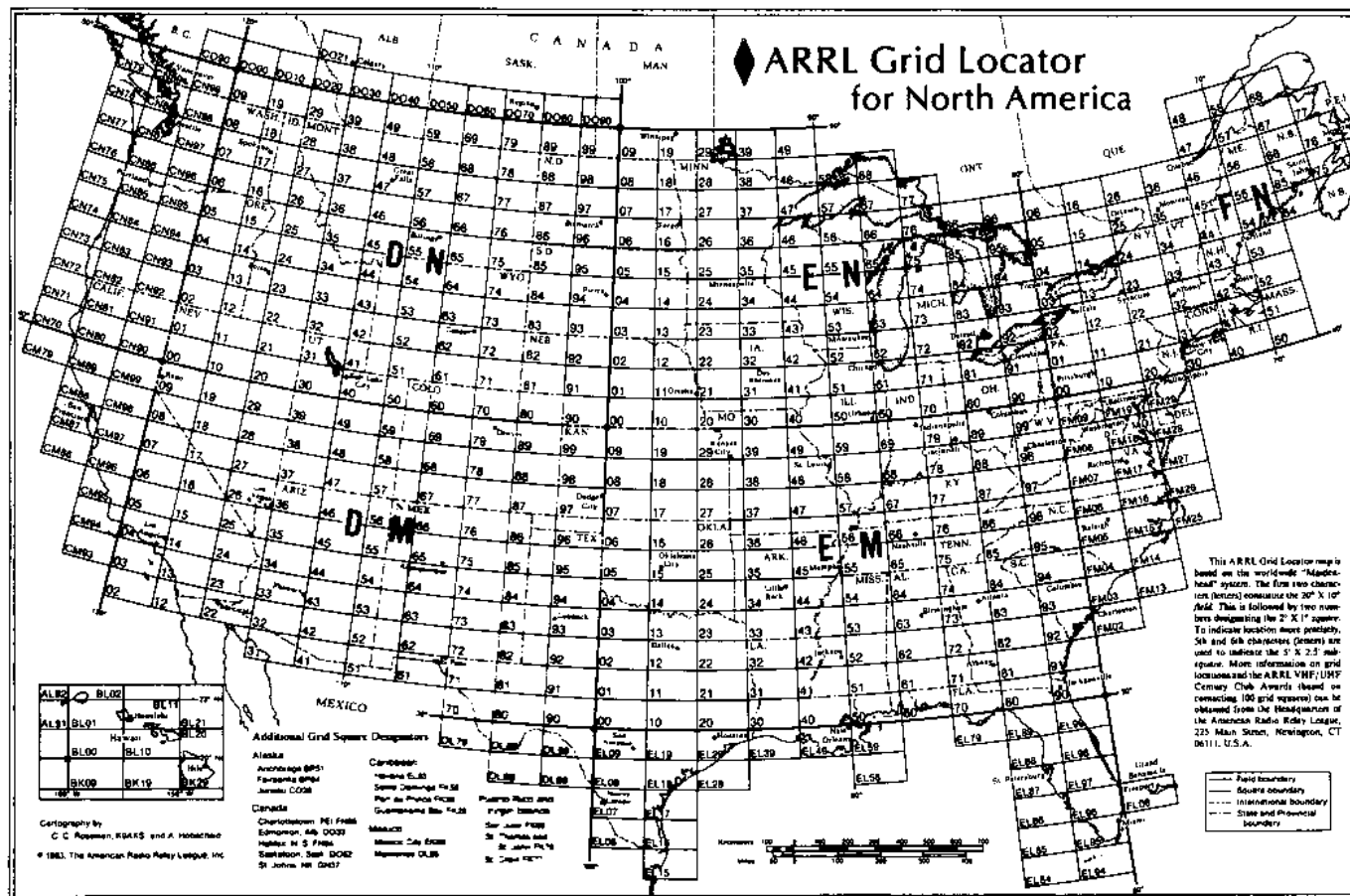
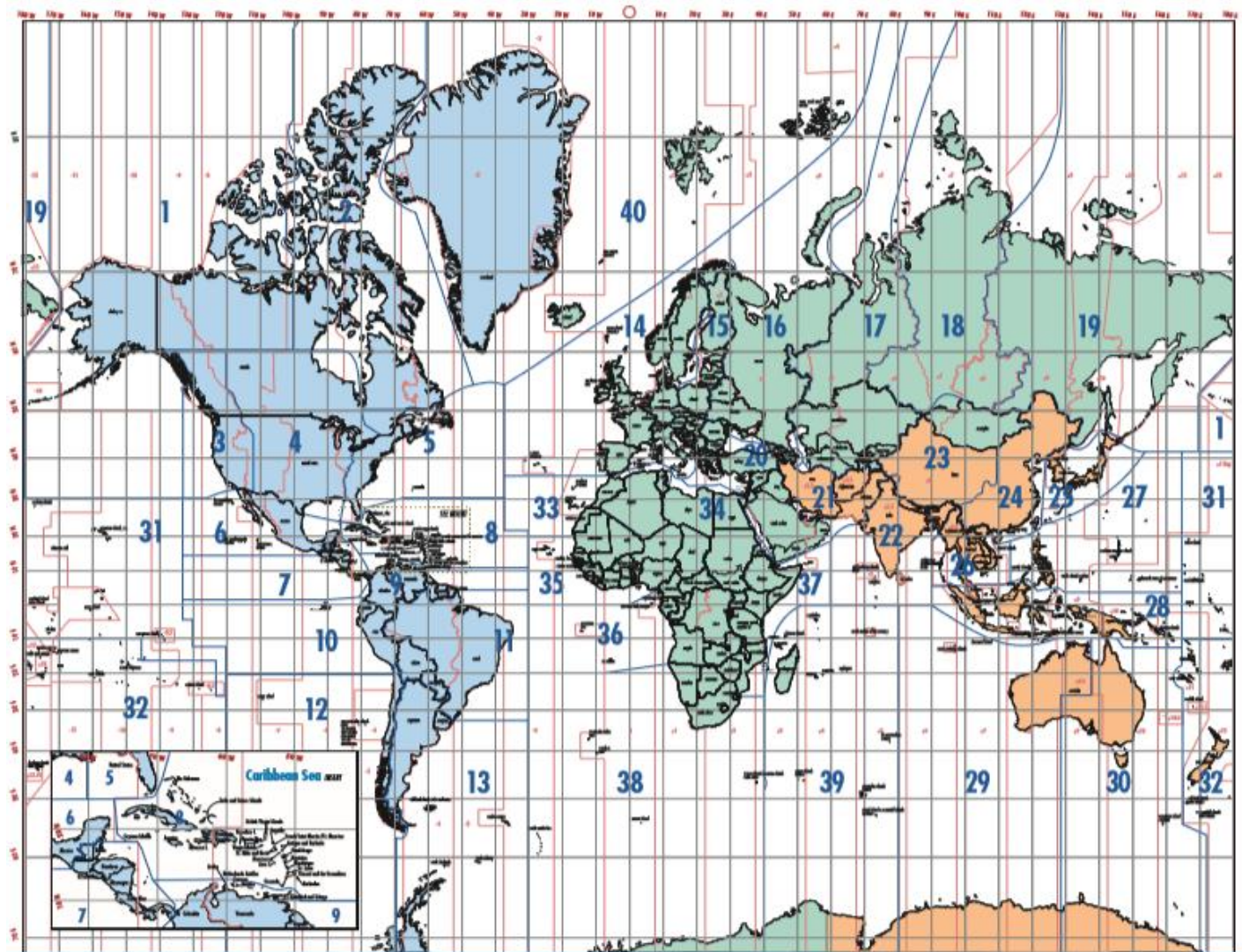


Figure 9-1—This map shows grid squares, used to specify your location for VHF and UHF SSB/CW operation.

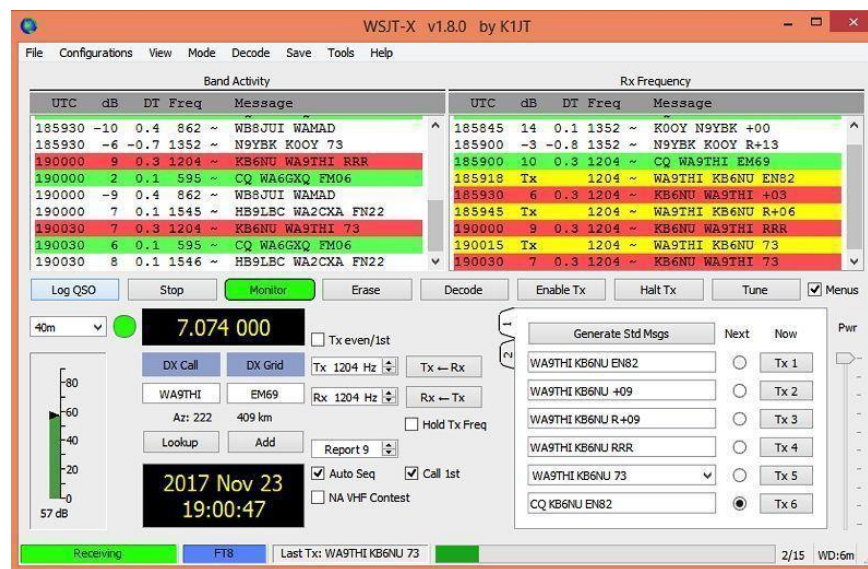
Zones

- 3 ITU Regions
USA is R2
- 40 CQ DX
- 90 ITU DX



DXing with Voice, CW, Digital

- **FT8** allows for digital contacts with very weak signals. Standard “canned” exchange
- **CW** or **Voice** DX contacts may be:
 - Very brief
 - Callsigns & RST
 - Contest
 - Short conversations
 - Occasional rag-chew



Chasing DX

- Casual DX
- DX Hunting
- DX Obsession

BS7H
Scarborough
Reef 2007



K9W

**Wake Atoll
2013**



Commemorative DXpedition

DX and DXepiditions

ARRL's DXCC Awards

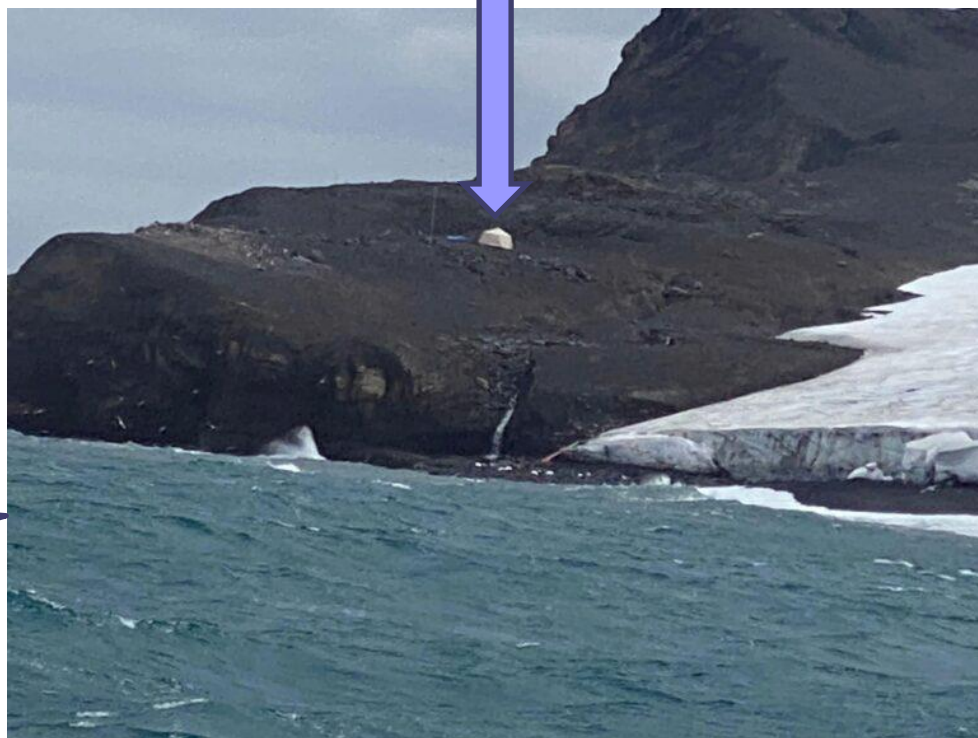
Century Club (100 entities)

...

Honor Roll (331 of 340 entities)

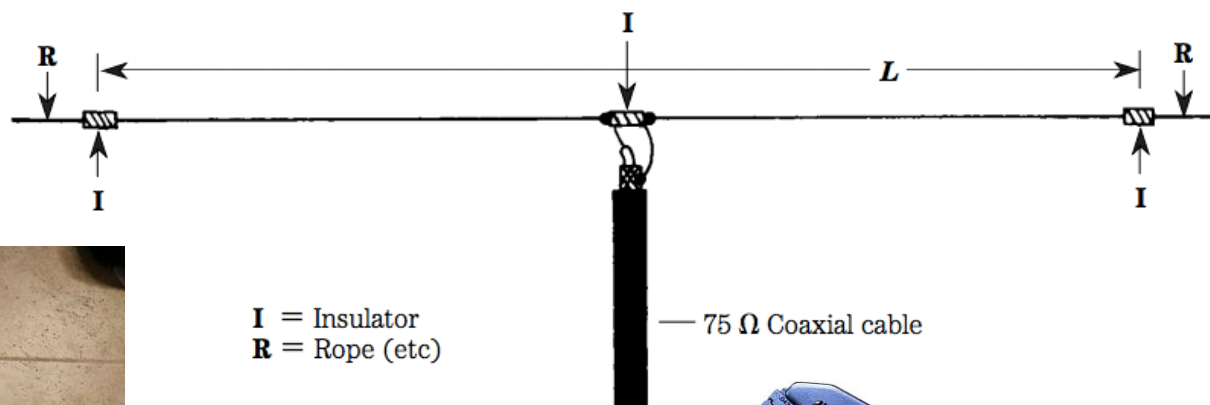
- Often working **split**
 - “Up 5” (Listening up 5 kHz)
- 10k to over 100k QSOs in several weeks

3Y0K DXpedition to
Bouvet Island,
Feb-Mar 2026



Put Your Knowledge to Work

■ Antennas



I = Insulator
R = Rope (etc)

— 75 Ω Coaxial cable



SWR meter or
Antenna Analyzer



RF Connector
Crimping Tool
\$30 Amazon

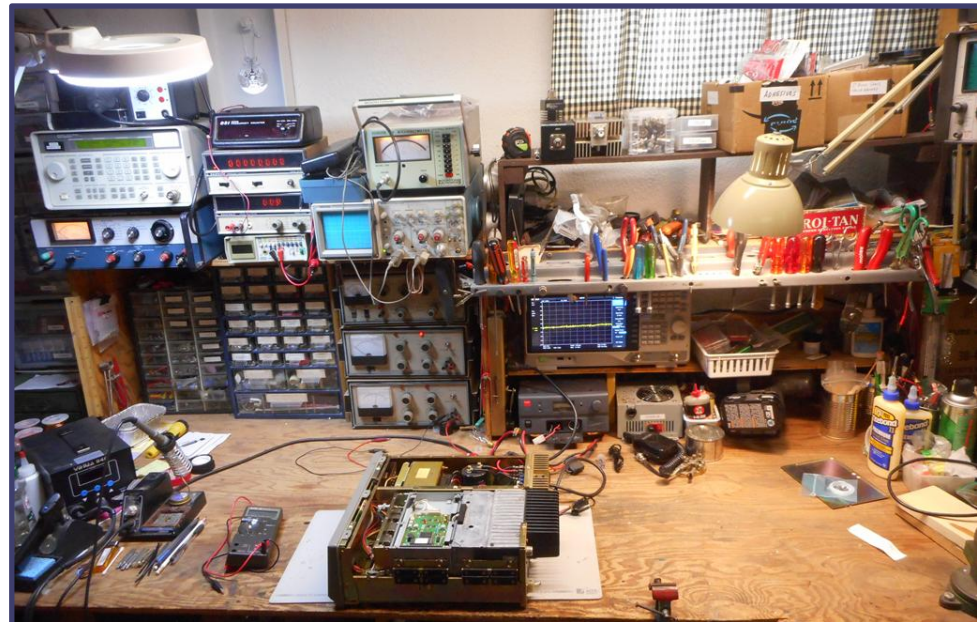


Soldering Gun
200+ Watts

Put Your Knowledge to Work

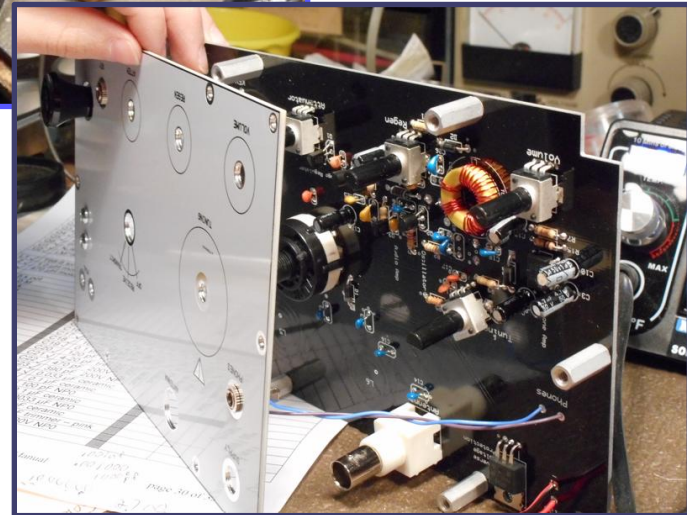
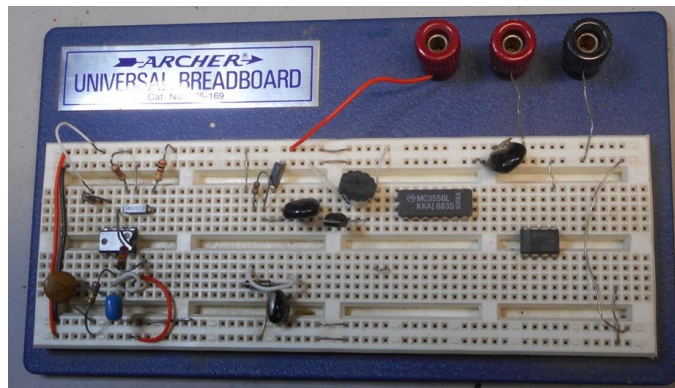
■ Electronic Workbench

- ☐ Digital Multimeter
- ☐ Variable Power Supply
- ☐ Temp-controlled Soldering Iron
- ☐ Small hand tools
- ☐ Oscilloscope
- ☐ RF Signal Generator
- ☐ PCB vise
- ☐ ...



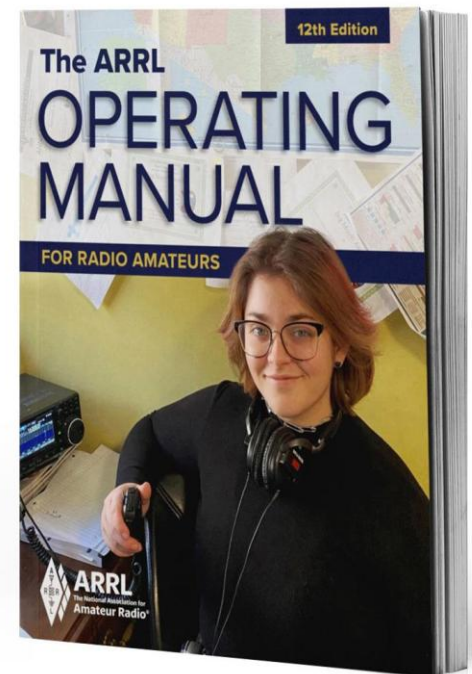
Put Your Knowledge to Work

- Kit building
- Circuit experiments
- Radio testing
- Homebrew projects



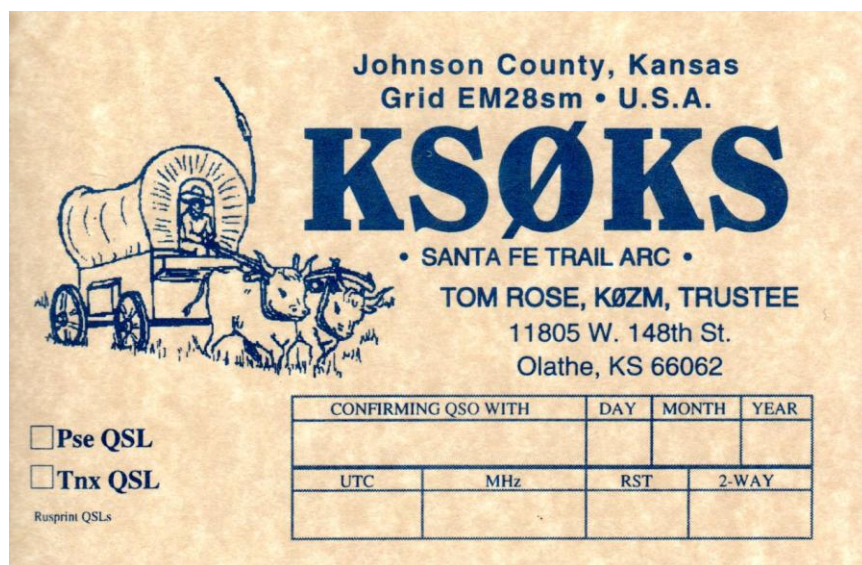
Books, Books and More Books

- ARRL Technician, General and Extra Class License Manuals
- ARRL Handbook
- ARRL Antenna Handbook
- ARRL Operating Manuals
- QRP: The Zen of Amateur Radio
- Practical Wire Antennas RSGB



QSL Cards

- Available from many sources and in many styles
 - Mostly on-line options
- May be very basic or include custom photo



- Logbook of the World (LotW) has reduced the use of paper QSL cards**
- **LotW is a must for any serious DXer**



Radio Stores & On-line Sources

- Associated Radio 8012 Conser, O.P. KS
- D&L Antenna Products – Hamfests
- WB0W antenna products – St Jo. – Hamfests

- Ham Radio Outlet - Various
- Texas Towers – Plano, TX
- DX Engineering -- Tallmadge, OH
- Numerous other on-line/catalog stores



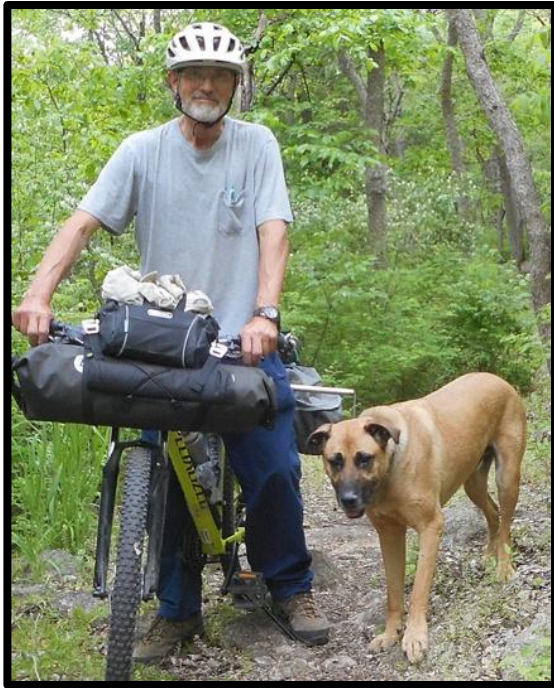
Area Hamfests

- Feb – Mine Creek -- LaCygne KS
- April – Hambash -- Raytown ARC
- July – Warrensburg ARC, MO
- Oct – ARRL Midwest Convention - Sedalia
- -----
- May – Hamvention – Dayton Ohio

Vanity Call Signs – 1x2 & 2x1

- Choose your call from those available
- \$35 fee for application and renewal
- Aside from a very few FCC-limited choices, Extra class licensees can choose virtually any vacant but valid US call sign
- Sites providing insight into availability of calls:
 - [AE7Q's Amateur Radio Database Query Tools](#)
 - [RadioQTH Amateur Radio Vanity License Search](#)
 - The above sites are not always in agreement
 - 0 (AE7Q) vs 32 (RadioQTH) as of 6 Feb 26 for 1x2 and 2x1 calls in the 0 district

Combine Radio & Other Hobbies



Bikepacking

Backpacking
& Fishing



Early-American Display
Telegraph Operator
Pony Express Festival





Enjoy your hobby!

- Thanks for being part of our class
- We hope to see you at the SFTARC meetings, breakfasts and activities.
 - Sat 6:30 / 8:30 am at Perkins, Gardner
 - I-35, Exit 210
 - 2nd Sat - Business Meeting, 8:00 am Typical
- Tuesday night Net. 8:00 pm, 145.47 MHz, 151.4 Hz tone
- Special Events, Parks on the Air
 - Tallgrass Prairie National Preserve – April or May