



Practical Considerations

SFTARC

2025 General License Class



Outline

- VHF/UHF/HF Transceivers
- Power Supplies and accessories
- Antennas, Connectors, Coax & Rotors
- Safety, Grounding, Noise, DC power connection
- Types of operating, Dxing
- Grid Squares, Zones, QSL cards, Logging
- Radio stores and on-line opportunities
- Area Hamfests
- Radio and antenna brands.
- Vanity call signs



Mobile VHF/UHF Transceivers

- Good choice for 1st radio
- 12 VDC - will need a power supply for indoor operation
- Mono-bander VHF or UHF (FM)
- Dual bander (FM; 2m/70cm most common)
- VFO function -- direct tune the frequency
- Built in channel memories
- Traditional FM + digital (**F**usion, DMR, DSTAR)
- Top-end models may include GPS and APRS

Mobile VHF/UHF Transceivers

- Needs a Tx CTCSS tone (PL tone/ sub-audible tone)
- Wideband receive
- Removable front panel
- Output power L, M, H: 5W, 10W, 35 – 70 W.
- Microphones have Touch Tone Pads
- UHF antenna connector (SO-239)





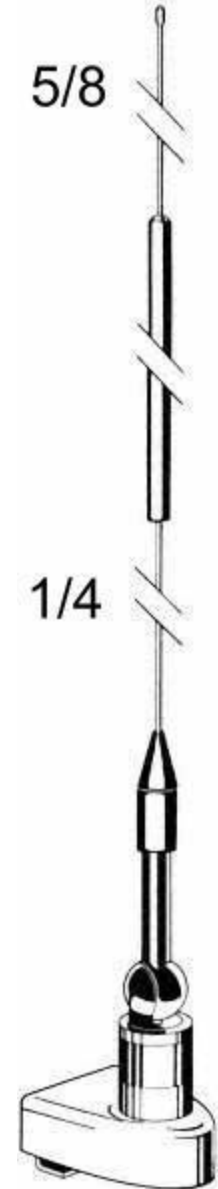
Mobile VHF/UHF Antennas

- Mono band, dual band, triband
- $\frac{1}{4}$ wave, $\frac{5}{8}$ wavelength mono band
- Base Type: all-in-one, NMO, SO239, 3/8-24 thread
- Mounts: Magnetic, through-hole, trunk, hatch lip, L-bracket
- 8 -15 ft of coax, Connector: UHF, BNC, SMA

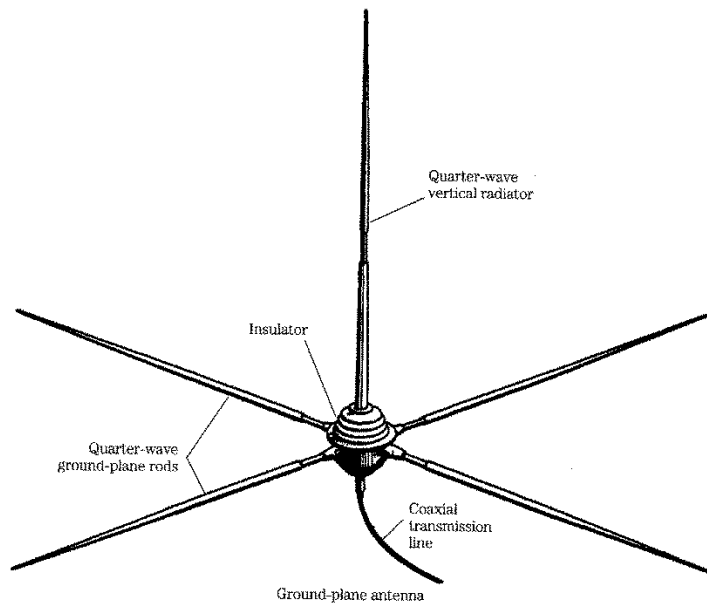
NMO Mounts for VHF/UHF



Mobile Antenna Options

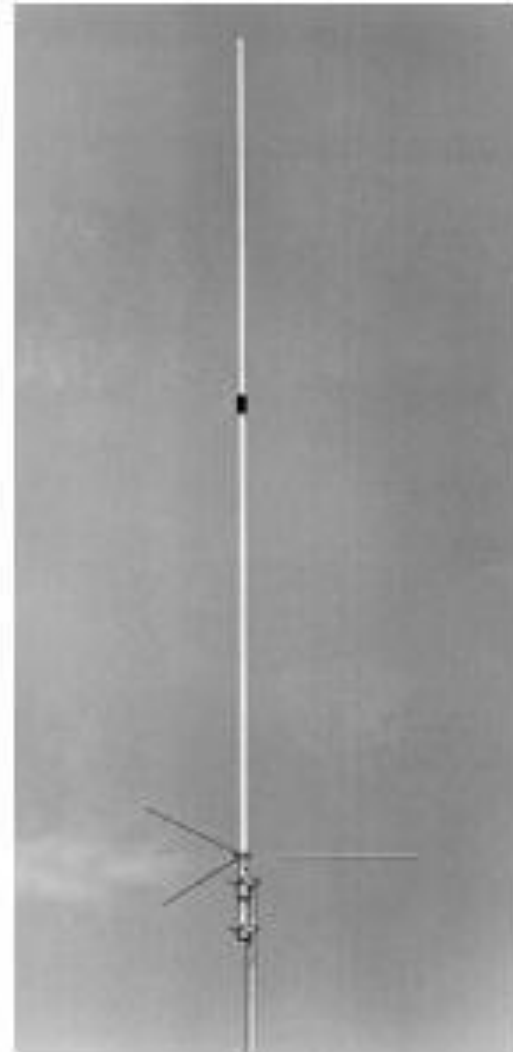


Base Station VHF/UHF Antenna

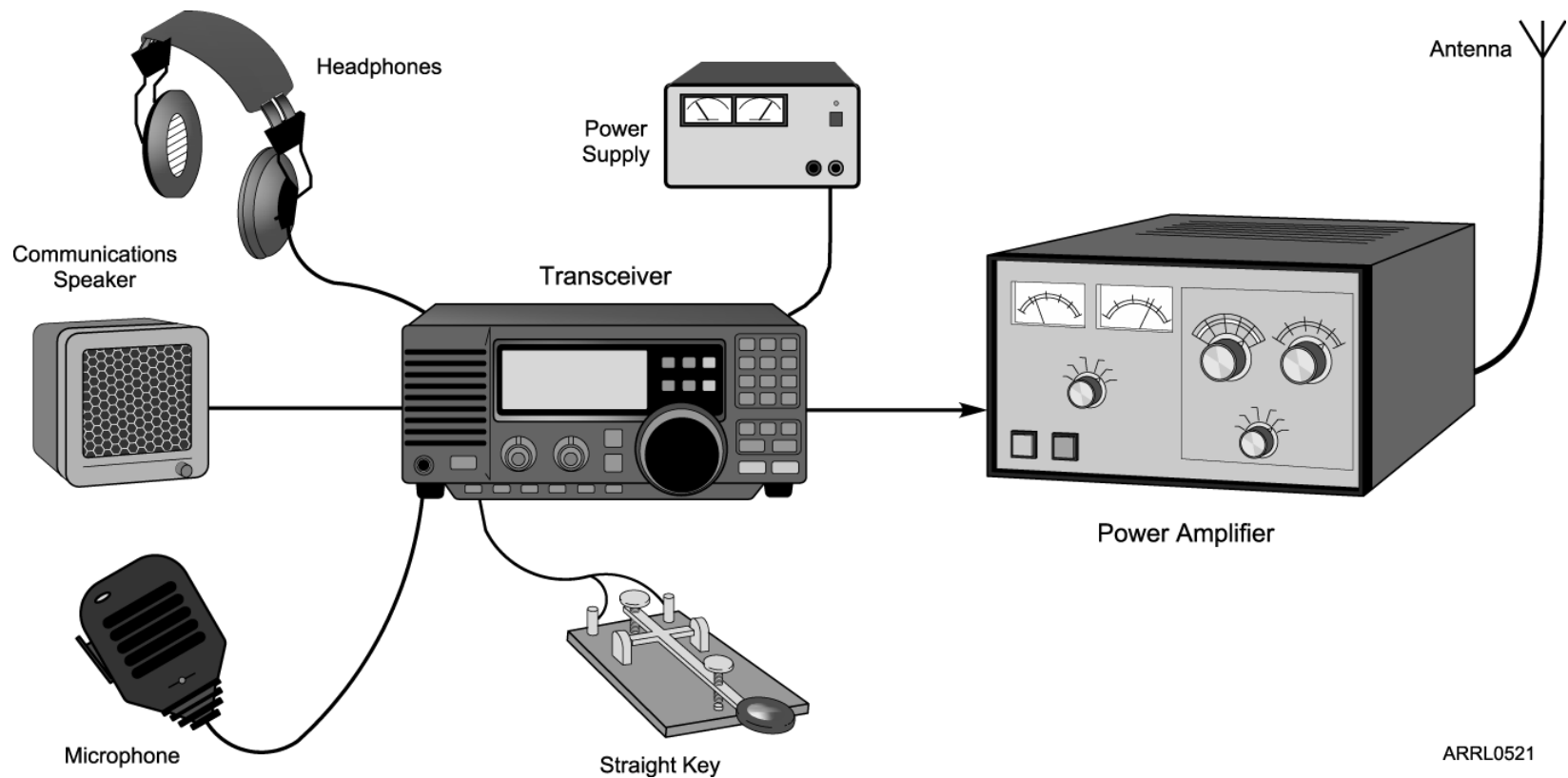


A Simple Ground-plane Antenna can be effective

Single-band, dual-band and tri-band models are available



The Complete HF Station



ARRL0521

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; 5 Channels; 5330–5403 kHz
 - Established 2002; Modified 2011
- May also cover 6m, 2m and 70 cm bands
 - Consider separate radios for 2m/70cm
- SSB, and CW modes; maybe FM, AM and RTTY
- Some HF transceivers include a built-in limited-range antenna tuner

Typical HF Transceivers

- 100 W of transmit power
- Newer “*rigs*” have “general coverage” receivers, often from 500 kHz to 30 MHz or higher
- Older rigs may be ham-band-only receive
- Software Defined Radios (SDR) are becoming more common, providing many features, small size and light weight
 - Spectrum display
 - Digital-mode ready – just plug into the computer



Typical HF Transceivers

- May require 12 VDC or 115 VAC for power
 - 12v has emergency-communications benefits
- Full size (base station) or compact (mobile)
 - Mobile radios often have removable front panels
- Older rigs may be ham-band-only receive
- Radios more than 40 years old may:
 - Have 3 or more vacuum tubes
 - Lack the WARC bands
- New HF transceivers are generally \$1000 and up; used transceivers \$250 and up

A Popular Base/Portable Xcvr

- The SFTARC has an Icom IC-7300
- 100W, 160-6m Tx, 30kHz – 74.8 MHz Rx
- SDR; Touchscreen; Built-in antenna tuner
- \$1000 on sale with rebate



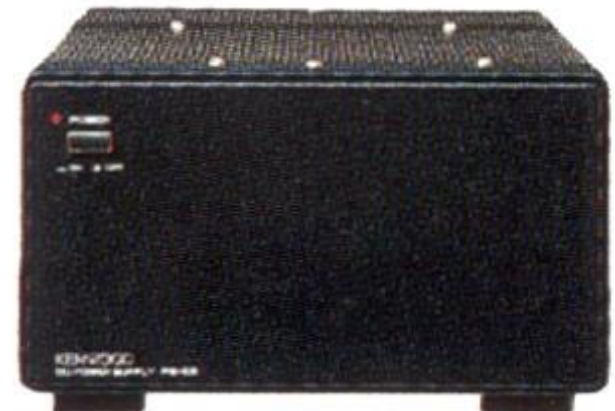
QRP radios are also an option

- 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

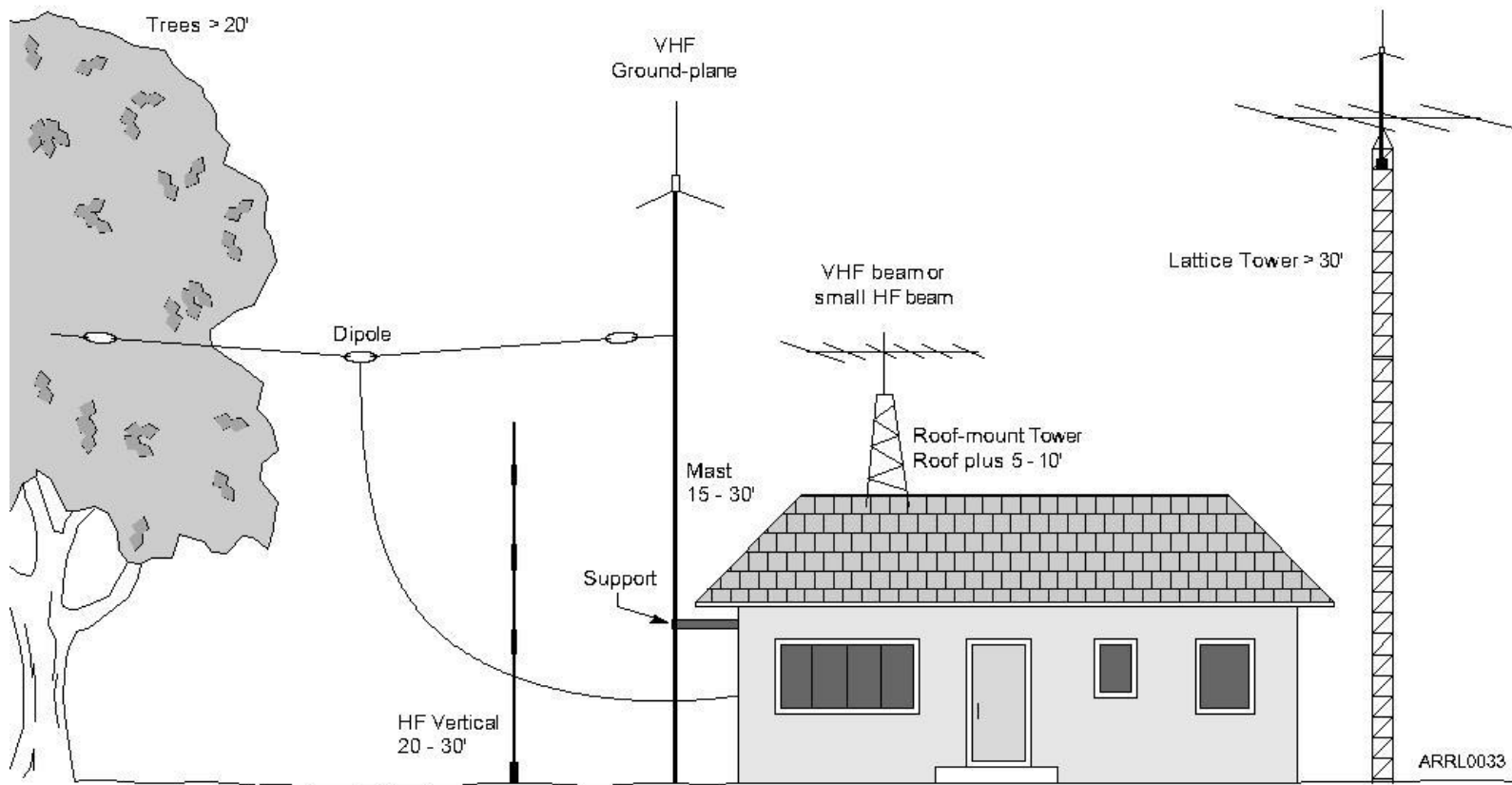


Other Accessories

- 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

■ Wire Dipoles

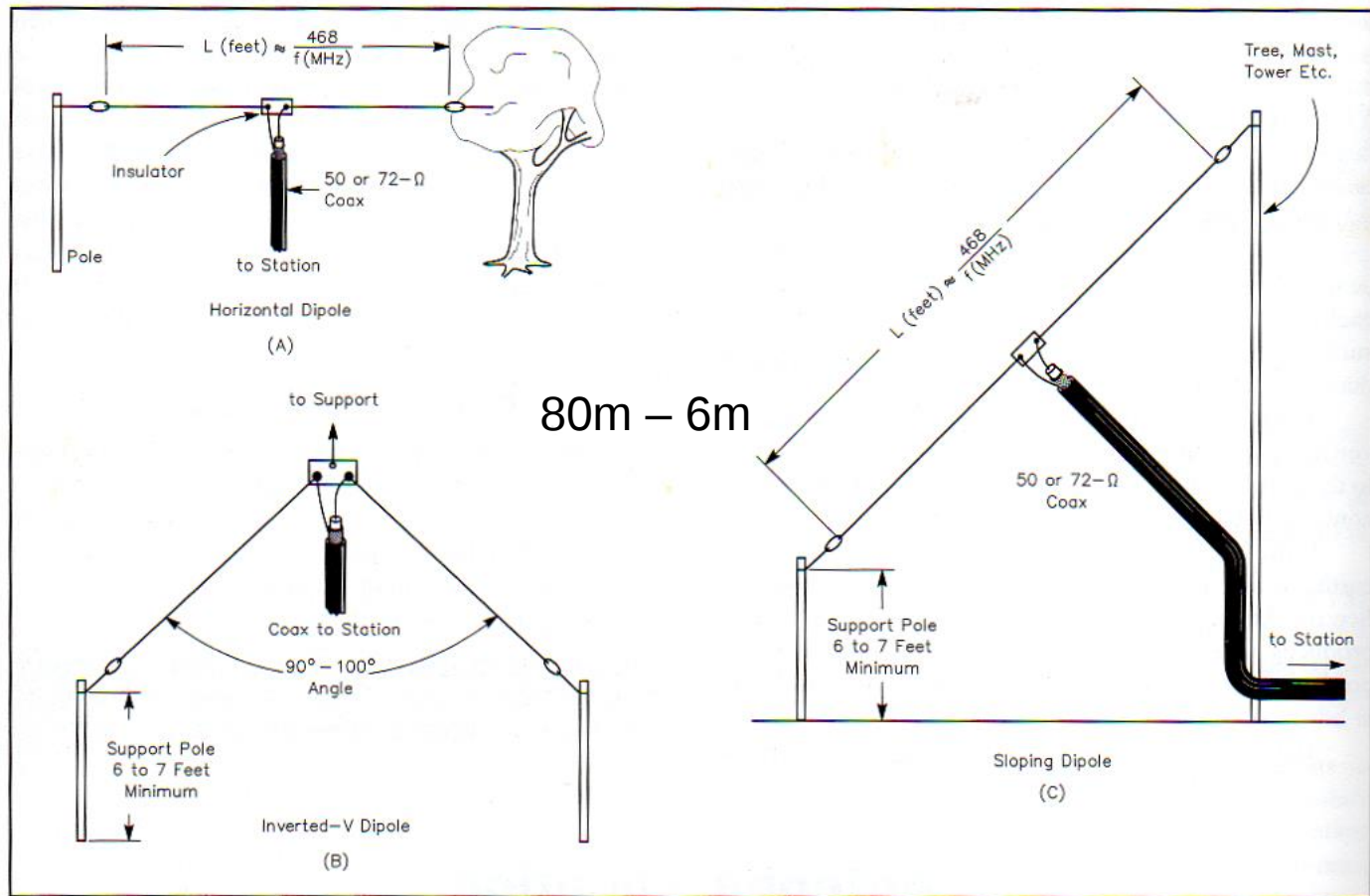
- ☐ Single band
- ☐ Trapped or fan multiband
- ☐ Multiband with tuner
- ☐ Multiband Off-Center Fed Dipole (Windom)
- ☐ Multiband End-Fed-Half Wave (EFHW)

■ Vertical

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

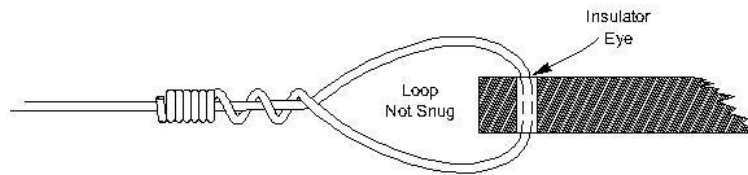
■ Random Wire with a tuner

Dipole Variations



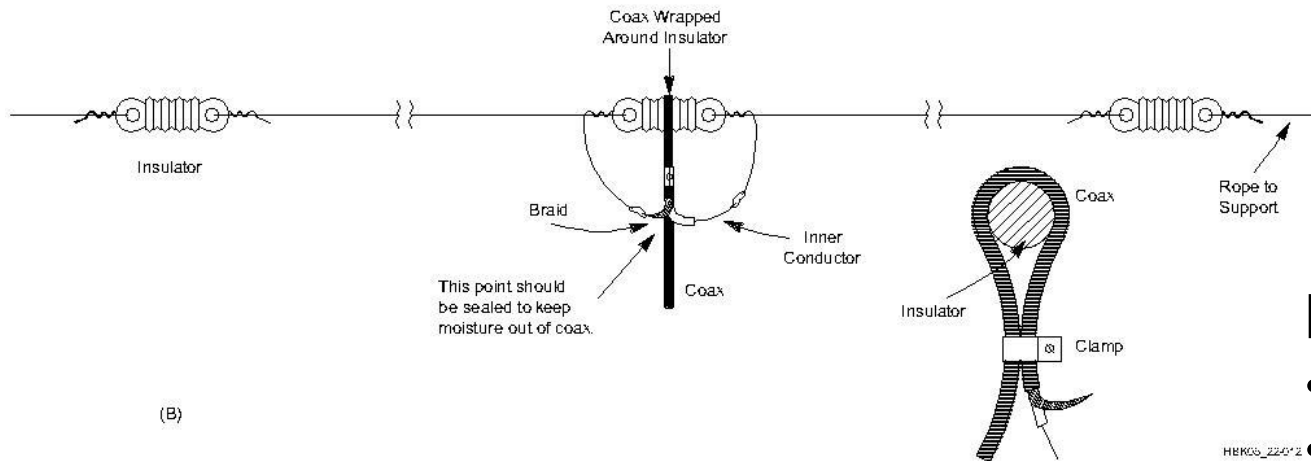
- The efficiency of a simple dipole is hard to beat.
- Most simple dipoles work only one band, however a 40m dipole will tend to also work on 15m.

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)

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

- 80m = 135 ft
- 10m = 16 ft

HEKOS_ZZG-Z

Antenna Wire and Rope

■ Antenna Wire

- Copperweld — copper-plated steel
 - Solid or stranded, 14 AWG Typ. 18 AWG
- 14 AWG copper, black Insulated, 19 -168 strands.
- Single house wire, PVC insulated, 14 AWG typical
- Aluminum electric fence wire, 17AWG

■ Ropes -- UV Resistance

- A special black Dacron rope is often used.
 - Very UV resistant.
- Nylon and Polyester are also good.
- Avoid Polypropylene, Cotton & Jute

Dipole Length

■ Typical lengths for common ham bands

Band λ	Frequency	Length
80 meters	3.725 MHz	125.6 feet
40 meters	7.125 MHz	66.6 feet
30 meters	10.125 MHz	46.3 feet
20 meters	14.200 MHz	33.3 feet
17 meters	18.100 MHz	25.9 feet
15 meters	21.200 MHz	22.1 feet
12 meters	24.92 MHz	18.8 feet
10 meters	28.500 MHz	16.5 feet
6 meters	52.000 MHz	9.0 feet

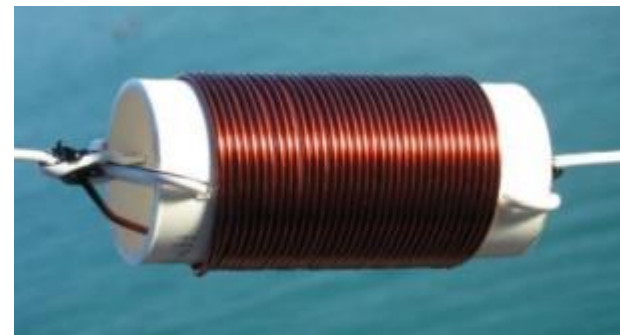
$$L = 468 / f$$

f = frequency in
MHz

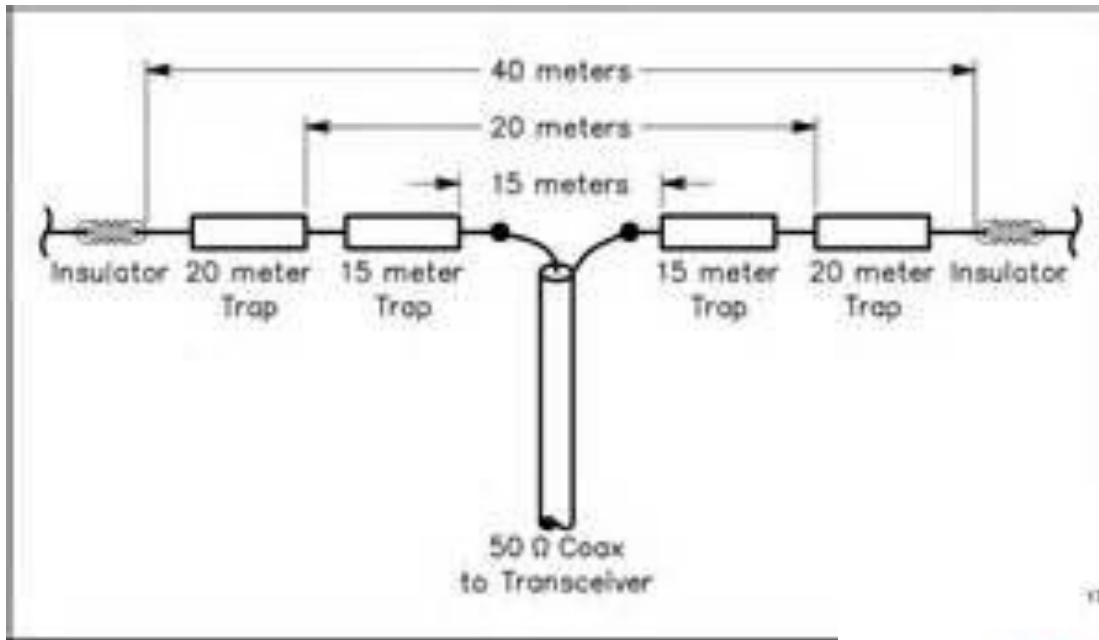
L = Length in feet

We shorten the antenna to raise the frequency

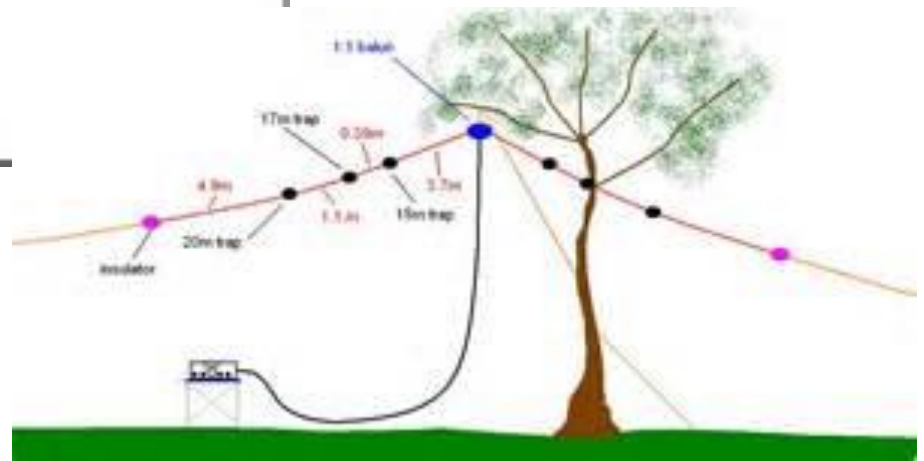
Loading coils can be used to physically shorten an antenna at the expense of bandwidth and efficiency



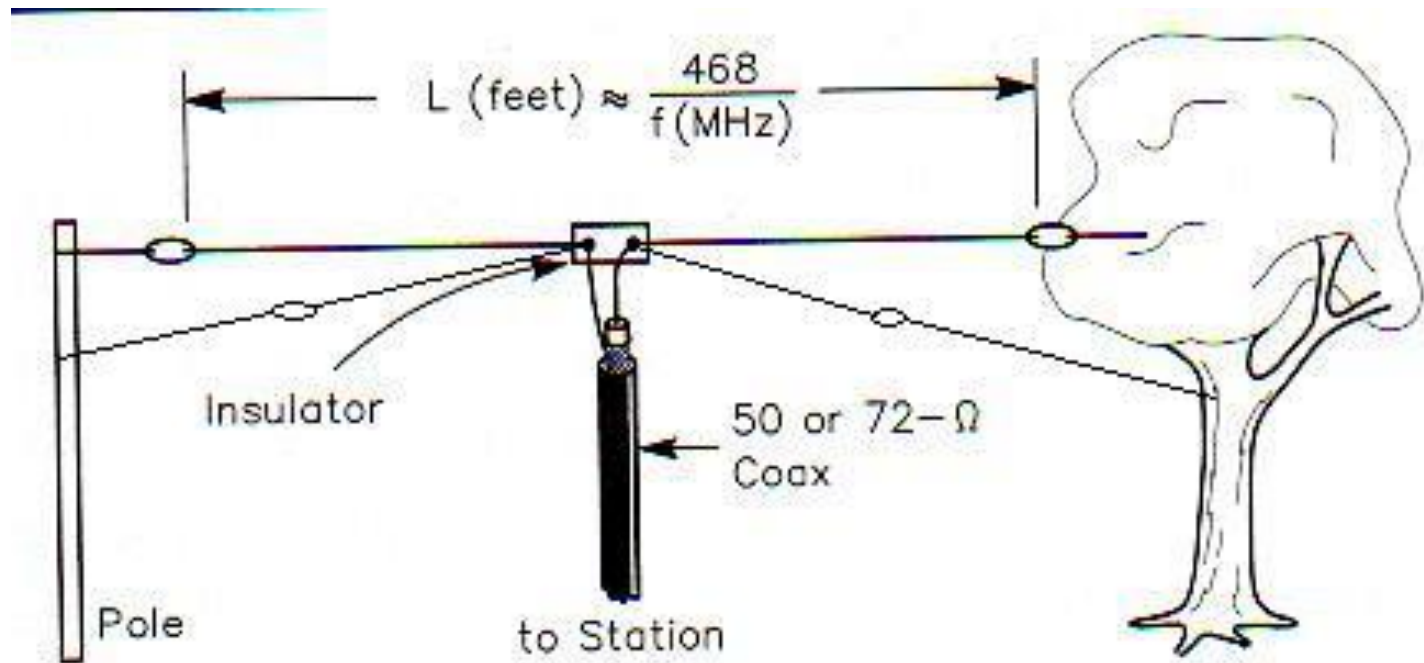
Trap Dipole – Multiband



- New individual traps have become difficult to find.
- Homebrewing is possible



Fan Dipole – Multiband



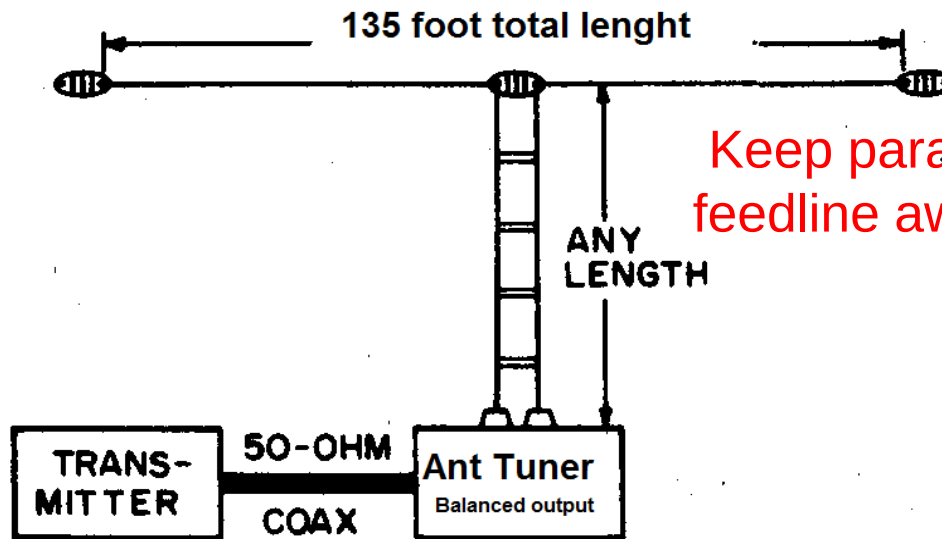
Hint: A 40m and 20m fan dipole will likely work on 15m also.

Horizontal Dipole
(A)

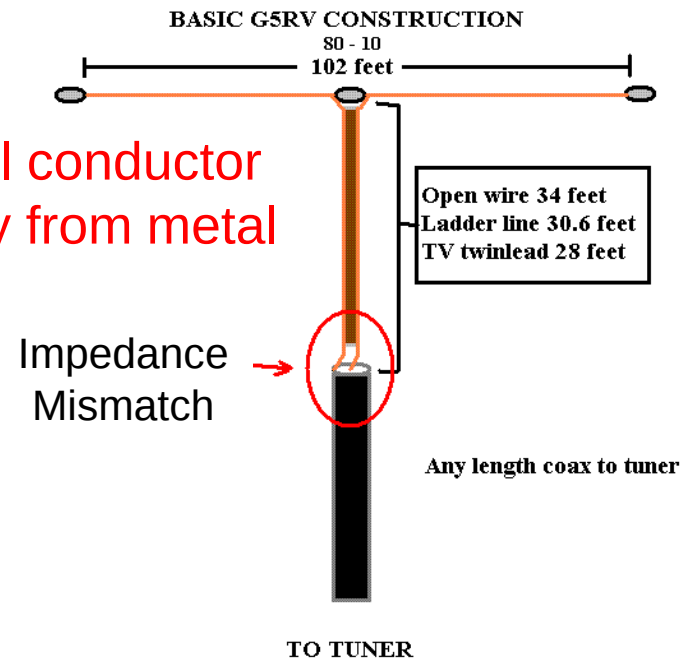
Note that all resonant 75/80 meter antennas will exhibit < 500 kHz of bandwidth

All-band Antennas that Require Antenna Tuners

80 – 10 m coverage



Keep parallel conductor feedline away from metal

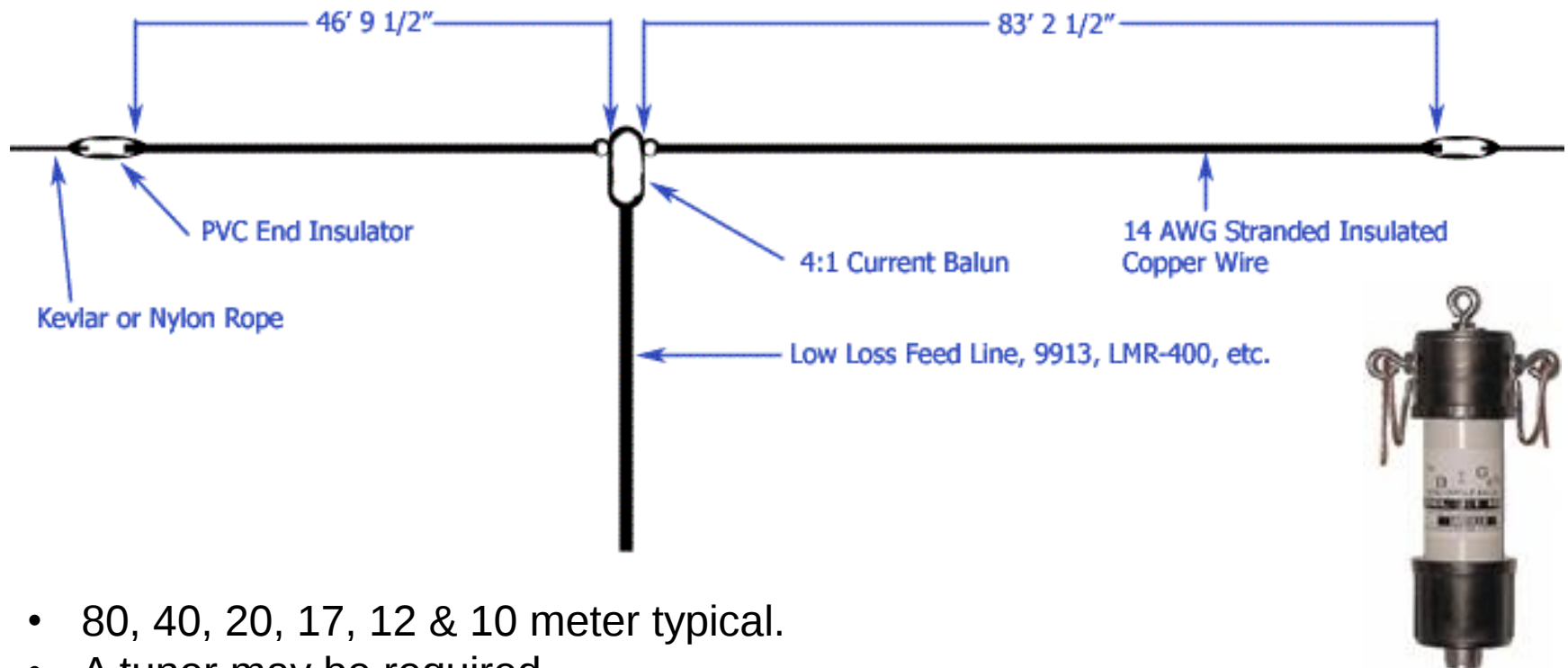


—A center-fed antenna system for multiband use.

80mDipole fed with ladder line (Zepp)

G5RV

Off-Center-Fed Dipole (Windom)

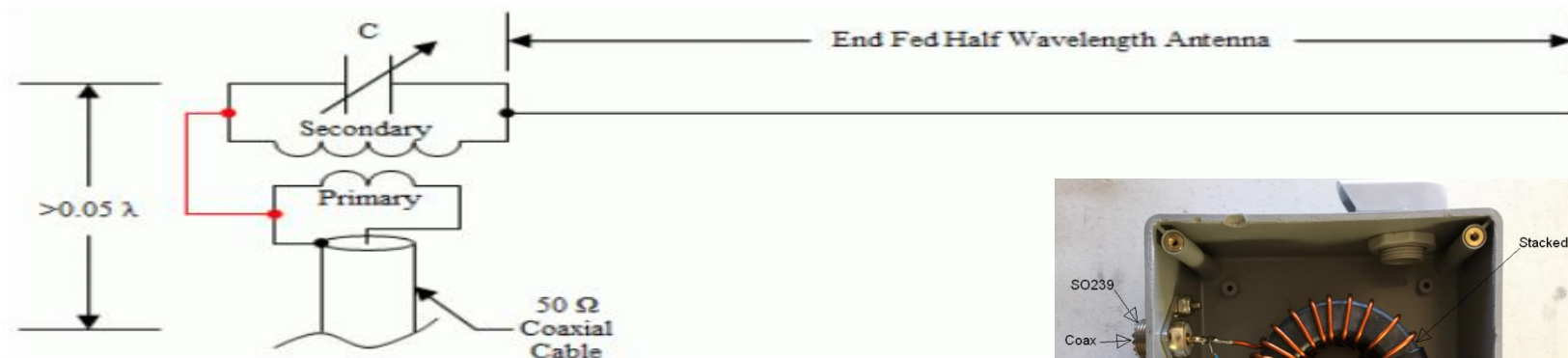


- 80, 40, 20, 17, 12 & 10 meter typical.
- A tuner may be required.

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

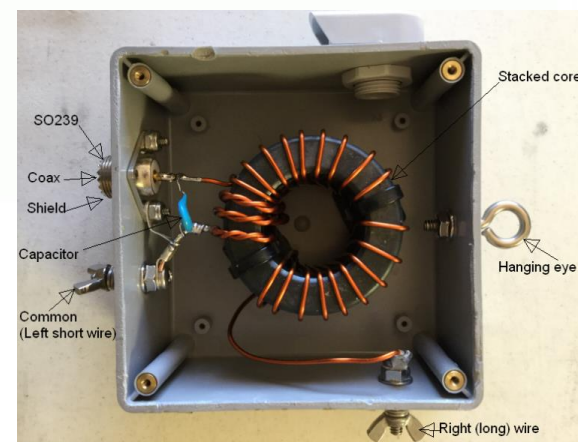
End Fed Halfwave (EFHW)

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.w7yrc.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 (100W)
EFHW ARRL kit \$80
80 – 10m 130 ft 1 kW EFHW
EFHW-8010 130 ft 1 kW
MyAntennas \$280

End Fed Halfwave (EFHW)

- EFHW antennas can be “homebrew,” built from kits or purchased fully assembled
 - ARRL 40m EFHW kit, 100w power rating, \$80
 - myantennas.com 80m EFHW assembled, 1kW power rating, <\$300 , EFHW-8010-1K



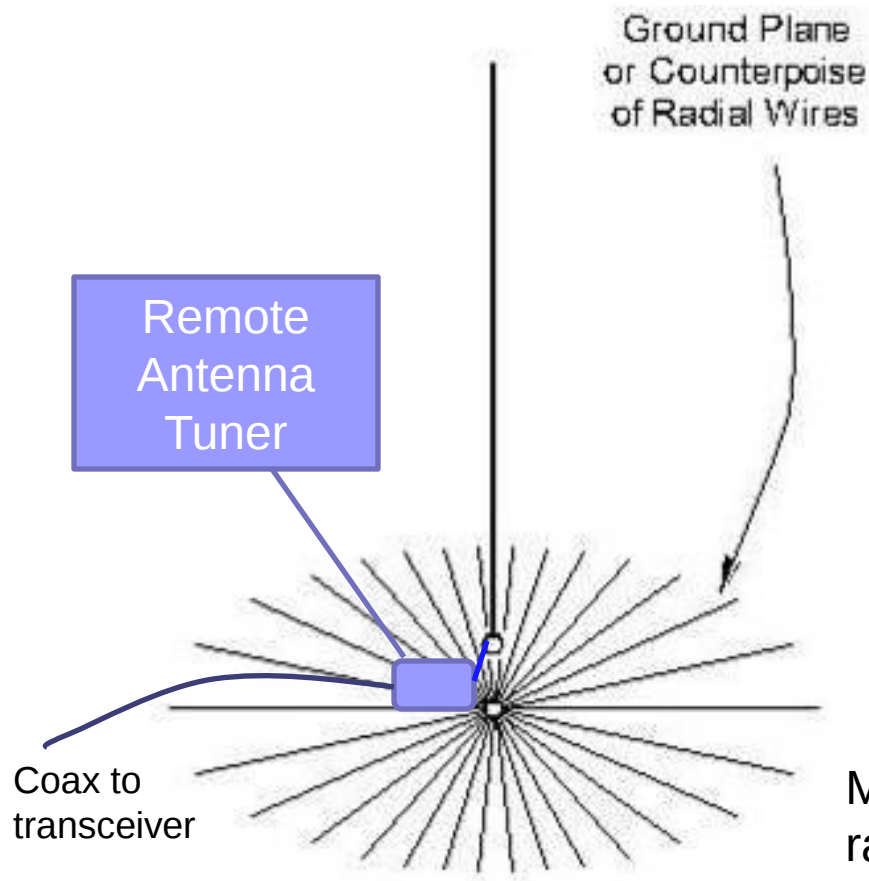
Table 2
EFHW-8010-1K SWR Measurements

Frequency (MHz)	Manufacturer's "Typical SWR"	SWR Measured At Entrance Panel	SWR Measured At Station
3.60	1.5:1	2.0:1	2.0:1
7.05	1.2:1	1.3:1	1.3:1
10.1	1.5:1	4.0:1	3.3:1
14.2	1.1:1	1.4:1	1.4:1
18.1	1.5:1	2.0:1	1.8:1
21.2	1.3:1	1.2:1	1.1:1
24.9	1.2:1	1.1:1	1.1:1
28.5	1.4:1	2.3:1	2.0:1

40m EFHW, 65 ft long: 40, 20, 15 & 10m bands
80m EFHW, 130 ft long: 80, 40, 30, 20, 17, 15, 12 & 10m

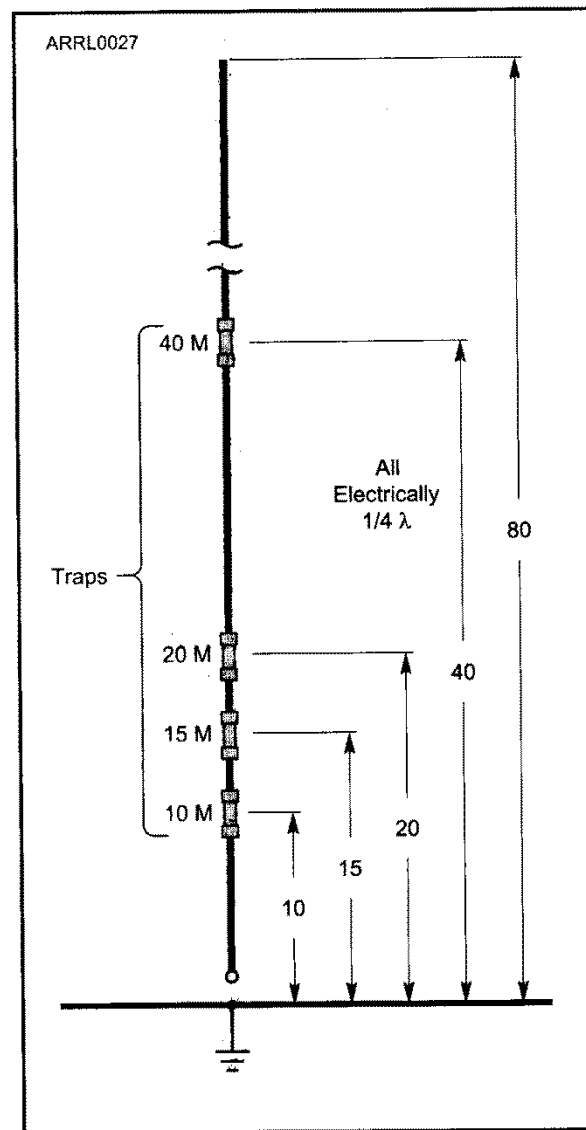
Ref: March 2016 QST
The article suggests the
SWR at 4 MHz is > 5:1

Multiband Verticals



Vertical with a Tuner

Minimum of 8 radials. 12, 16 or 32 are better



Trap Vertical

Multiband Verticals

- Traps provide for multi-band performance.

Hustler:

- 4BTV 10/15/20/40m 20 ft tall
- 5BTV 10/15/20/40/80m 23 ft
- 6BTV 10.15.20/30/40/80m

Butternut:

- HF9V
- 80/40/30/20/17/15/12/10/6m
- 26 ft tall

Note: 80m bandwidth will be very narrow



Radials Required

Mix and Match

- The **Cushcraft R5 vertical** uses only **four 4-ft elevated radials**. Covers 10, 12, 15, 17 & 20m
- Add a 40/80m fan or trapped **dipole** for 7-band coverage



The R5 is
obsolete
and was
replaced
by the
R6000
which gets
poorer
reviews

Beware of:

Antennas that cover all frequencies from 3.5 to 30 MHz with no need for an antenna tuner.

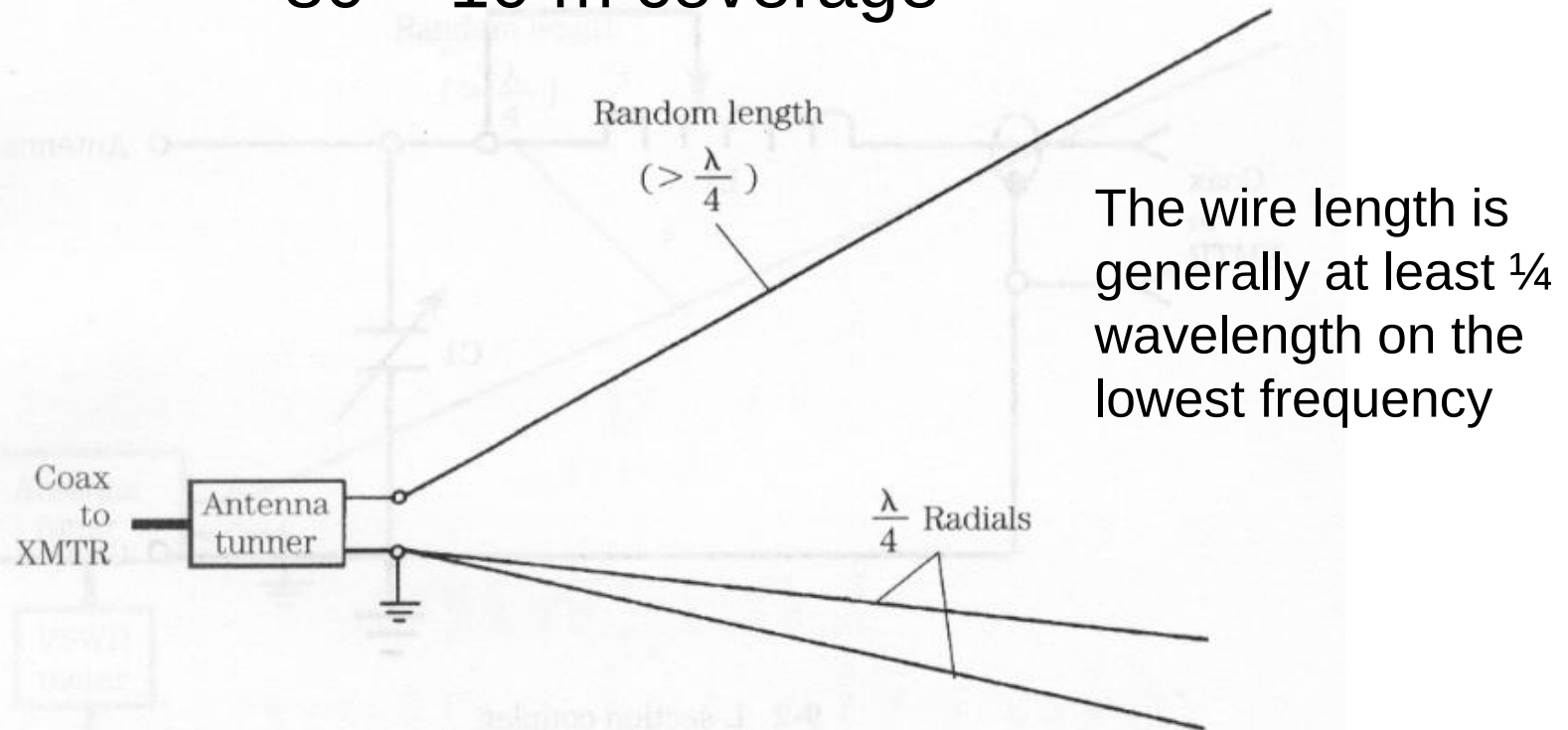
- Verticals that require NO GROUND RADIALS
- **Broadband:**
 - TX 3.5 – 57MHz
 - RX 2.0 – 90MHz
 - VSWR: 1.6:1 or less
 - Max Power: 250W SSB



Comet 250B

Random-Wire All Band

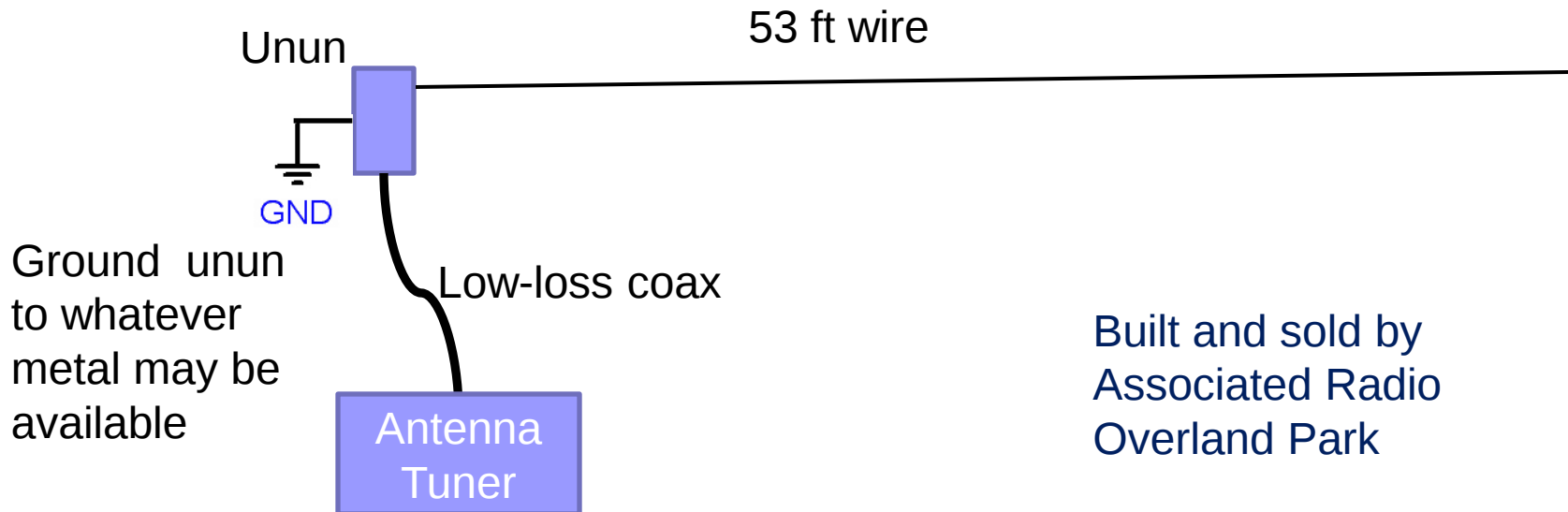
80 – 10 m coverage



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

End Fed Wire – Non-resonant length

- 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, however it exhibits poor efficiency compared to a dipole.

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
- 2 Mobile “Hamstick” antennaa used to form a dipole
 - Viable for 20m and higher bands
 - Narrow bandwidth
- Random wire with attic-mounted automatic antenna turner.
 - 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

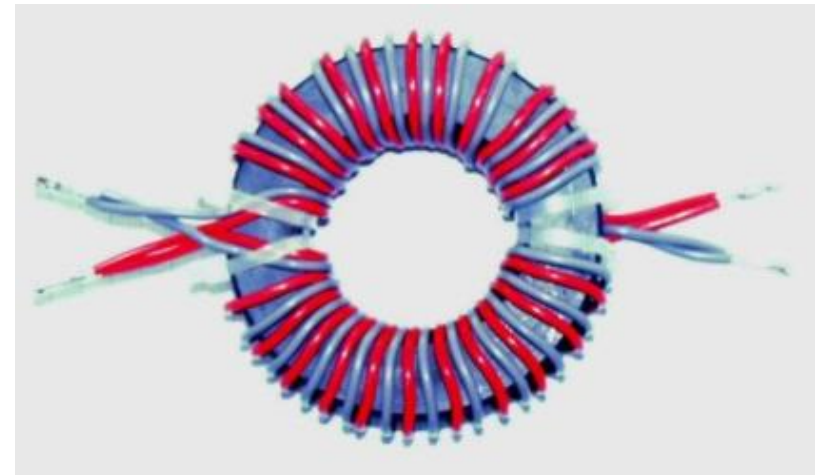
Antenna Tuners

External tuners have a wider tuning range than built in tuners



Baluns

- Transitions between un-balanced and balanced sources and loads
 - i.e.: coax cable and dipole antenna
- Can convert impedances (Typical: 1:1, 1:4, 1:9)
- There are voltage baluns and current baluns



Directional Yagi

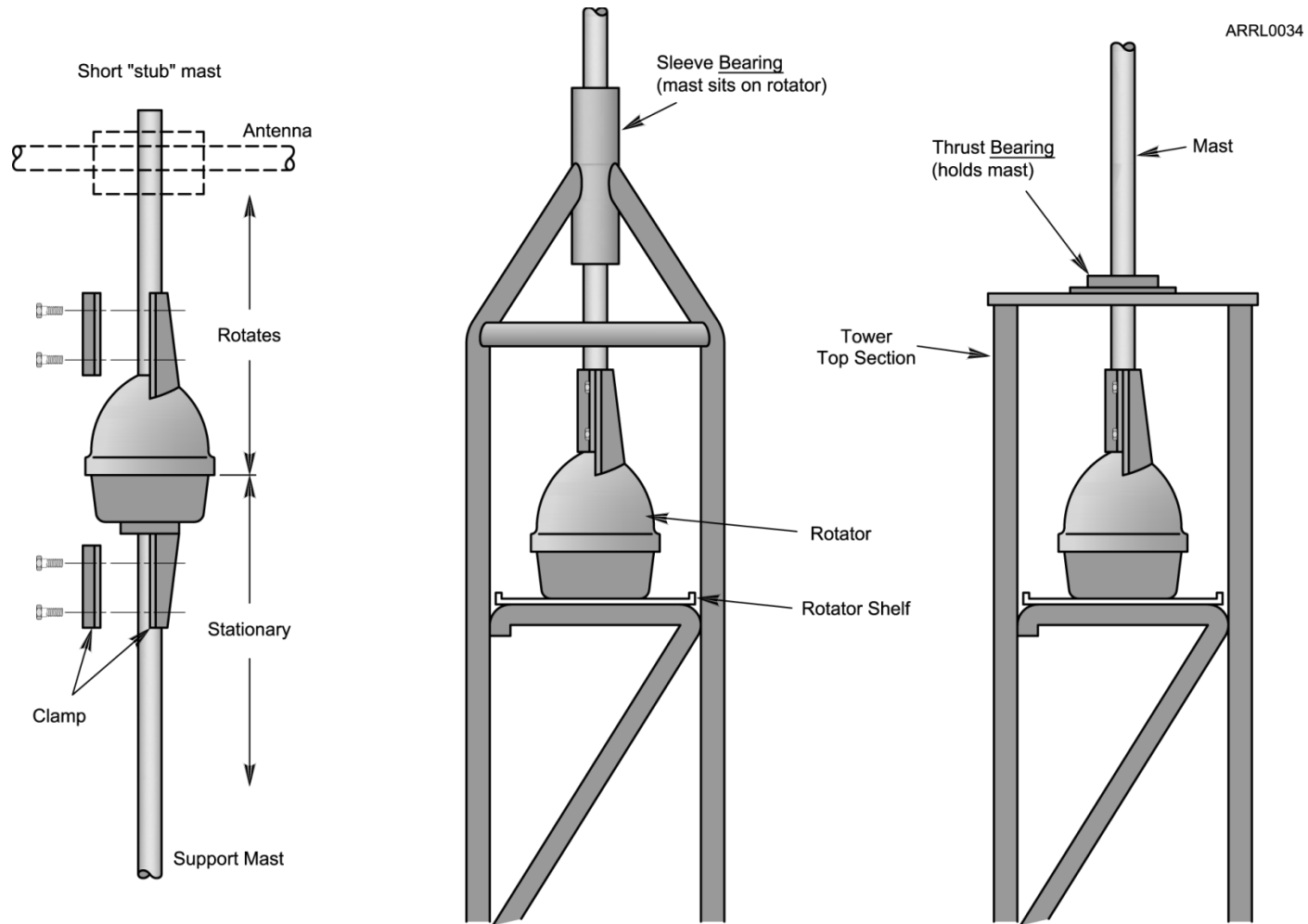


Monoband Beam



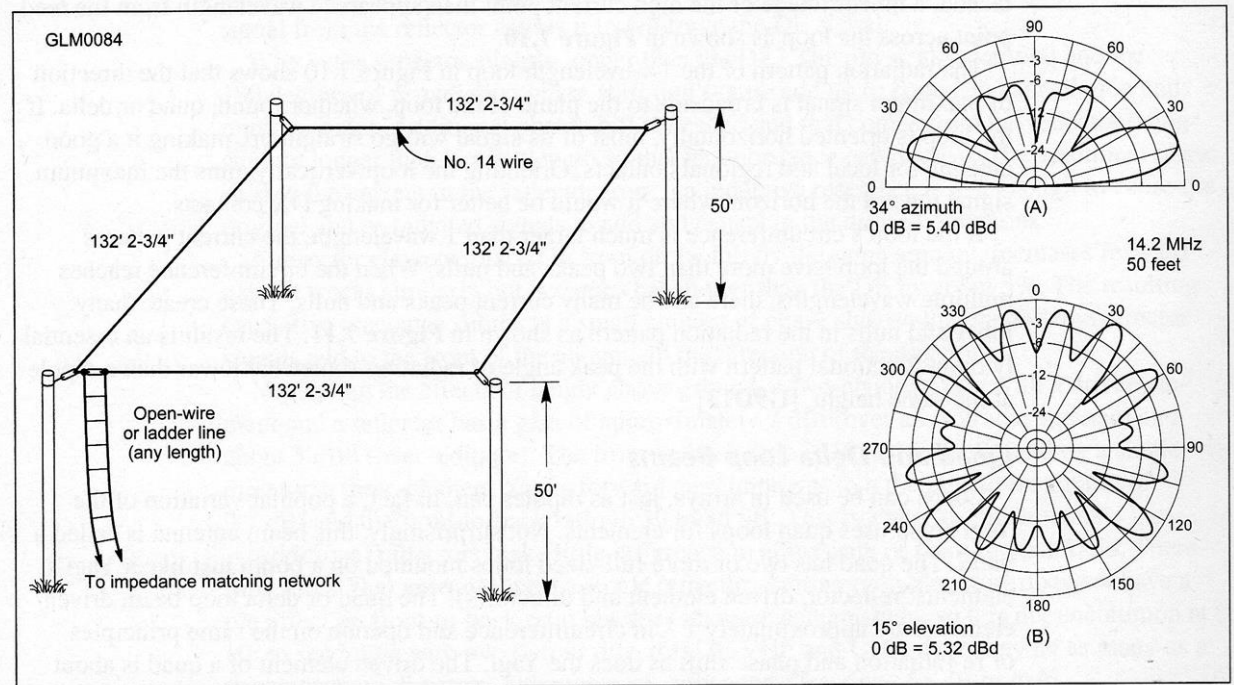
Multiband Beam

Antenna Rotor Mounting



Large Horizontal Loop

- For the 160 m band, each side is about 132 ft long, for a total length of 529 ft.
- It would be about 265 ft for 80m

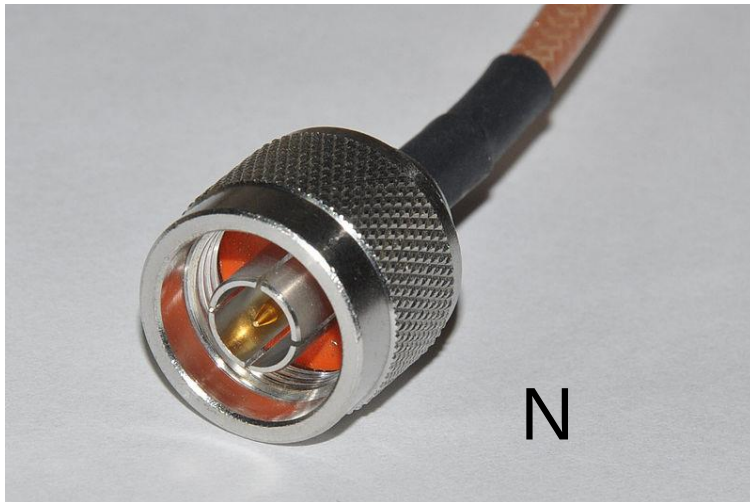


Antenna Connectors

UHF or
PL-259



BNC



N



SMA

Coax Loss

Tech Pg 4-17

Gen Pg 7-23

□ Remember: 3 dB of loss = $\frac{1}{2}$ of your power is lost

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

Goal: Try to keep the loss to about 1 dB or less

Safety

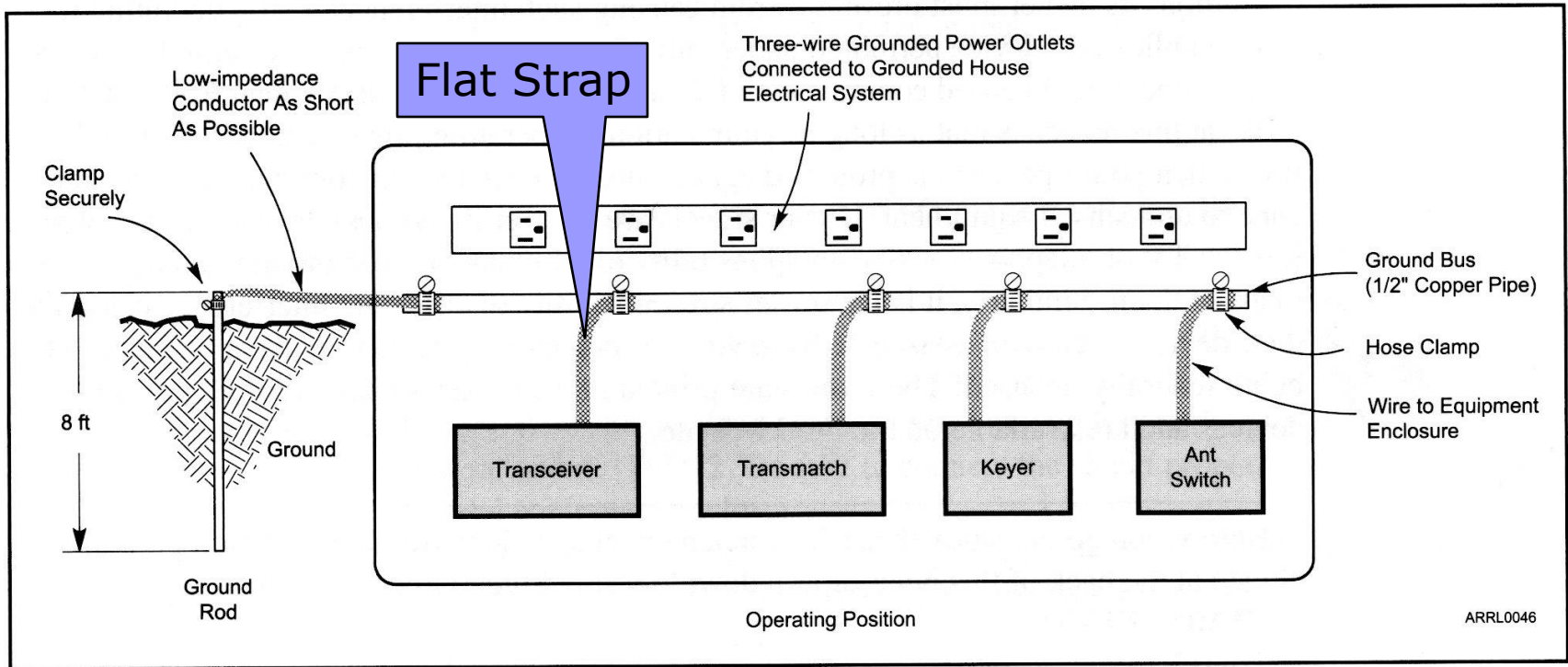
- Use a safety belt when climbing towers or poles
- Stay clear of power lines
- Mount antennas so others cannot touch the antenna when you're transmitting
- Lightning arrestors help protect you and your equipment

Remember to evaluate RF Exposure levels, particularly with indoor and attic antennas



Grounding

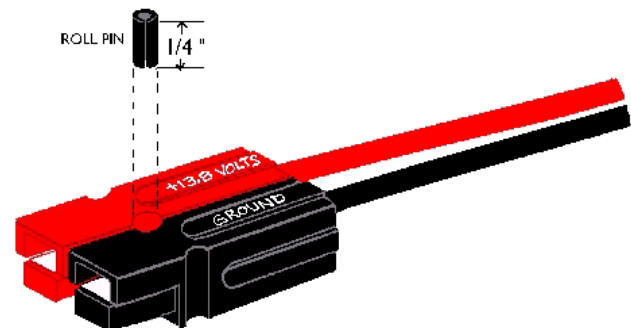
Pg 5-24



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

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
 - Inadequate for higher power radios
- Go direct to battery
 - Requires going through the firewall.
 - Don't forget to turn the radio off!
- Consider adding Anderson Power-pole connectors





Noise Sources and RFI

■ Common Noise Sources

- ☐ Power lines
 - ☐ Wall warts with switching power supplies
 - Cell phone chargers
 - Laptop power supplies
 - Individually turn off your own circuit breakers in your house to help locate the source
-
- Use a lowpass filter (LPF) on the HF radio
 - Ferrite chokes on audio & telephone lines

Types of HF QSOs (Contacts)

- Ragchews (conversation; CQ response; 3 – 30 min)
 - RST, QTH, name, rig, antenna, age, occupation, ...
- Short contacts (exchange call signs and signal report; common with DX; typically ≤ 1 min; 1.5 min for FT8)
- Nets (on the air meeting; 10 min to all day)
- Schedules (connect with 1 or more friends)
- Contests (short contacts, often on weekends)
- POTA; SOTA; IOTA, Special Event Stations)
- DXepiditions (very short exchange; 10 sec.)

Grid Squares Popular on 6m (EM28)

Maidenhead Grid (EM28mt)

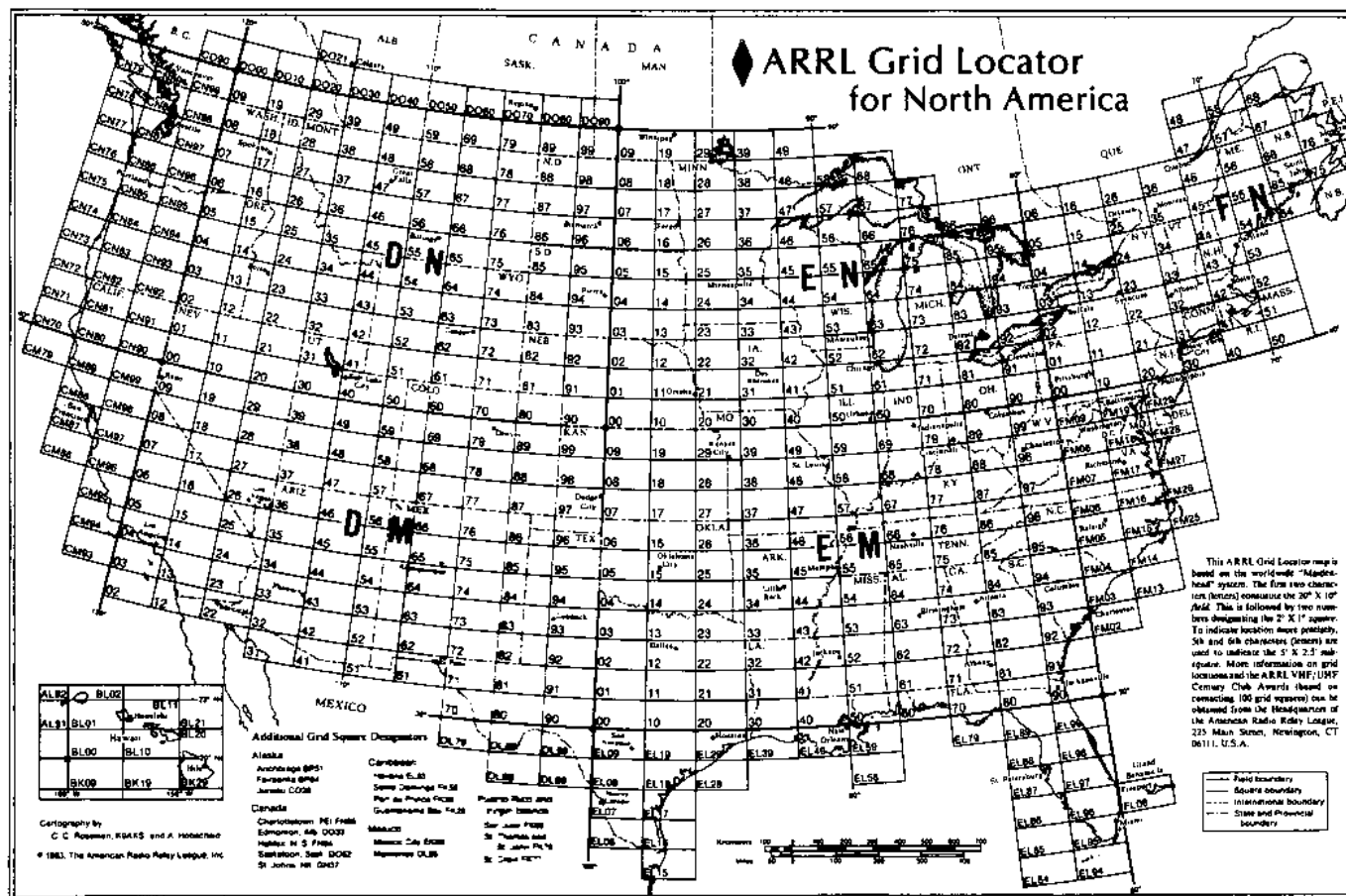
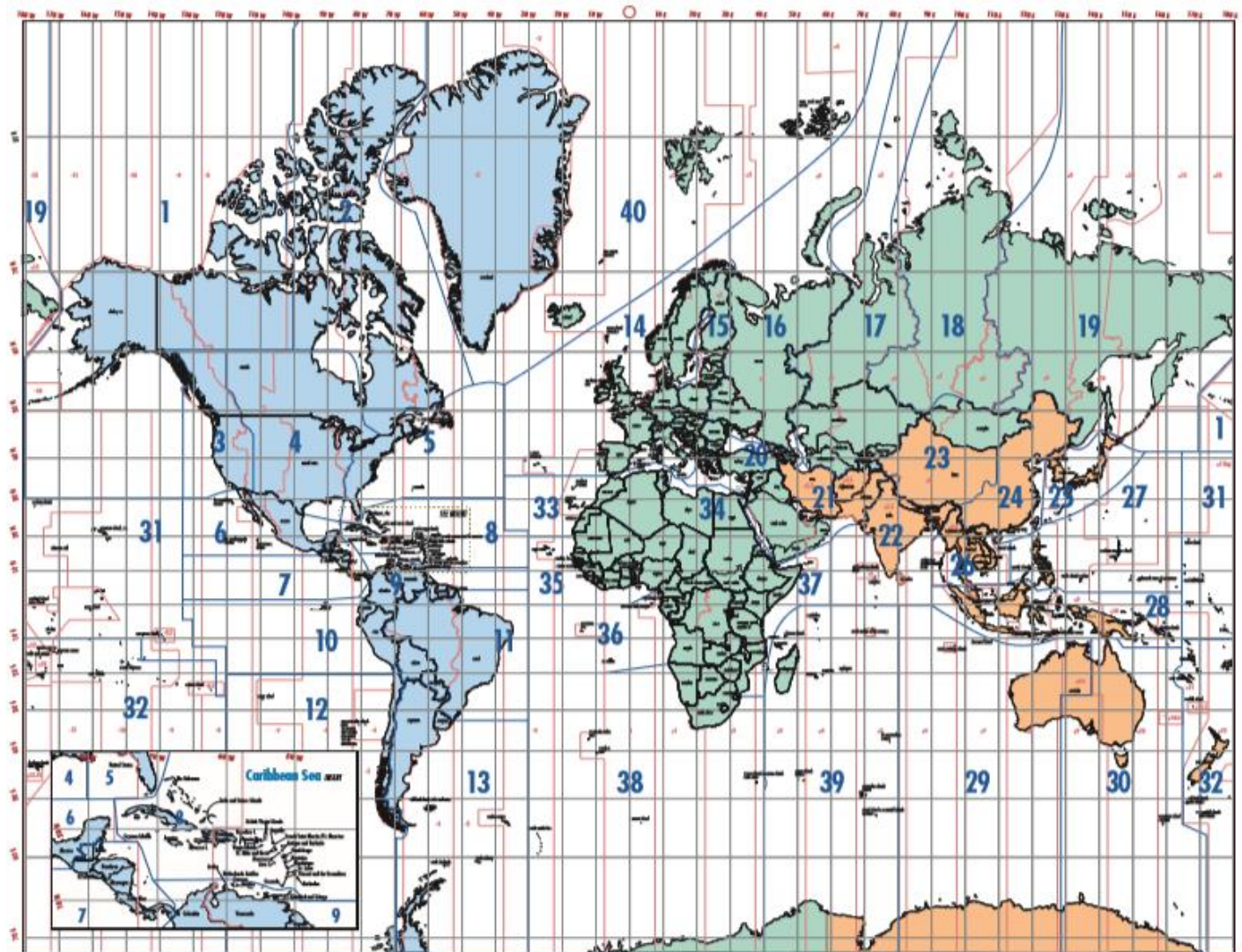


Figure 9-1—This map shows grid squares, used to specify your location for VHF and UHF SSB/CW operation.

Zones

- 3 ITU Regions
- (We are in Region 2)
- 40 CQ DX Zones
- 90 ITU DX Zones



POTA (Parks on the Air) and Special Event Stations

SFTARC at
Lone Elm Park, Olathe
October 2021



- Santa Fe Trail
- Oregon Trail
- California Trail



Chasing DX

DXpeditions tend to go to rare and exotic places and operate for multiple weeks, making tens of thousands of contacts



K9W

Wake Atoll
2013



Commemorative DXpedition

Working DX

- There are online spotting networks
 - DX Station's call; frequency; time active; reporting stn
 - DX Watch; DX Summit; Ham Call DXSpots; ...
- DXpeditions tend to work "Split" operation
 - Example: "PJ2DDX listening up 5"
- Some DX stations QSL via a QSL Mangers
 - Online resources to find mangers
 - Clublog.org; www; qrz.com/page/qs; ...
- ARRL's DXCC Awards
 - Contact and confirm 100 "Countries"(entities) then work your way up (there are currently 340 entities)

Books, Books and More Books

- ARRL Technician and General Class License Manuals
- ARRL Handbook
- ARRL Antenna Handbook
- ARRL Operating Manuals
- QRP: The Zen of Amateur Radio
- Practical Wire Antennas RSGB
- SIDEWALK SALE Across America -- Fiction



Logging



- Most hams log HF contacts that are non-routine
(Example: I may not log simple HF-net check-ins)
 - Only contacts that involve third-party traffic need to be logged per FCC rules
- Logs are important for confirming QSOs, i.e.: QSLs
- Paper logging

STATION CALLSIGN: _____

HF Log Sheet

PAGE ____ OF ____.

DATE	UTC		FREQ	MODE	POWER	CALLSIGN	QTH	RST		COMMENTS
	ON	OFF						SENT	RCVD	

1
2
3
4

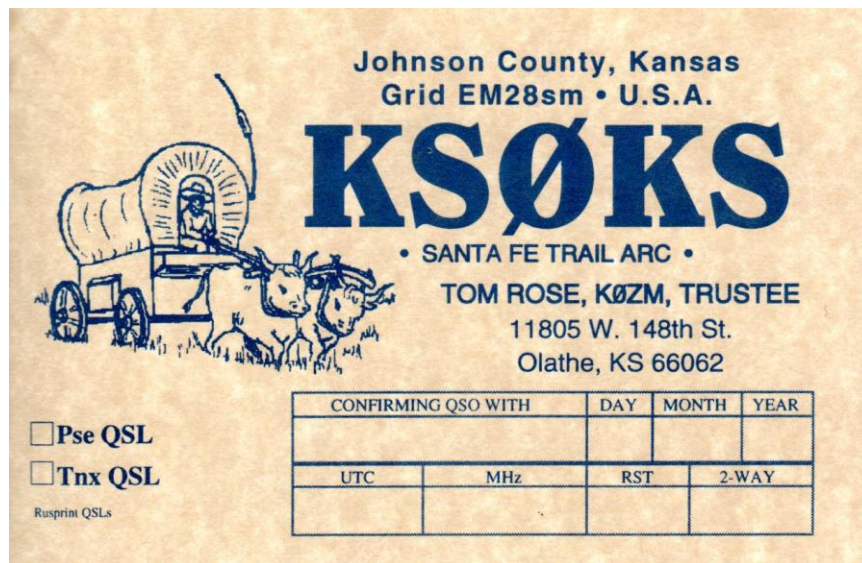
- Logging software

□ Many sources:

- Purchase: **N3FJP**, N1MM, Ham Radio Deluxe, ...
- Free: elog, Logger 32, DXKeeper, Log40M, SwissLog, ...

QSL Cards

- Available from many sources and in many styles.
- May be very basic or include custom photo
- Proof of contact for awards; use as “wallpaper”



Exchanging QSL Cards

- For contacts inside the US and Canada:
 - Regular Postal Service mail
- International
 - Direct international postal mail
 - Fastest but expensive; may include:
 - QSL Bureau
 - ARRL Bureau for outgoing – modest cost
 - Free ARRL incoming bureau
 - Provide 0-district Mgr with SASEs





Online QSO Confirmation

QSOs may be confirmed virtually online

- ☐ Various online databases – match contacts
- ☐ Compatible with logging software
- **Logbook of the World (LotW)**
 - ☐ ARRL sponsored
 - ☐ Very secure; recognized for DXCC & awards
 - ☐ Somewhat challenging setup procedure
- **eQSL – Basic - free – can design a card online**
 - ☐ eqsl.cc



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 -- Ohio
- Numerous other on-line/catalog stores



Area Hamfests

- Feb – Mound City KS
- April - ~~Shrine~~ Raytown
- November – Raytown

-
- May – Hamvention – Dayton/Xenia Ohio
 - October – Sedilia, MO
 - See: <https://www.arrl.org/hamfests-and-conventions-calendar>

Radio Brands

■ Most popular new HF entry-level radios:

- ☐ Icom
- ☐ Kenwood
- ☐ Yaesu
- ☐ Chinese brands: Often QRP

Yaesu
FT-891
< \$700



■ Old Radios:

- ☐ Drake, Swan ...
- ☐ Heathkit (kit built)



Icom IC-7300 \$1000 with sale/rebate

Antenna Brands

- Butternut (HF verticals)
- Comet (mostly VHF and UHF)
- Diamond (mostly VHF and UHF)
- Hustler (HF, VHF and UHF)
- Jetstream (lower cost; mostly VHF and UHF)
- Larsen (Commercial grade VHF and UHF)
- MFJ (HF, VHF and UHF) – Out of business
 - Cushcraft, Hy-Gain
- Princeton (HF Wire @ Associated Radio)





Vanity Call Signs

- Choose your call from those available
- Nominal fee for application and renewal
- Examples:
 - KS0KS
 - KS0JC
 - KS0JD
 - K0NK



Enjoy your hobby! Continue to Learn

- 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 in Gardner;
 - Business meeting, 2nd Sat, In-person & Zoom
 - Tech Night: 4th Thursday; Zoom only
 - Special Events; Parks on the Air; Contests
 - May – Tallgrass Prairie National Preserve
 - 4th Weekend in June: Field Day - Ensor Museum
 - Last weekend in Aug: KS QSO Party
 - Sept/Oct: Ensor Special Event