The American Radio Relay League

Choosing Your First HF Antenna

Greater Fairfield Amateur Radio Assn

May 1, 2017

Joel R. Hallas, W1ZR
Contributing Editor, QST
ARRL

What do you want your antenna to do?

- ❖Convert an electrical signal to an E-M wave.
- ❖Launch that wave in the direction of a distant station.
- ❖Avoid tangling, burning or garroting animals or people.
- ❖Keep you out of zoning court.
- ❖Leave some money in your accounts for the next radio.

- Convert an electrical signal to an E-M wave.
  - RF power applied to an antenna can end up as:
    - An electromagnetic wave, or
    - Heat
  - Heat doesn’t travel very far!

- Convert an electrical signal to an heat.
  - Losses in the ground system of a vertical monopole, or
  - Losses due to current flow in resistance -- $P = I^2 \times R$
- We'll keep an eye on these as we discuss antenna types.

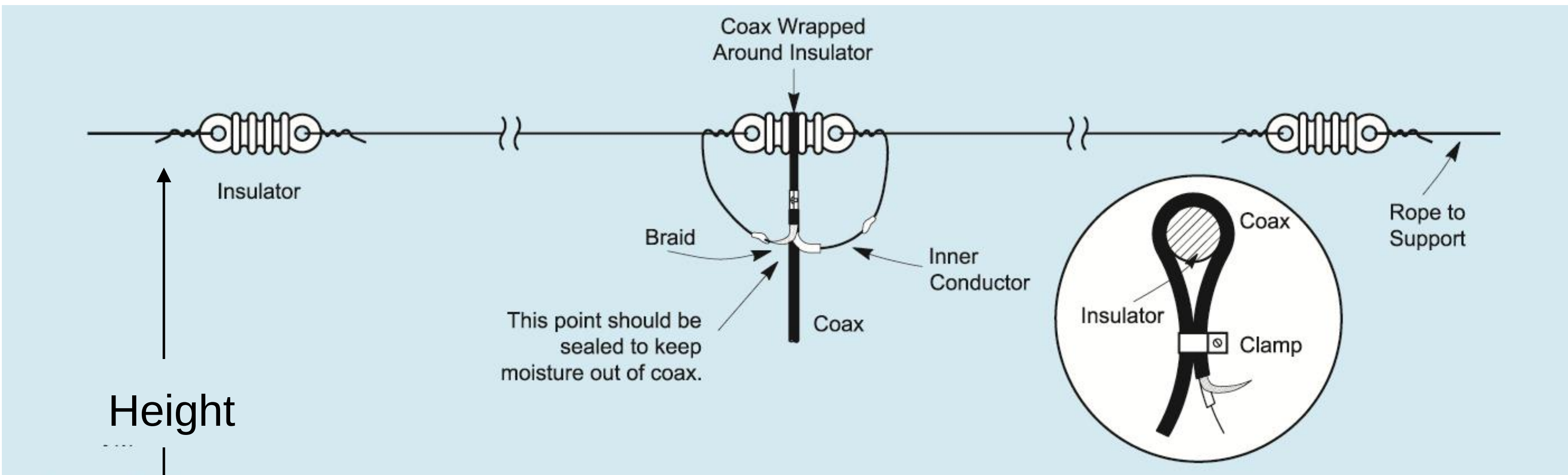
What do you want your antenna to do?

- ❖ Launch that wave in the direction of a distant station.
- ❖ An isotropic antenna is one that sends signals all over.
- ❖ Real antennas concentrate energy in particular directions.
  - ❖ Elevation – measure of how high above the horizon.
  - ❖ Azimuth – measure of which direction around the compass.
- ❖ Your next antenna may be able to change directions, but your first probably won't!

Directivity – A Two Edged Sword!

- ❖ Directivity means energy is focused in particular directions
  - Signals are stronger to and from those directions
  - Interference from other directions is reduced
- ❖ But –
  - You can only communicate well with certain directions
  - Or, you need multiple antennas to cover all directions
  - Or, you need to be able to move your antenna

Where to Start?
The Half-Wave Coax-Fed Horizontal Dipole

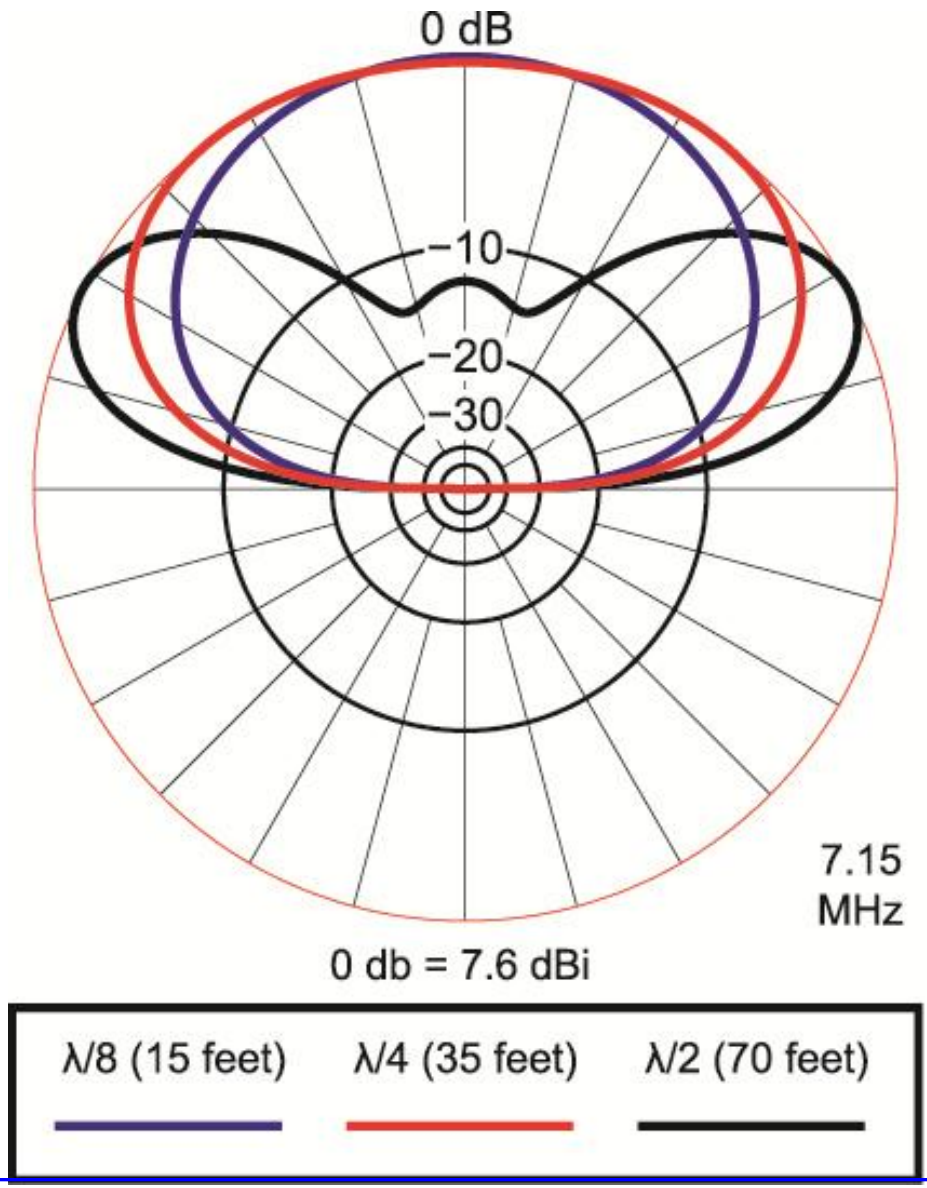


Approximate length = 468/F(MHz)

Ground

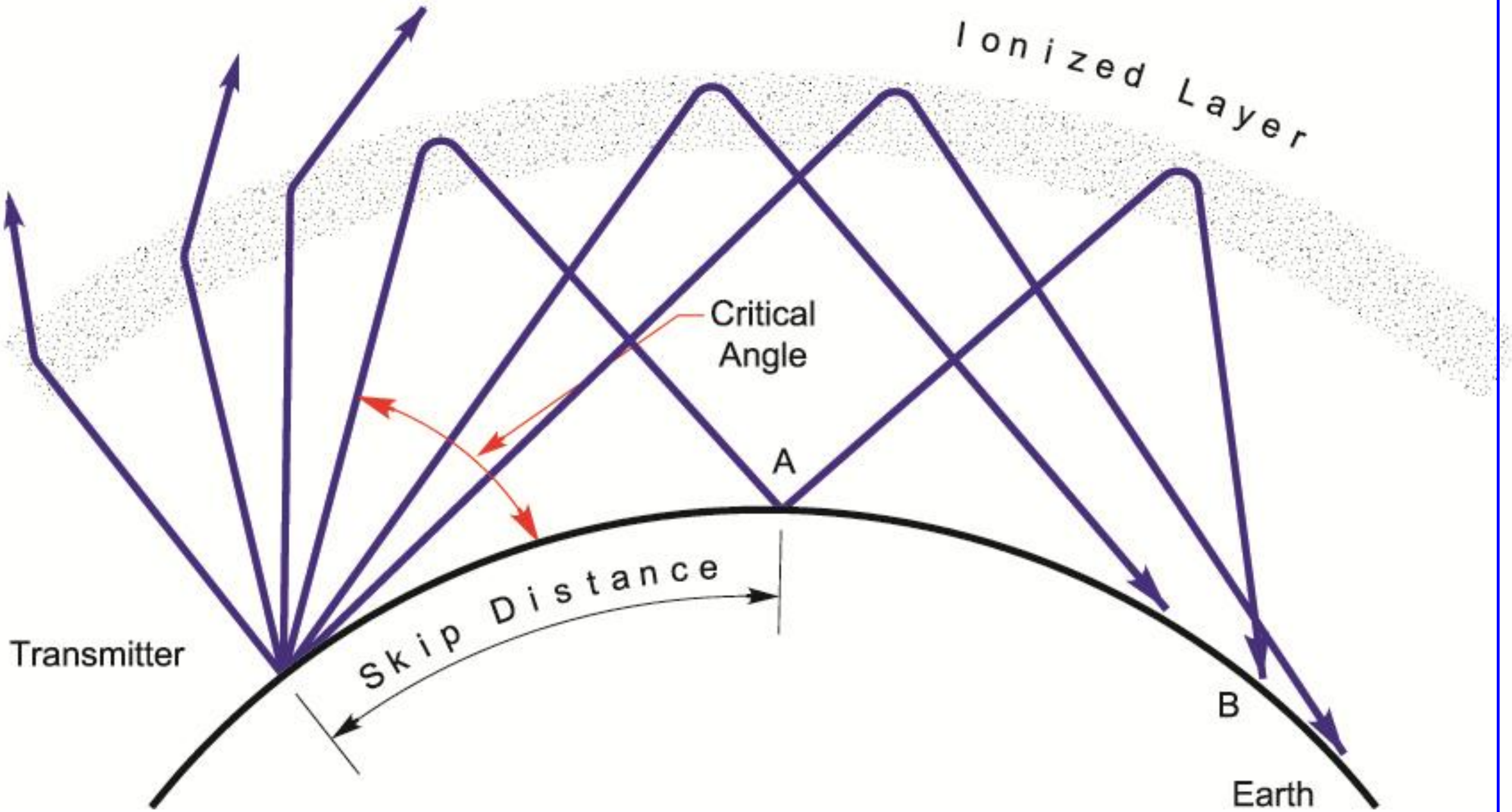
80/75 meters,	3.75 MHz	–	125 feet
40	7.15	–	65.5
20	14.15	–	33.1

Elevation Pattern of a Dipole at Different Heights

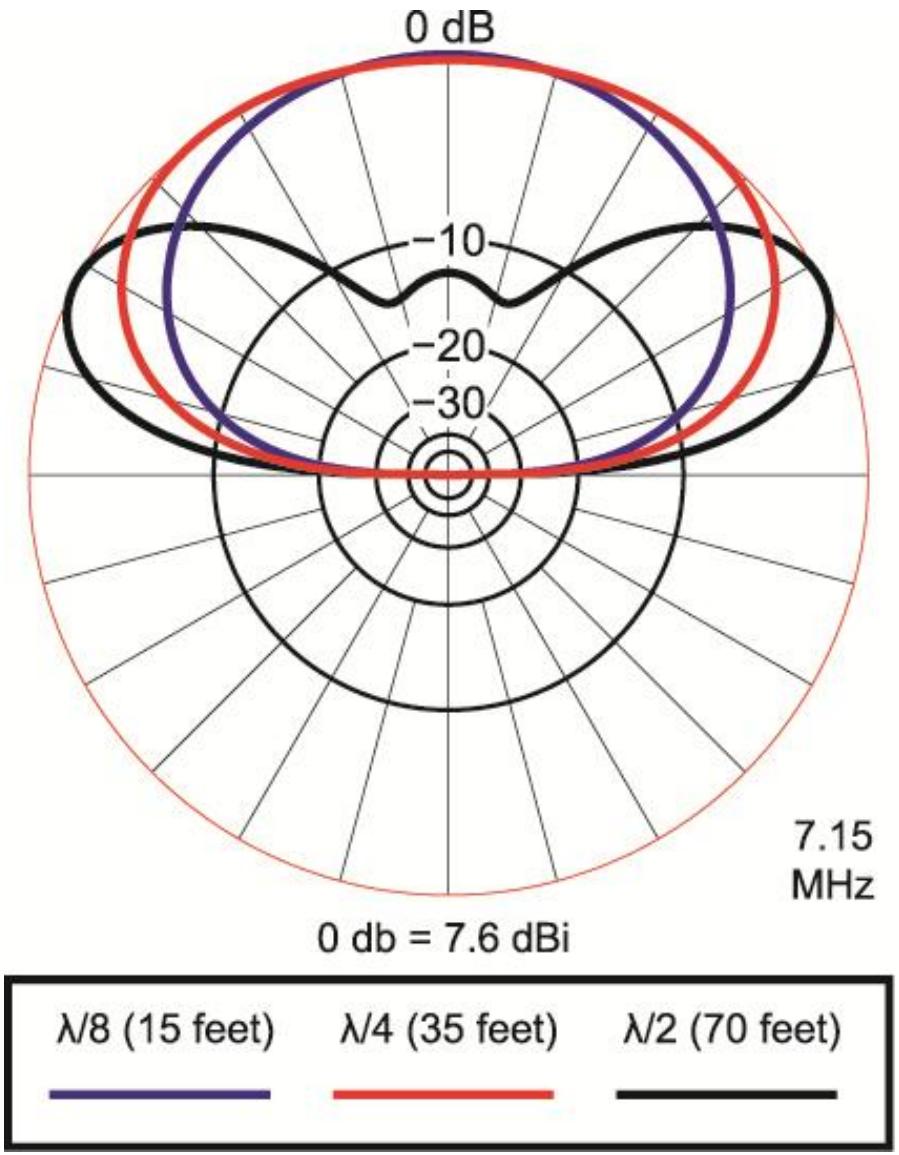


7.6 dB = 5.75 X

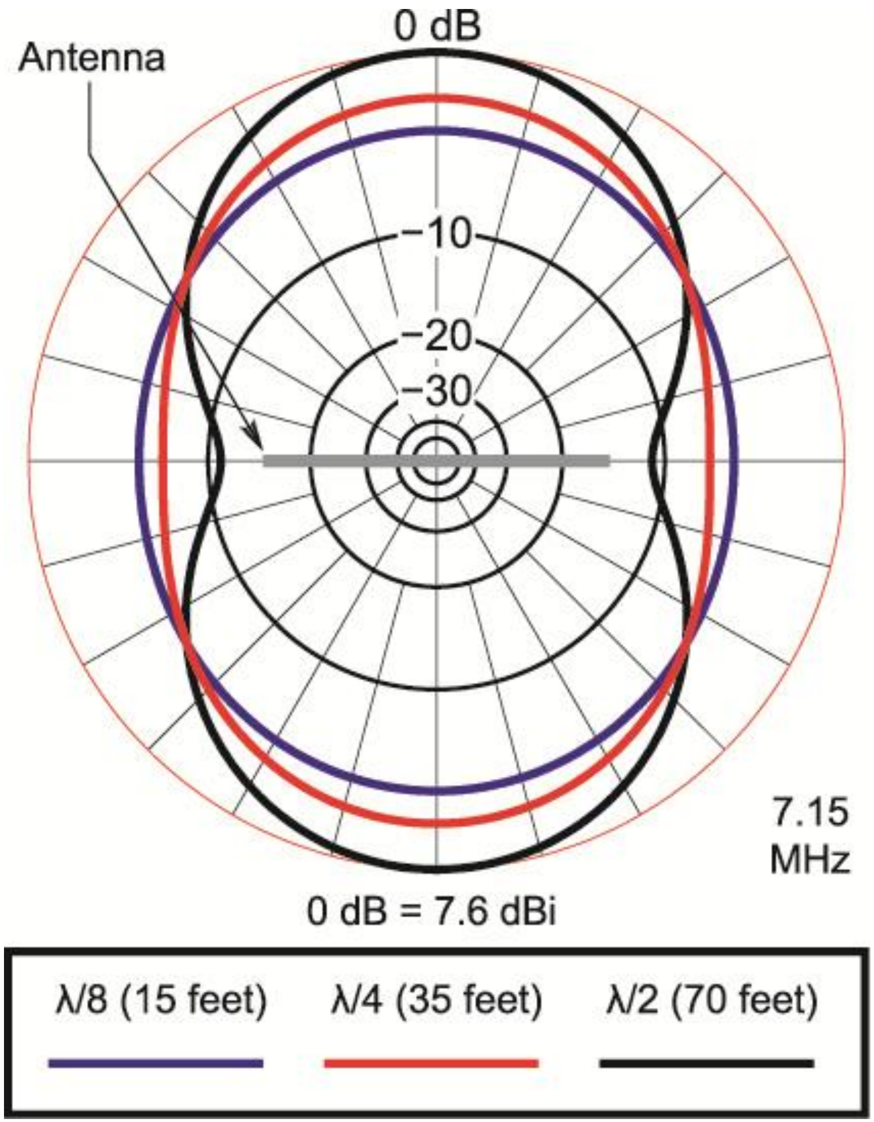
Path of Radio Wave Via the Ionosphere



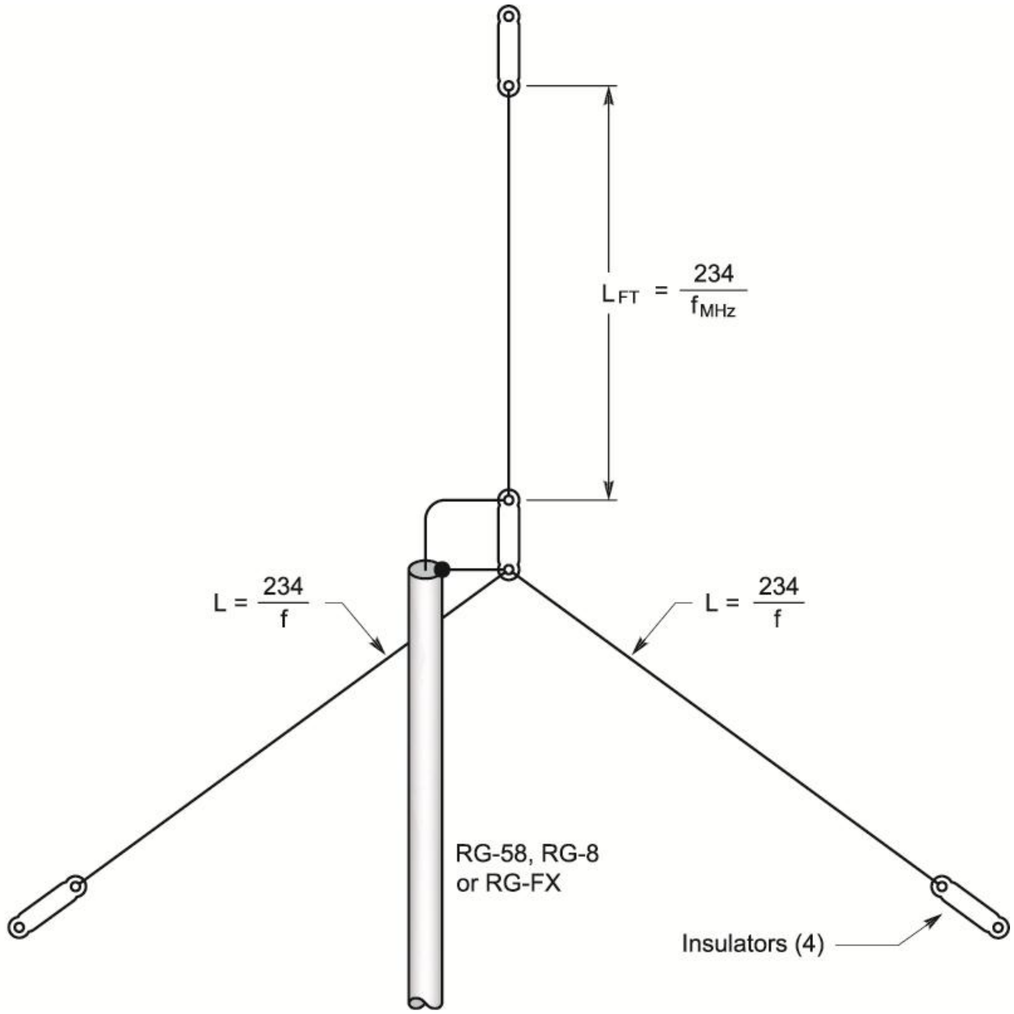
Elevation Pattern of a Dipole at Different Heights



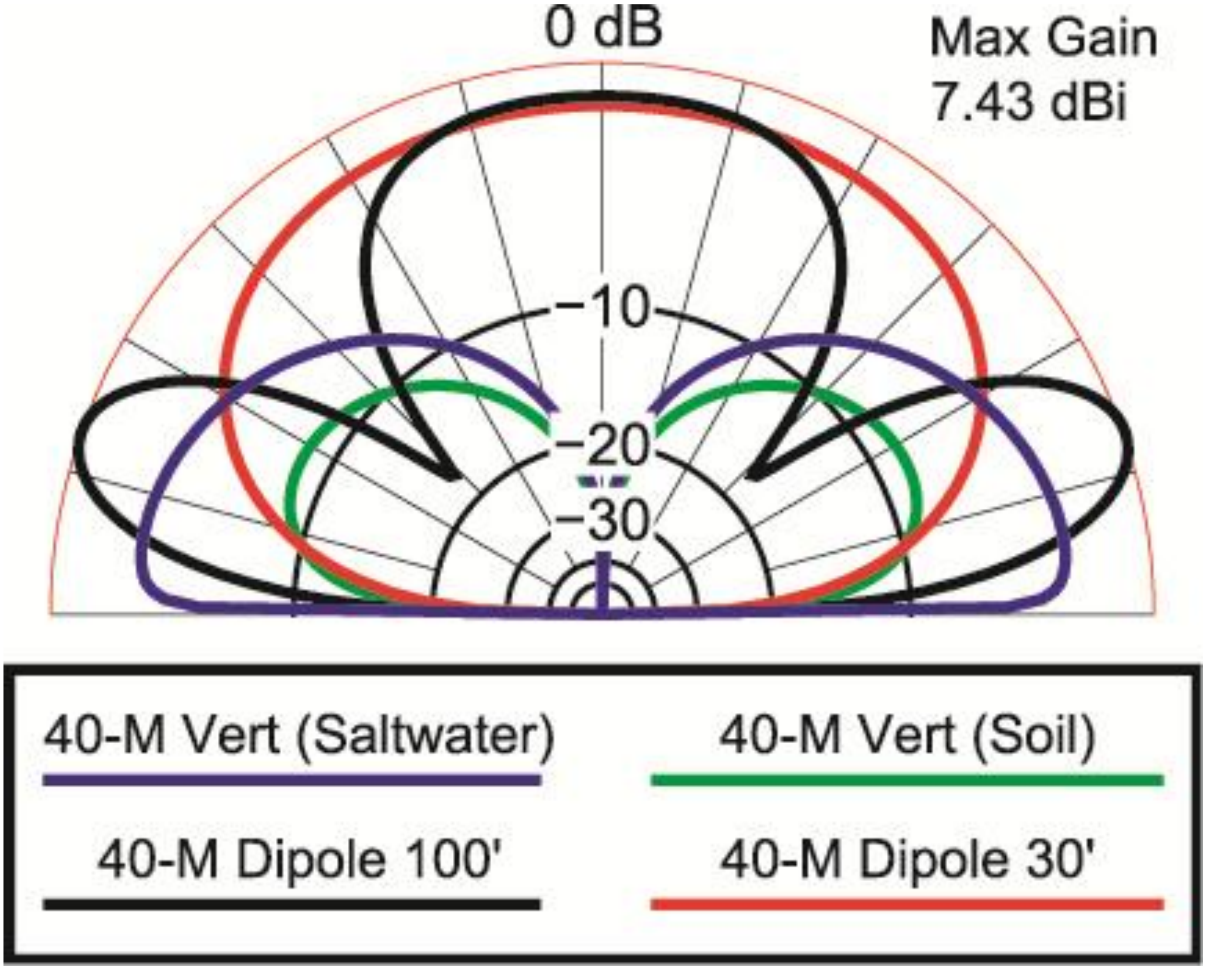
Azimuth Pattern of a Dipole at Different Heights



The Quarter-Wave End-Fed Monopole



Elevation Pattern of a Dipole and Monopole



Elevation Pattern of a Dipole and Monopole

Note:

Jeff Cronin, KB1MZL, asked a question about the preceding figure. Jeff noted, quite correctly, that the total power of the vertical monopole over soil was lower than that over seawater and wondered where the losses were. I didn’t think of the right answer at the time.

The reason is that while the antenna may be radiating the same power (assuming a low-loss ground system), the plot shows the radiation in the far field. The energy sent at low angles is dissipated by passing over the lossy ground.

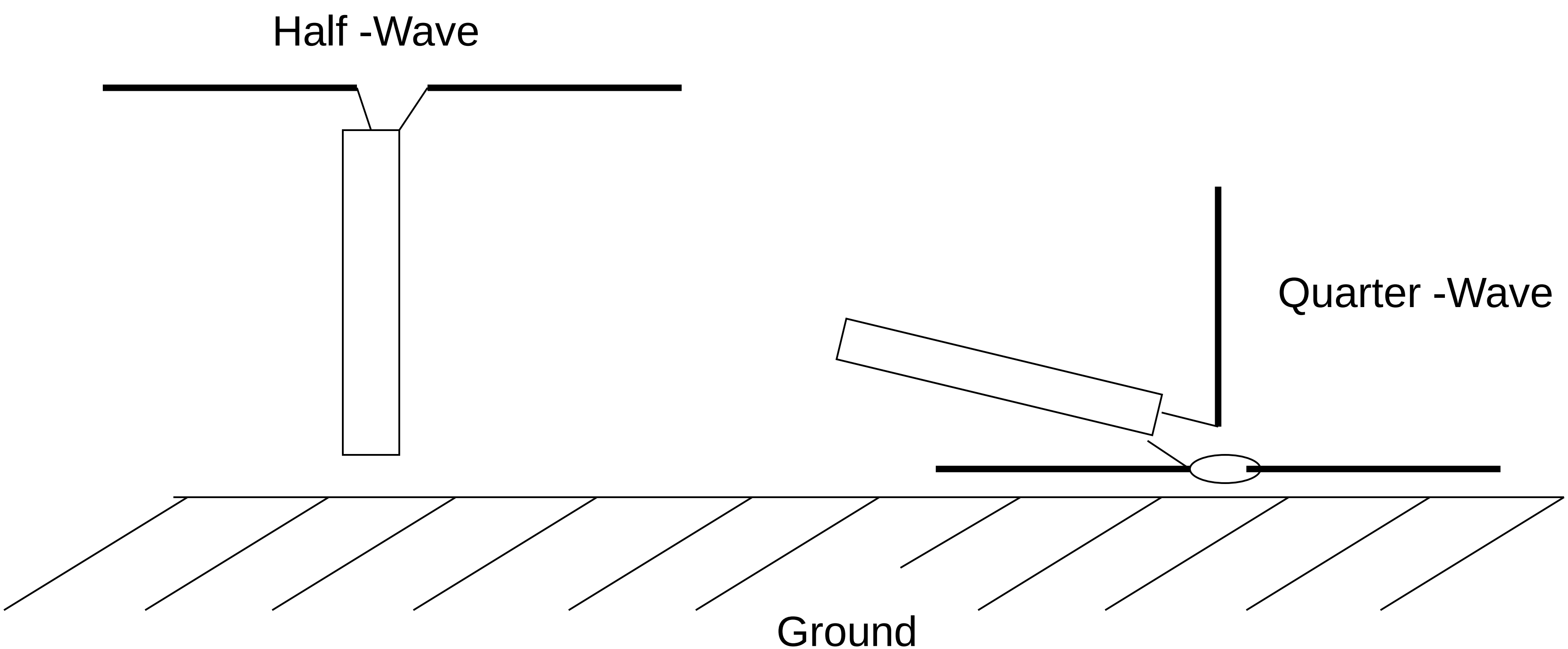
A (potentially) interesting corollary is that early shipboard radar started with vertical polarization to obtain low angle radiation, however, the system was overloaded with “sea clutter” from every wave in front of the radar. They shifted to horizontal polarization and the problem was solved. The height was enough that at UHF they still got down low enuf, but didn’t have so much at 0° elevation where the waves were.

The Antenna System You Want

The Antenna System You Likely Get

Two Typical Options for a First HF Antenna:

- ❖Horizontal Dipole
- ❖Vertical Monopole



Summary of Pluses and Minuses

- Horizontal dipole
  - Stronger signal than monopole in best directions.
  - Weaker signal than monopole off ends.
  - Good for short distances, may be better for long as well.
  - Performance depends on height above ground
- Vertical monopole
  - Works equally well (or equally poorly) in all directions.
  - Smaller footprint – maybe.
  - Can be more stealthy.
  - Best for long range, but not great away from the water.
  - Performance depends on ***two*** ground factors.

Variations

- Horizontal dipole
  - Inverted V – single support.
  - Feed with low-loss line (and tuner) to work multiple bands.
  - Other multiple band arrangements possible.

- Vertical monopole
  - Ground mounted or elevated.
  - Multiband with tuner at base.
  - Other multiple band arrangements possible.

GFARA Field Day Antennas

80-40 Meter station –

Two-band coupled resonator

20-15-10 Meter station –

A) Three element triband Yagi

B)Three-band coupled resonator

GOTA Station

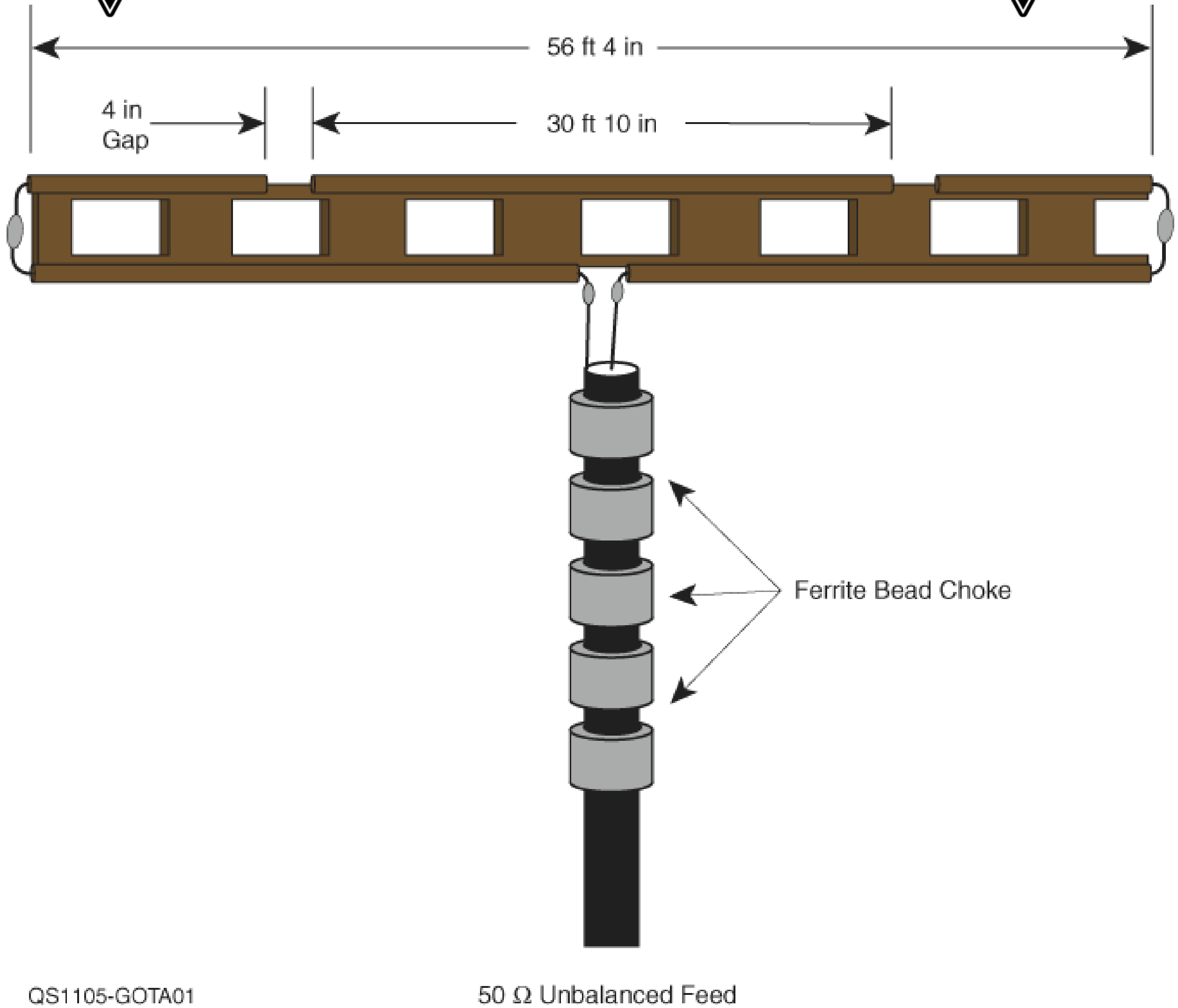
G5RV Dipole + tuner

GFARA Field Day Antennas

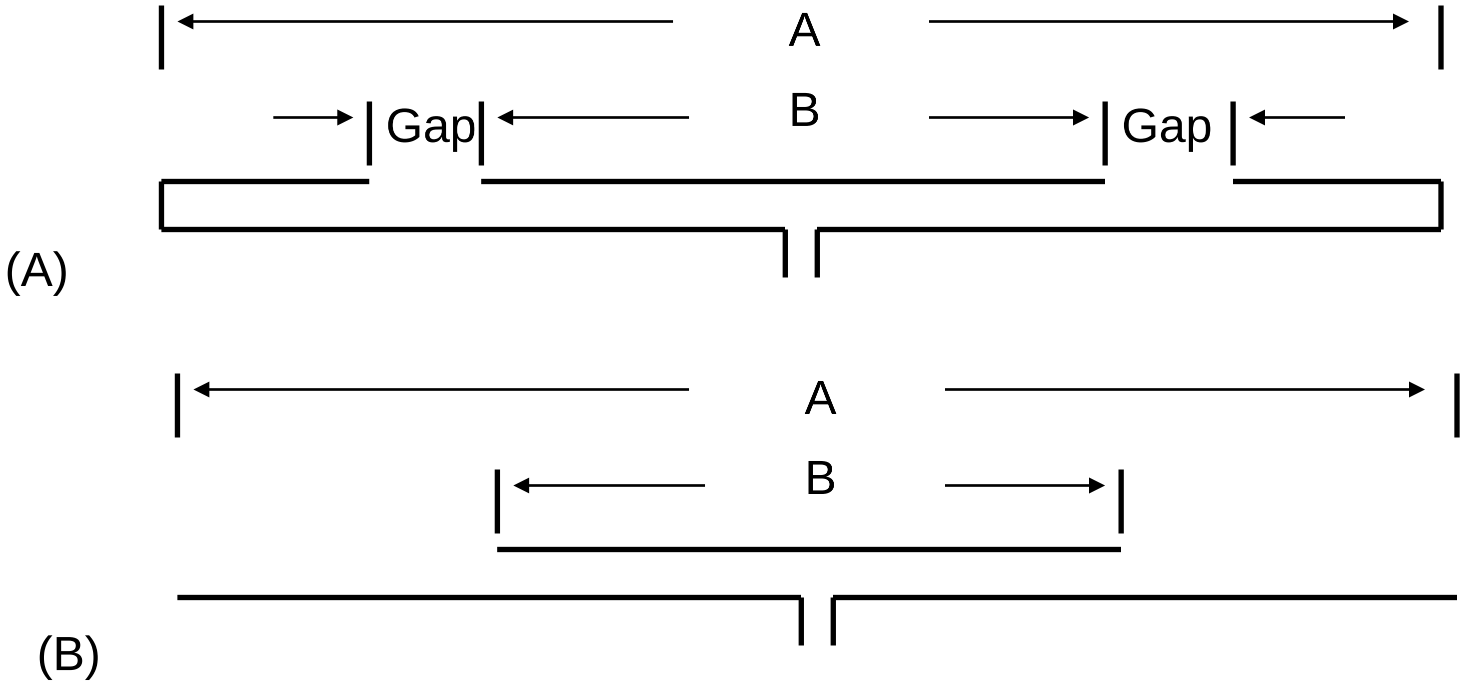
80-40 Meter station –

Two-band coupled resonator

The American Radio Relay League



“Folded *Skeleton Sleeve*” from May 2011 QST


A
B
Gap
Gap
(A)
A
B
(B)

The American Radio Relay League

Folded Skeleton Sleeve Antenna Dimensions (Figure 1A)

Bands (Meters)	*A (Feet)*	*B(Feet)*	*Gap (Inches)*
160/75	210	114	24
80/40	111.4	61.5	12
80/30	104	43.2	4.8
80/10	96	15.4	9.6
75/60	110.6	81.4	3.6
75/40	107	60.8	7.2
74/41 (MARS)	100.2	59.8	7.2
40/30	58	43	6
40/20	56.3	30.8	4
40/10	51.4	15.4	3.6
30/20	42	30.7	7.8
30/17	40.8	24.08	5.5
30/15	38.0	20.7	5.4
20/17	30.6	24	4.2
20/15	29.6	20.5	9.1
20/10	27.6	15.4	3.6
17/15	24.3	20.5	9.0
17/12	23.6	17.4	9.6
17/10	23.2	15.3	10
15/10	20	15.3	4.2
10/6	14.4	8.3	5.6
6/2 (CW/SSB)	7.4	3.0	3.6
6/2 (FM)	7.1	2.9	4.2
4/2 (UK)	5.4	3.0	2.25

The American Radio Relay League

Unfolded Skeleton Sleeve Antenna Dimensions (Figure 1B)

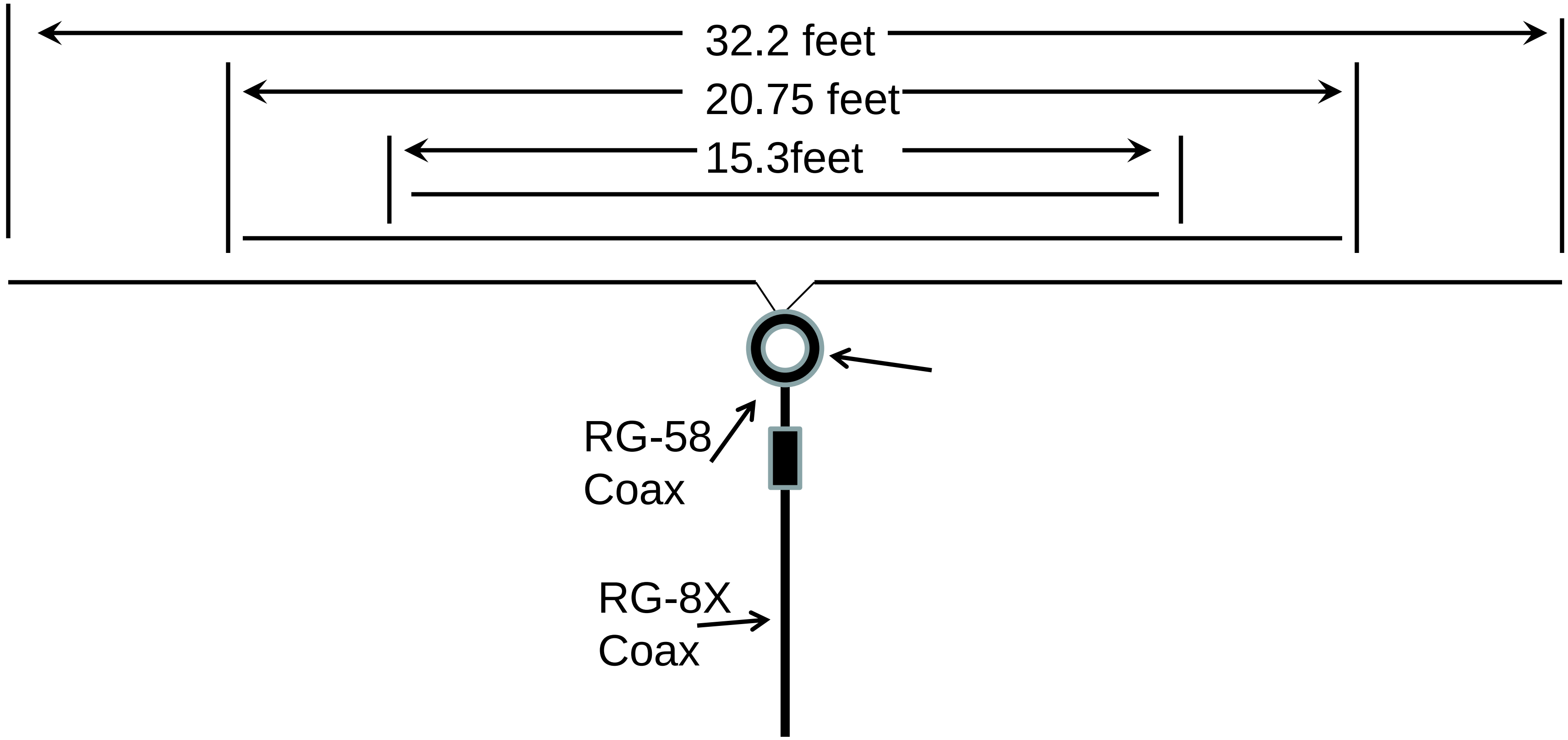
Bands (meters)	*A (Feet)*	*B(Feet)*
160/80	*248*	*118*
160/60	*248*	*81*
80/40 (CW)	*127*	*61.5*
75/60	*121*	*81*
75/40 (SSB)	*118*	*60.5*
40/30	*63*	*43*
40/20	*64**	*30.9*
40/10	63	15.3
30/20	44.8	30.8
30/17	45.6	24.3
30/15	*44.7*	*20.6*
20/17	*32*	*24*
20/15	*32.3*	*20.5*
17/15	*25.2*	*20.44*
17/12	*25.3*	*17.4*
17/10	*25.3*	*15.3*
15/12	*21.4*	*17.3*
15/10	*21.3*	*15.3*
12/10	*18.24*	*15.14*
6/2 (CW/SSB)	8.9	3.0
6/2 (FM)	8.6	2.9
4/2 (UK)	6.3	3.0
2/70 cm (FM)	3.0	11 inches

*64 feet for uninsulated 40 meter extension,
63. if window line used for full length (recommended).

20-15-10 Meter station –
A) Three element triband Yagi

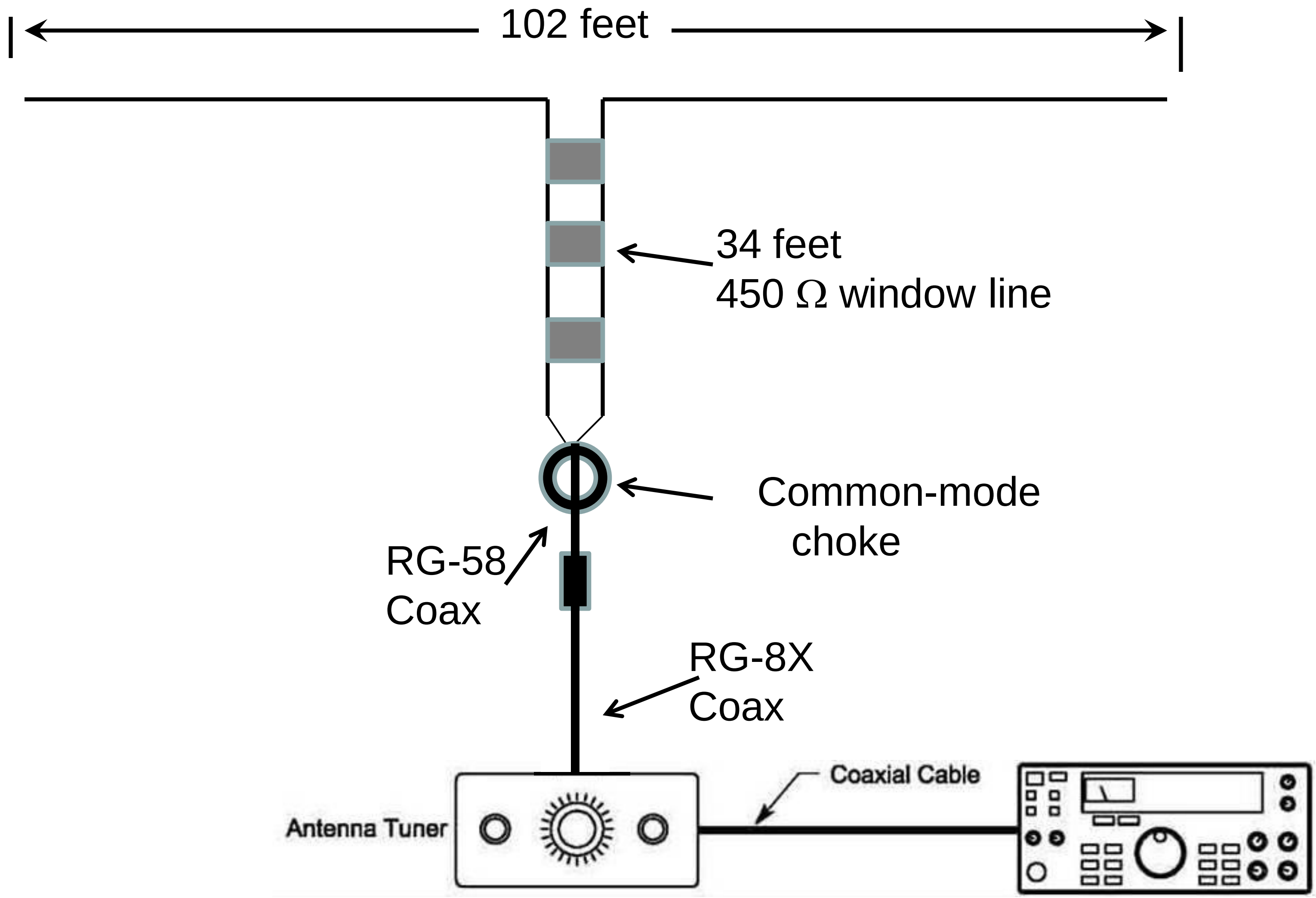
20-15-10 Meter station –
B)Three-band coupled resonator

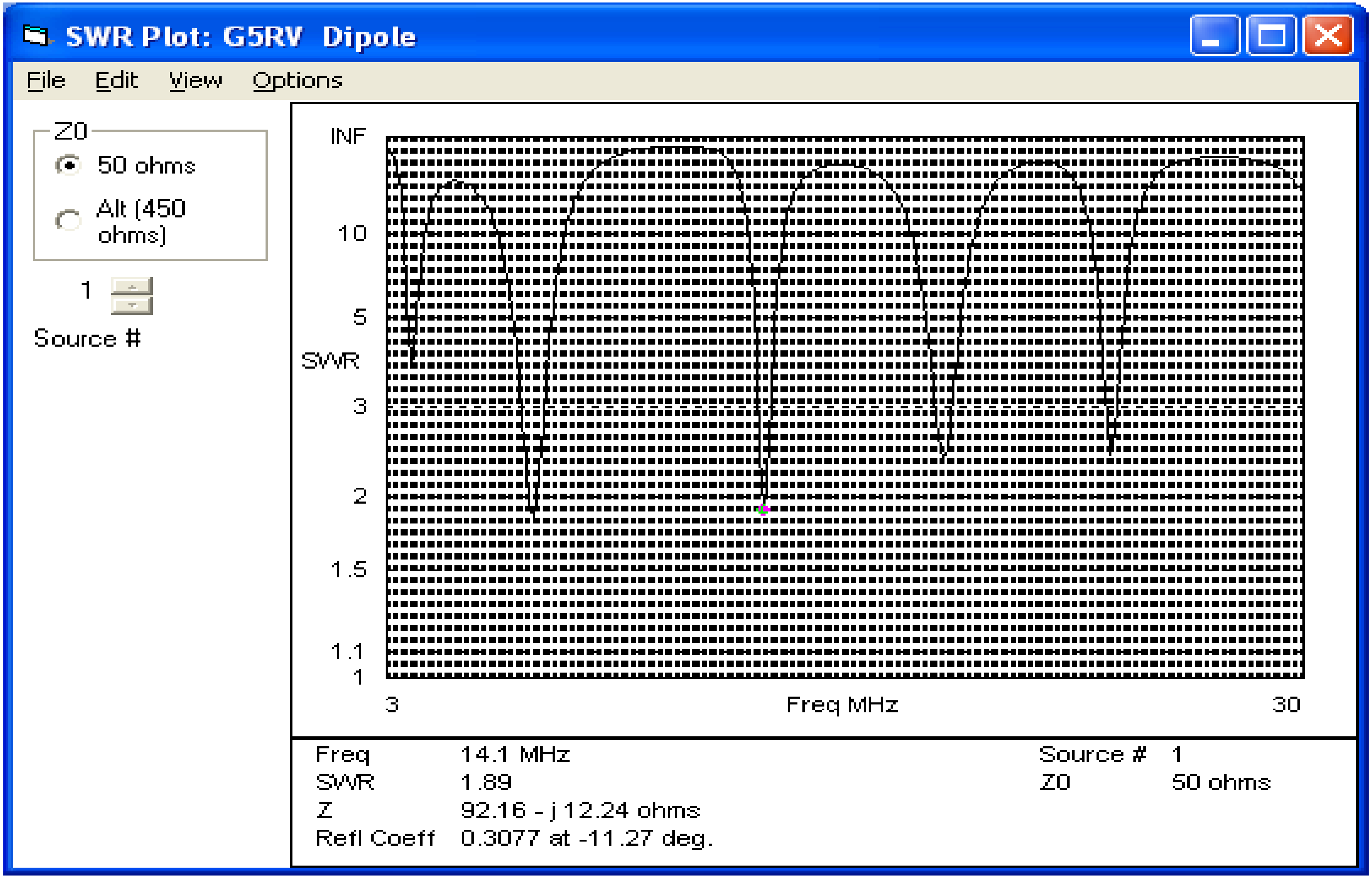
20-15-10 Meter station –
B)Three-band coupled resonator



Look in June 2017 QST

GOTA Station - G5RV Dipole + tuner





G5RV Amateur Band SWR:

3.7 MHz – 3.6:1	10.1 – 70:1	18.1 – 15:1	24.9 – 8.3:1
7.2 MHz – **2.2:1**	14 MHz – **2:1**	21.0 – 28:1	28.3 – 49:1

Questions?

The American Radio Relay League

Thanks for Your Attention

73, and hope CU on HF!

W1ZR books of particular interest