Antenner for mottak

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LA2T 22.01.2019

Antenner for mottak

- Viktige egenskaper
  - God følsomhet
  - Lavt signal-støyforhold
  - Robust konstruksjon
  - Enkel installasjon
  - Lave kostnader

Signal Støy Forhold

$$\mathrm{SNR} = \frac{P_{\mathrm{signal}}}{P_{\mathrm{noise}}},$$

$$\mathrm{SNR}_{\mathrm{dB}} = 10\log_{10}\left(\frac{P_{\mathrm{signal}}}{P_{\mathrm{noise}}}\right)$$

3. System signal-to-noise ratio (SNR)

The system noise power is related to the system noise temperature as:

$$P_N = kT_s \Delta f \text{, W} \tag{7.26}$$

From Friis transmission equation:

$$P_r = (1-|\Gamma_t|^2)(1-|\Gamma_r|^2)e_t e_r |\hat{\rho}_t \cdot \hat{\rho}_r|^2 \left(\frac{\lambda}{4\pi R}\right)^2 D_t(\theta_t,\varphi_t)D_r(\theta_r,\varphi_r)\cdot P_t \tag{7.27}$$

one can calculate the signal power P_r. Thus, the SNR ratio becomes:

$$SNR = \frac{P_r}{P_N} = \frac{(1-|\Gamma_t|^2)(1-|\Gamma_r|^2)e_t e_r |\hat{\rho}_t \cdot \hat{\rho}_r|^2 \left(\frac{\lambda}{4\pi R}\right)^2 D_t D_r \cdot P_t}{kT_s \Delta f} \tag{7.28}$$

The above equation is fundamental for the design of telecommunication systems.

Beregning av støygulv

- Noise=kTB
- k=Boltzman's Constant = 1.38E-23
- T=Temperature in degrees Kelvin
- B=Bandwidth in Hertz
- Using a room temperature of 293K (68F) and 1 Hz bandwidth we get:
- Noise=4.04E-21
- This is a linear number that needs to be converted to dB.
- Noise=10*Log(4.04E-21)= -203.9 dBw/Hz (dB referenced to 1 watt)
- More commonly we see this number in dBm (dB referenced to 1 millwatt):
- Noise=-203.9dBw + 30dB = -173.9 dBm (often rounded to -174 dBm/Hz for convenience)
- In DTV the bandwidth is often specified as 6 MHz since that's the maximum bandwidth allocated to each channel.
- The increase in noise in a 6 MHz bandwidth over a 1 Hz bandwidth is:
- 10*Log(6,000,000)=67.8 dB
- The noise in the 6 MHz DTV bandwidth is:
- -174 dBm/Hz + 67.8 dB = -106.2 dBm or just -106 dBm.

Pekka Ketonen, OH1TV

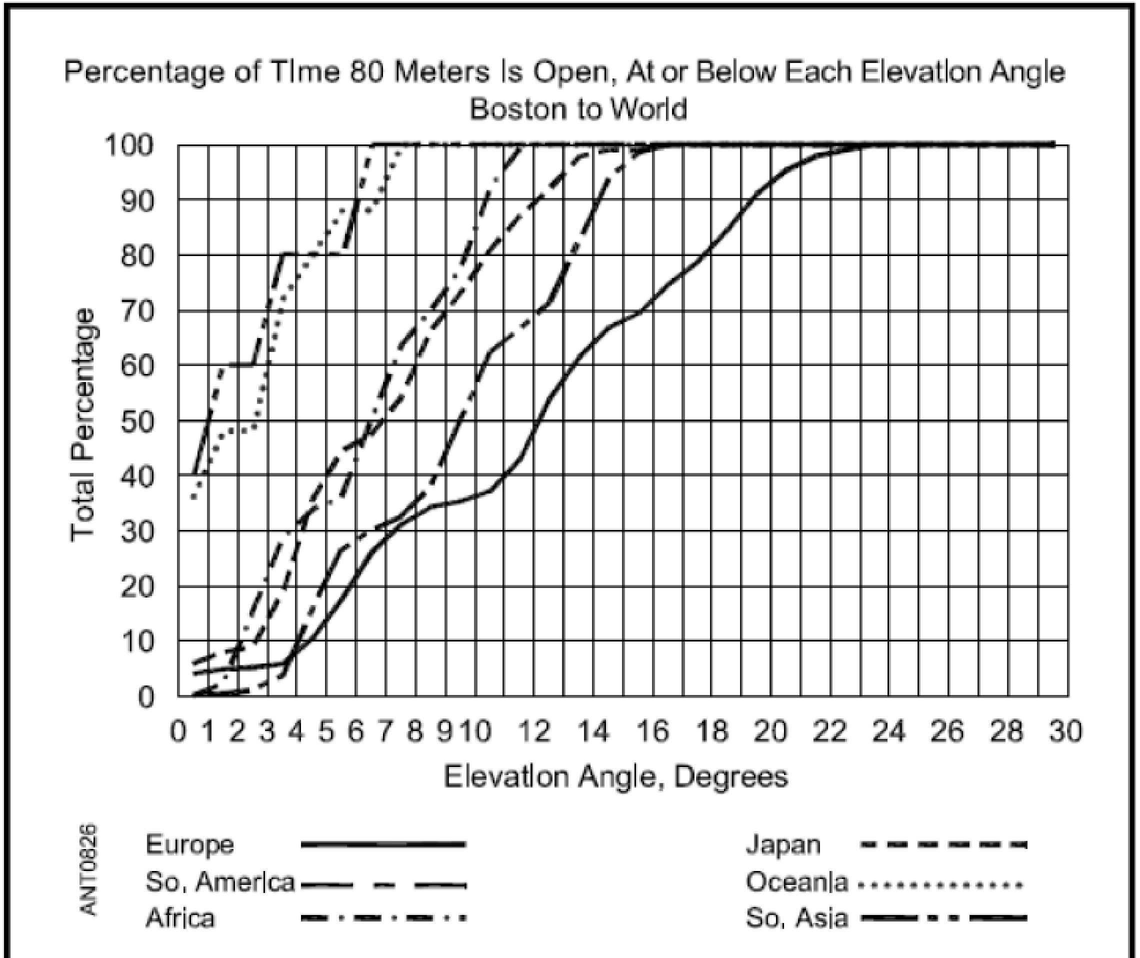


Figure 4.31 — The cumulative distribution function showing the total percentage of time that 80 meters is open, at or below each elevation angle, from Boston to the world. For example, 50% of the time the band is open to Europe from Boston, it is at 13° or less.

Angle of arrival

Example: **80m band** in Boston area:

<u>All DX-stations arrive at 23deg elevation or less.</u>

<u>50% of the time they arrive at 12deg or less.</u>

Some continents arrive always at 10deg or less.

Situation here in OH is quite the same.

Wullenweber, Gablingen, Tyskland, -124 dB

Wullenweber

AN/FLR-9 Army/Air Force, AN/FLR-10 Navy,

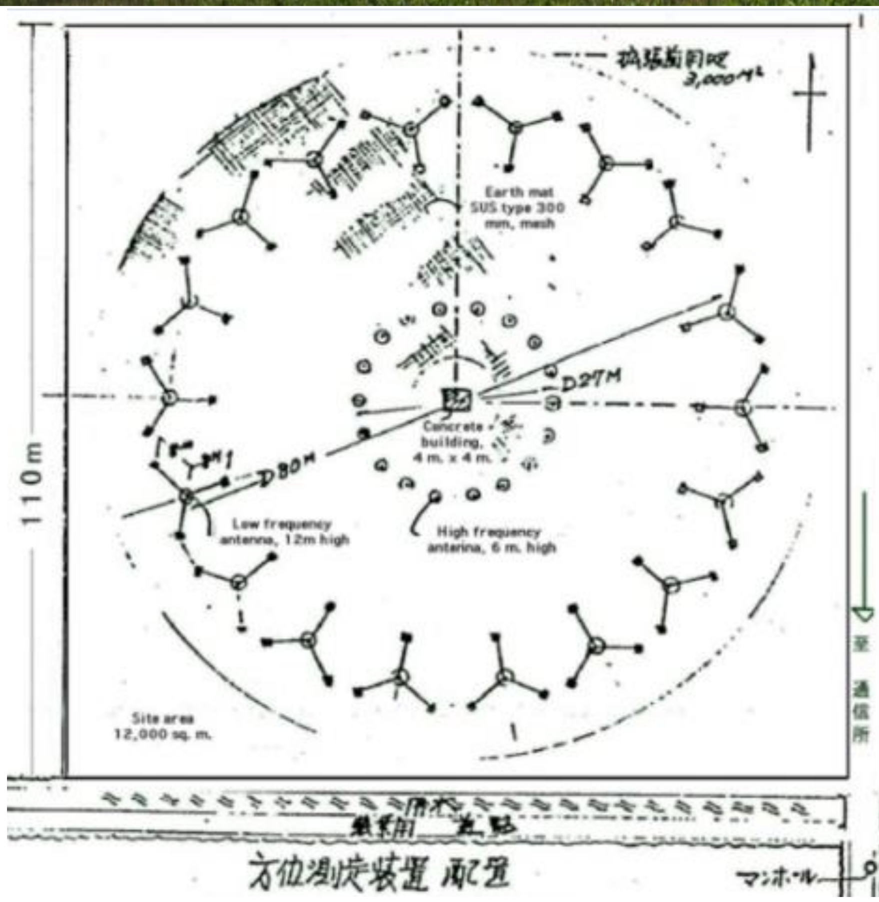
- The antenna array is composed of three concentric rings of antenna elements.
- Each ring of elements receives RF signals for an assigned portion of the 1.5 to 30-MHz radio spectrum.
- The outer ring normally covers the 2 to 6-MHz range (band A), but also provides reduced coverage down to 1.5 MHz.
- The center ring covers the 6 to 18-MHz range (band B) and the inner ring covers the 18 to 30-MHz range (band C).
- Band A contains 48 sleeve monopole elements spaced 78.4 feet apart (7.5 degrees).
- Band B contains 96 sleeve monopole elements spaced 37.5 feet (11.43 m) apart (3.75 degrees).
- Band C contains 48 antenna elements mounted on wooden structures placed in a circle around the central building.
- Bands A and B elements are vertically polarized.
- Band C elements consist of two horizontally polarized dipole antenna subelements electrically tied together, and positioned one above the other.

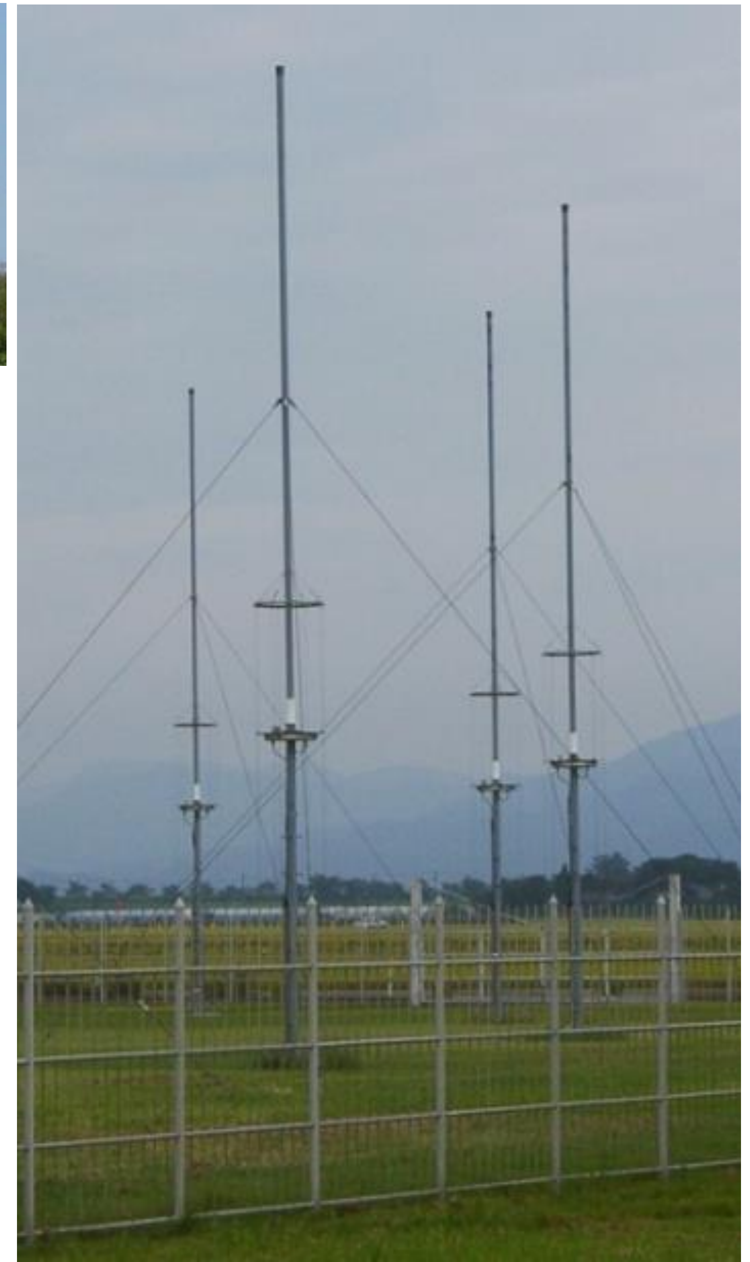
- The array is centered on a ground screen 1,443 feet (439.8 m) in diameter. The arrangement permits accurate direction finding of signals from up to 4000 nautical miles (7408 km) away.

AN/FLR-9, Wullenweber, Misawa, Japan

Elmendorff, Alaska

Pusher AX-16, (Plessey Ltd.), -116 dB

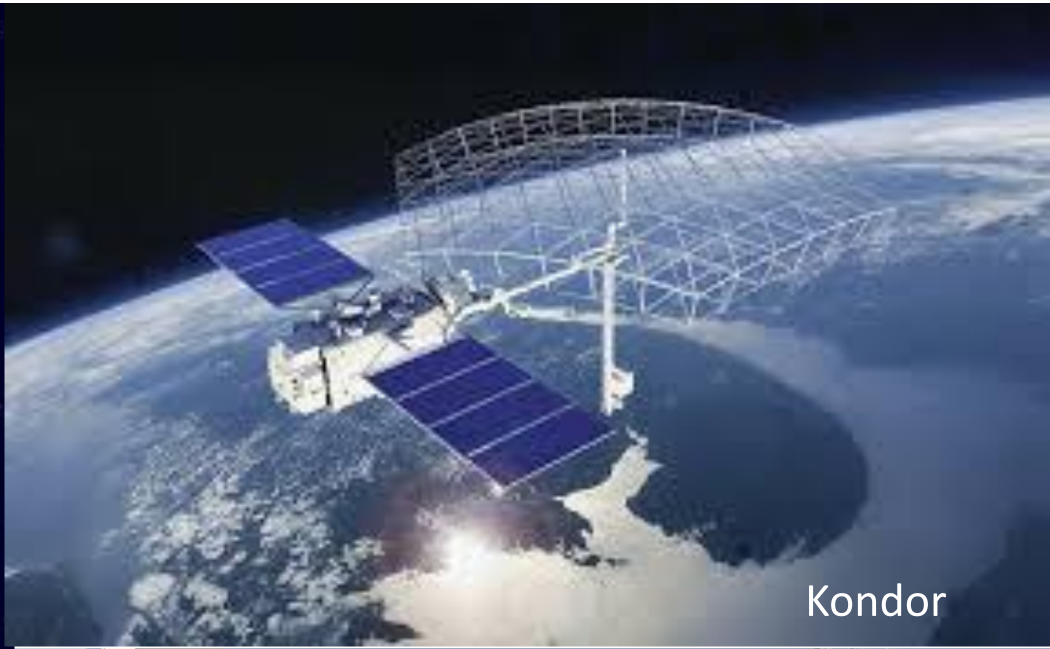




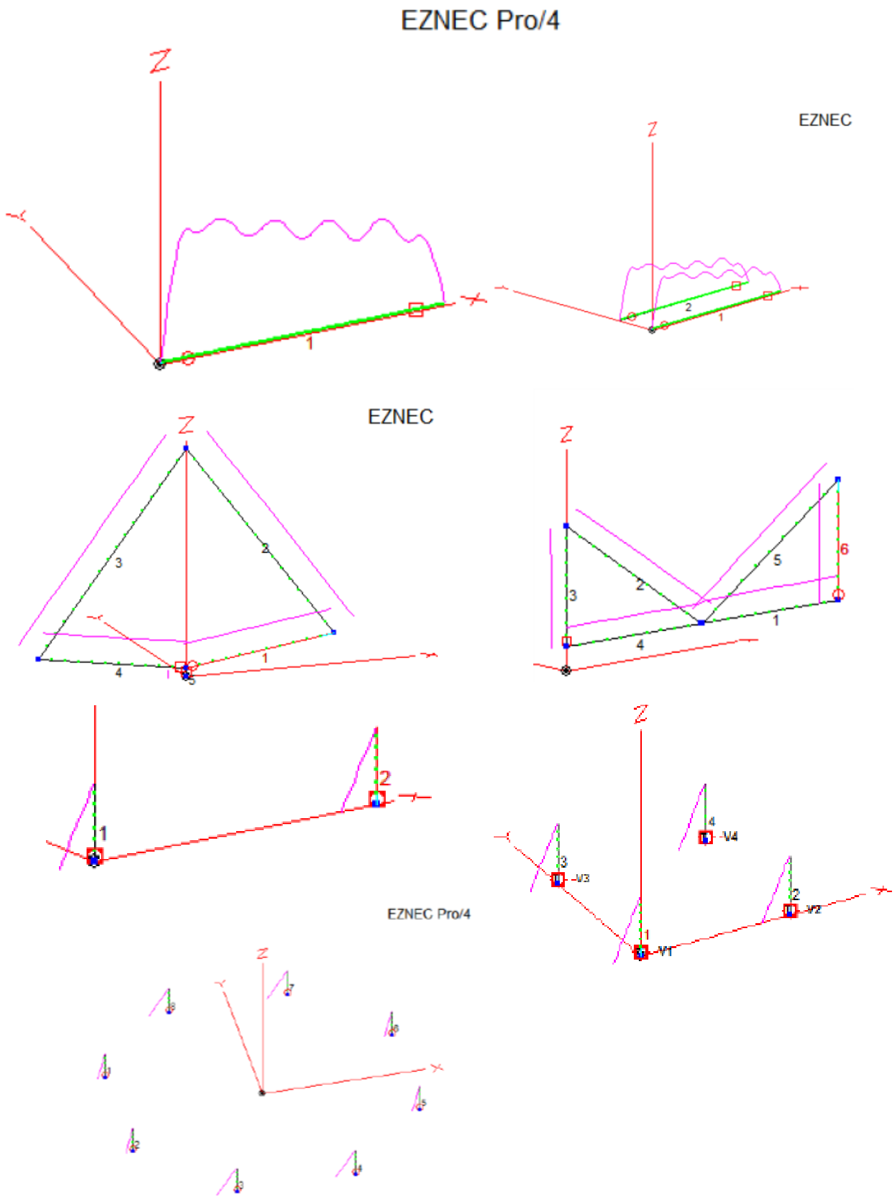
HF Signint/Comint Radioer

Dagen fokus er satellitter

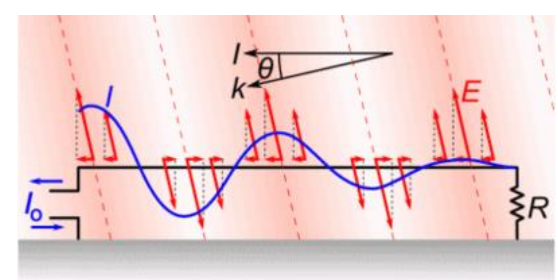
(Begynte med Rhyolite/Aquacade 1970, USA)

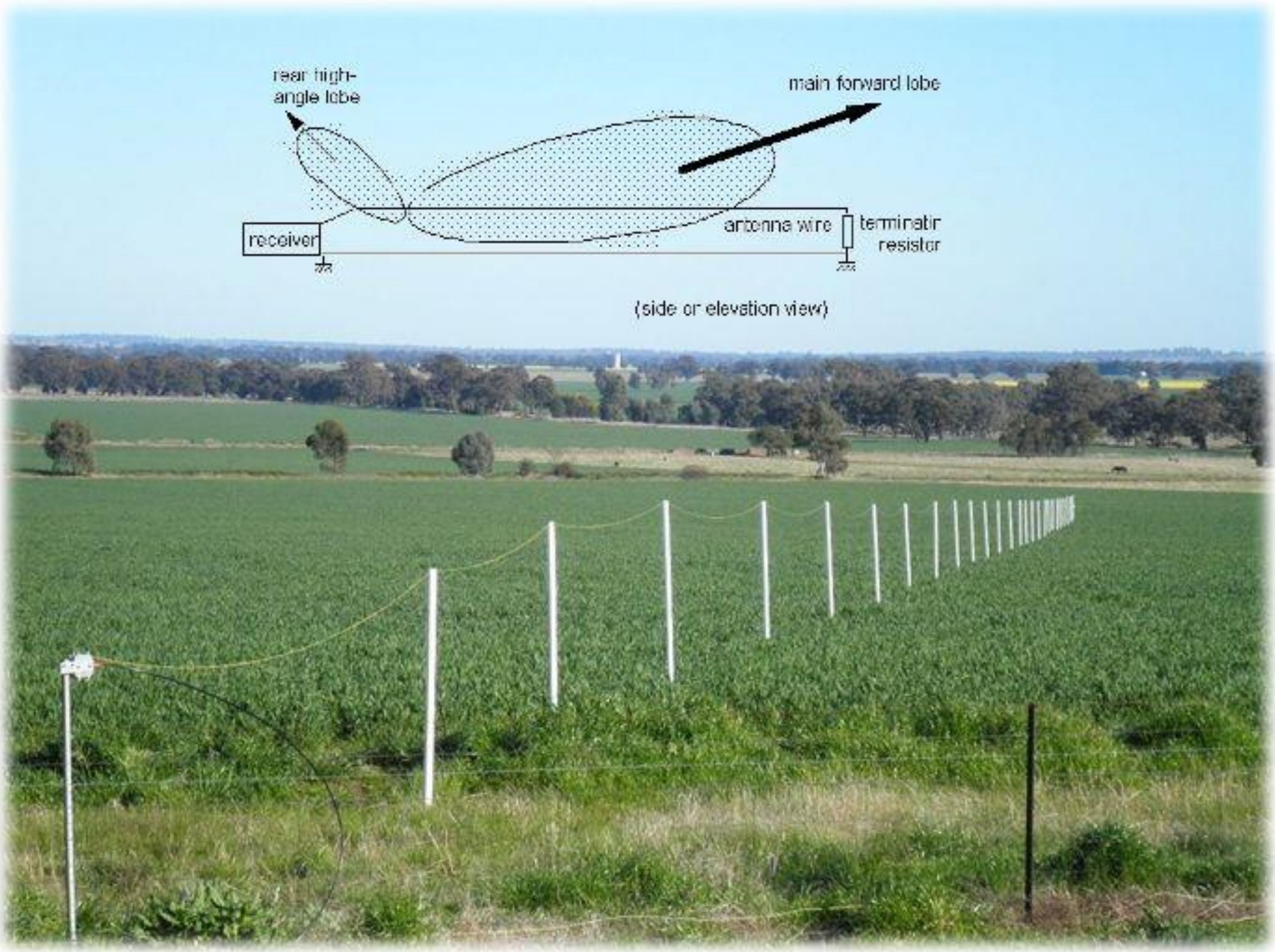


Klassiske Rx antenner, Ketonen, OH1TV

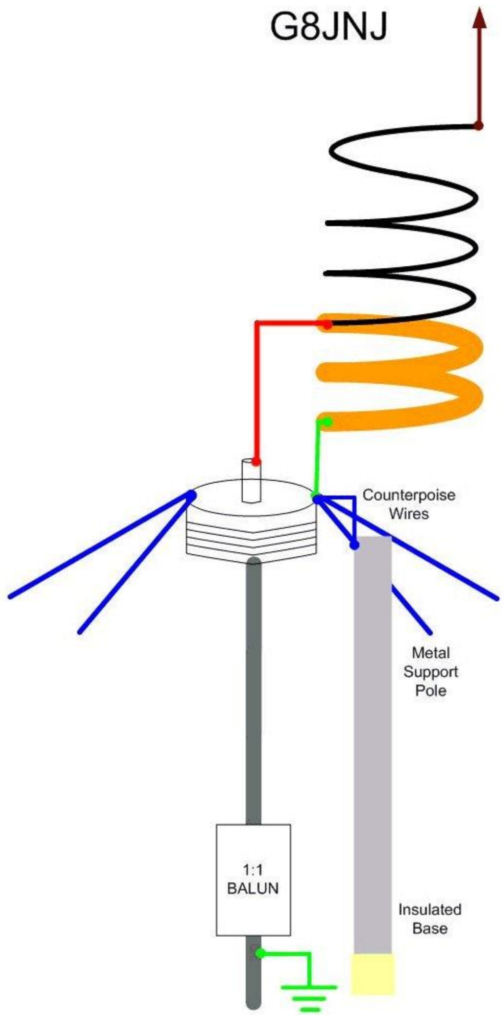


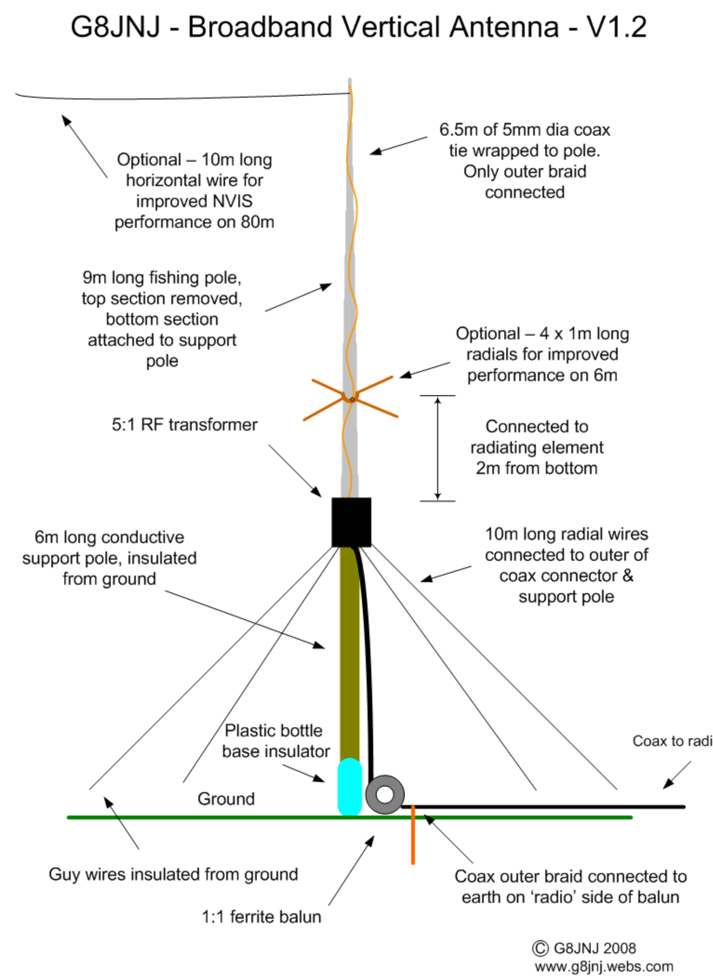
Antenne	Elev grd	Max Gain dB
80m 2L Beverage	24	-4,24
160m 2L Beverage	23	-5,35
80m 2Lx2Y Beverage	24	-1,20
160m KA9Y Loop	31	-25.6
16080 m DHDL Loop	23/31	-28.5/-20,6
160m 6m 2x faset-Vert.	23	-9,95
160-80m 6m 4-SQ	21/23	6,2/6,7
160 6m 8-SQ	19,8	8,78



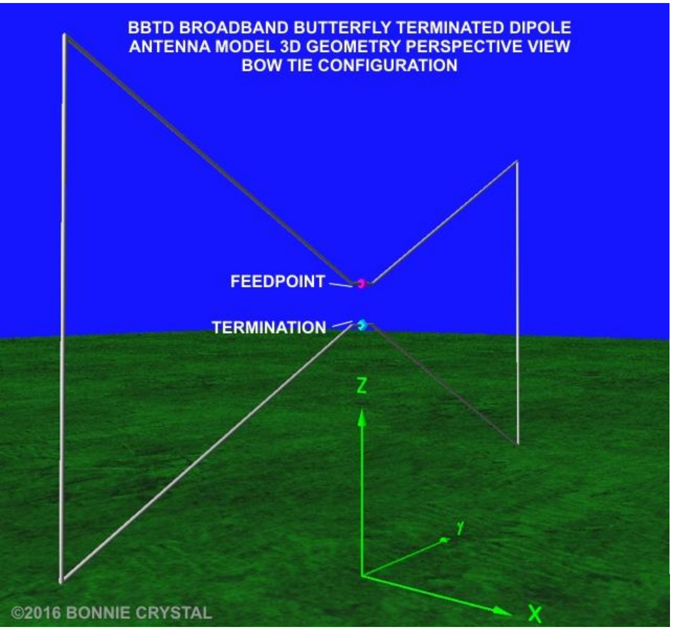

rear high-
angle lobe
main forward lobe
receiver
antenna wire
terminatir
resistor
(side or elevation view)

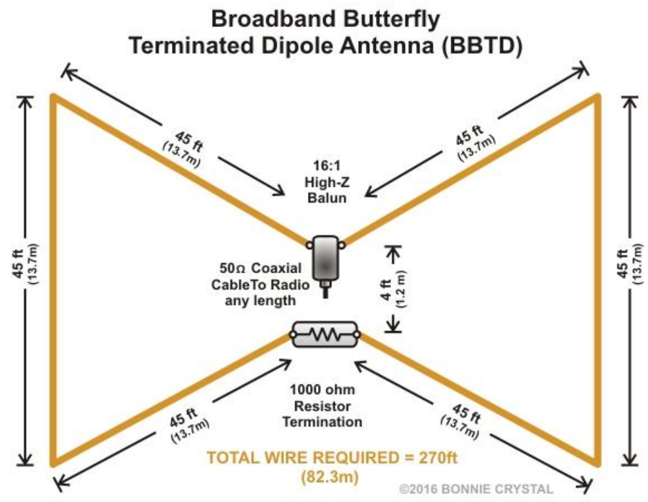
Vertikale antenner

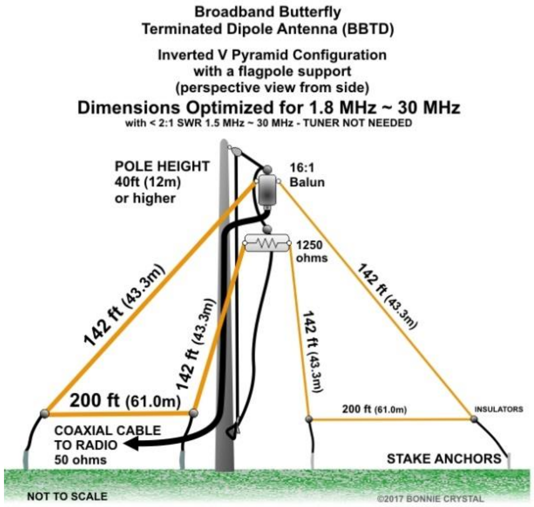


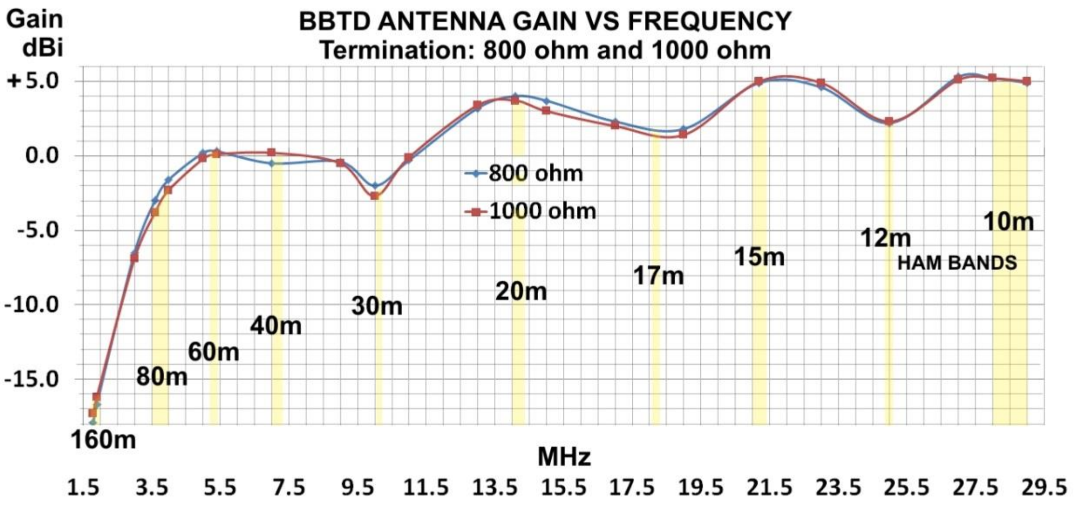


Vertikal loop

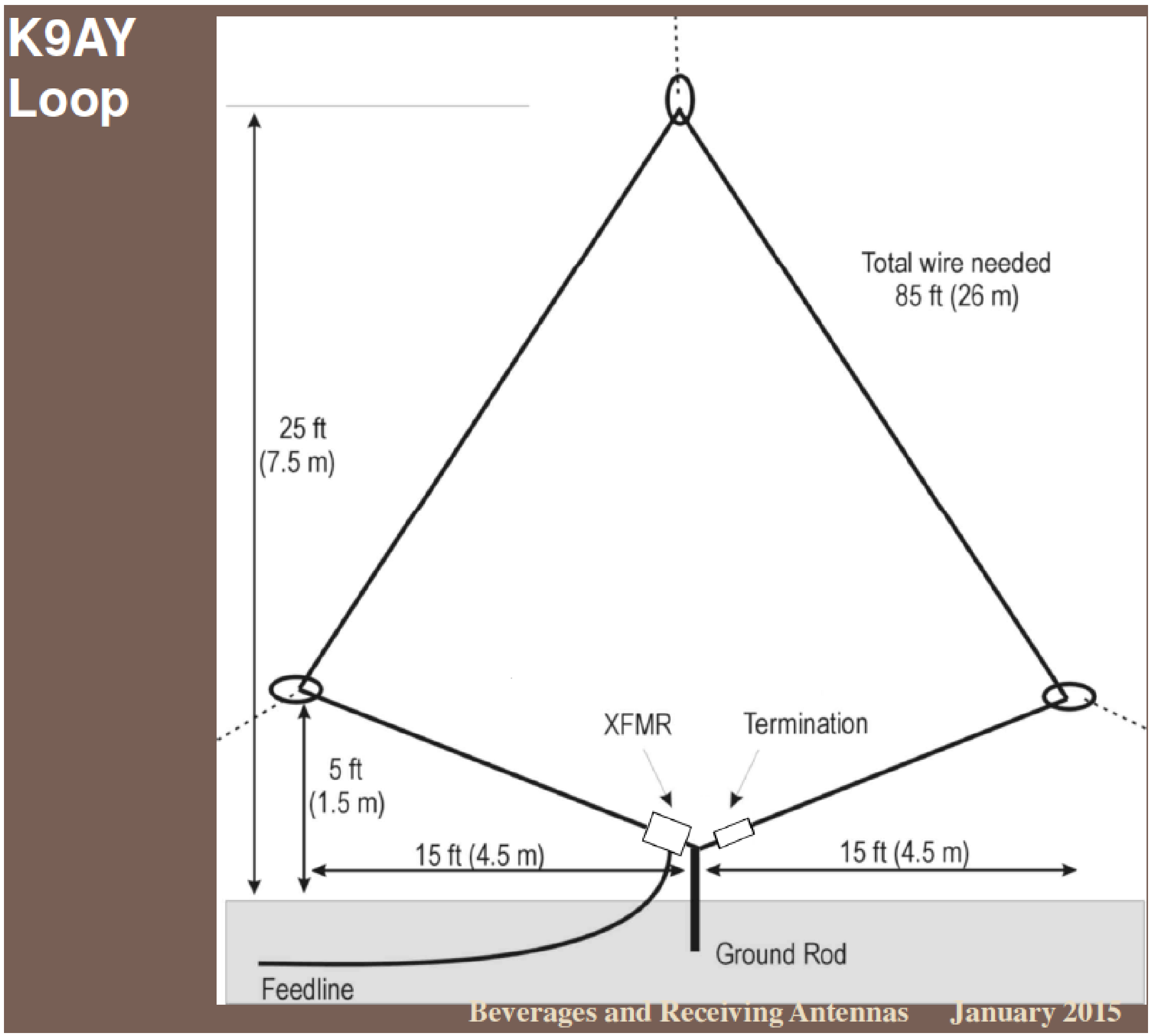




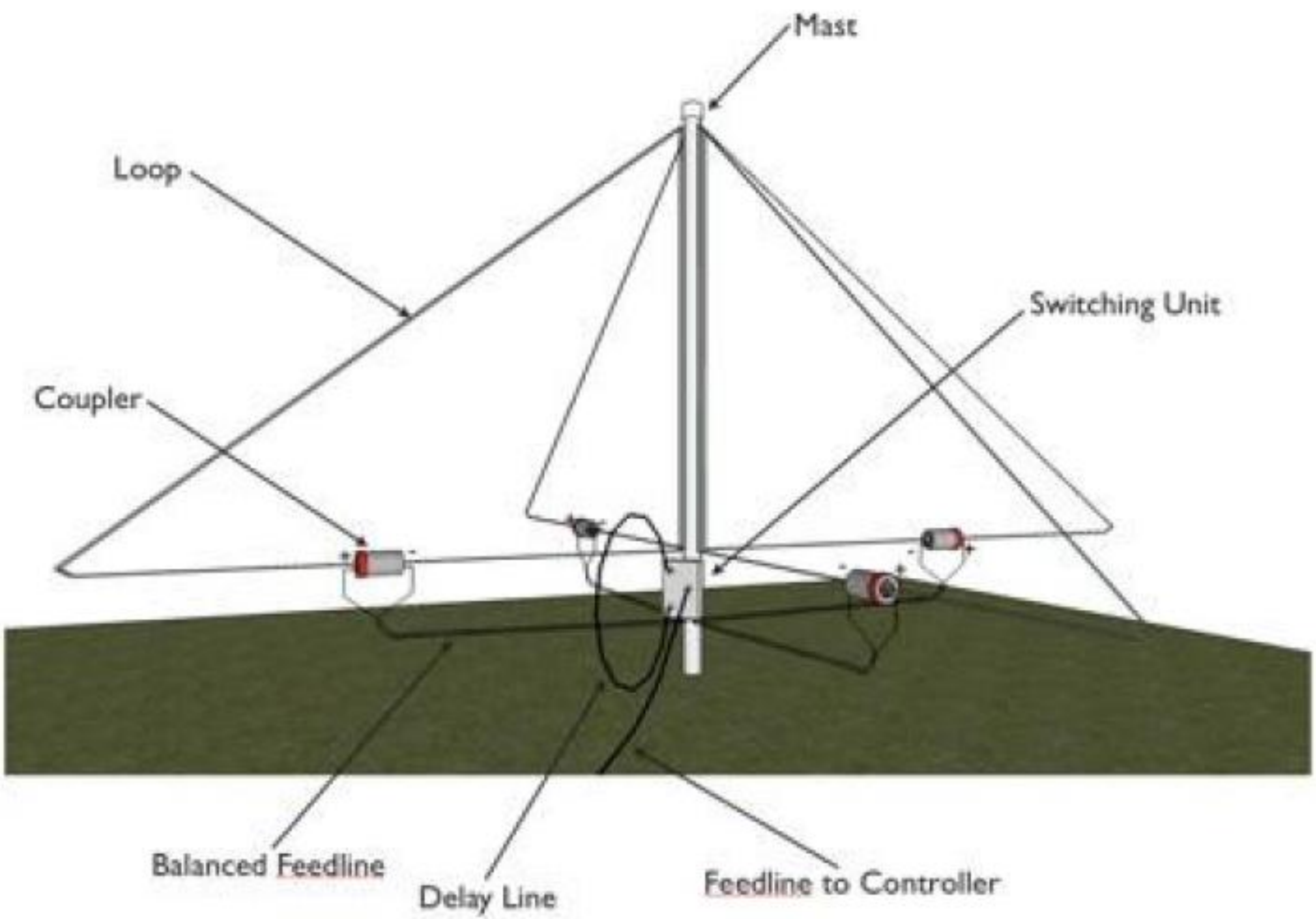




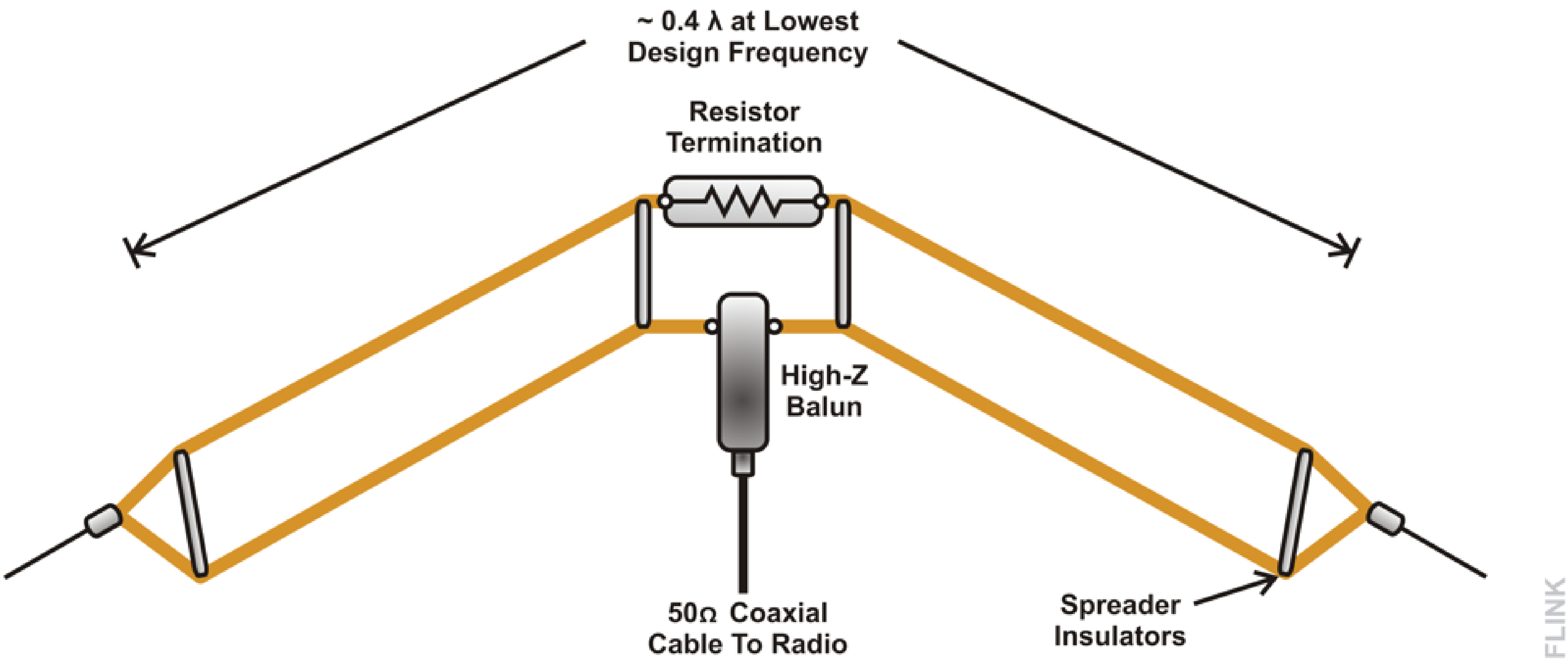
K9AY Loop


K9AY
Loop
Total wire needed
85 ft (26 m)
25 ft
(7.5 m)
XFMR
Termination
5 ft
(1.5 m)
15 ft (4.5 m)
15 ft (4.5 m)
Ground Rod
Feedline
Beverages and Receiving Antennas January 2015

90° Faset K9AY Loop

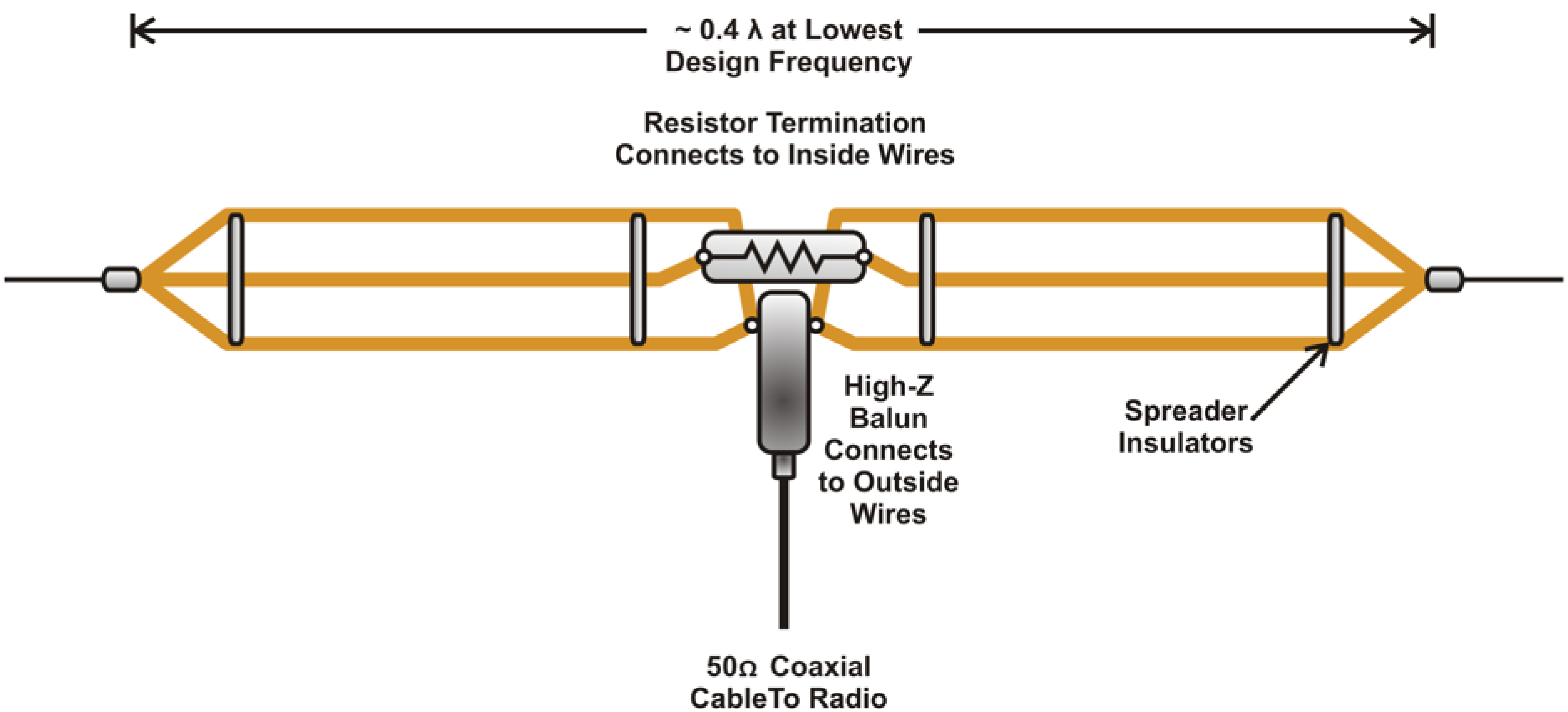


Foldet dipol



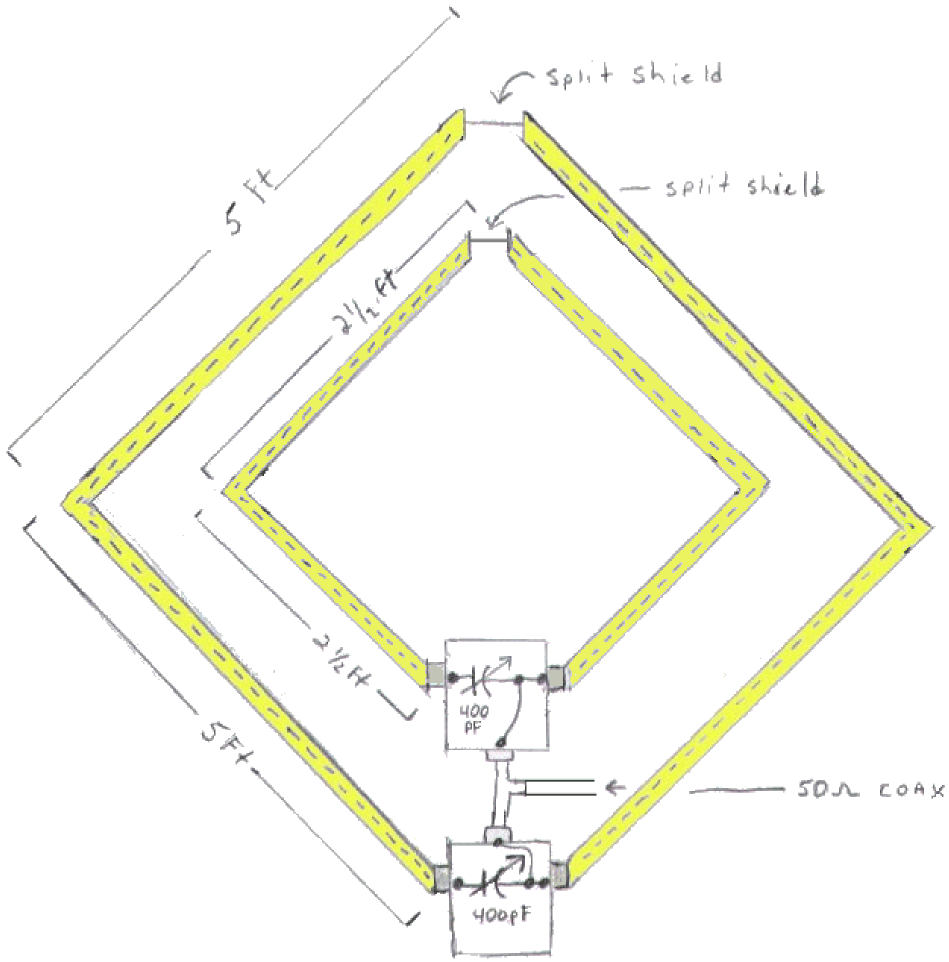
Terminated Folded Dipole Antenna (T2FD or TFD)
Inverted-V Configuration

T3FD, (variant av T2FD)

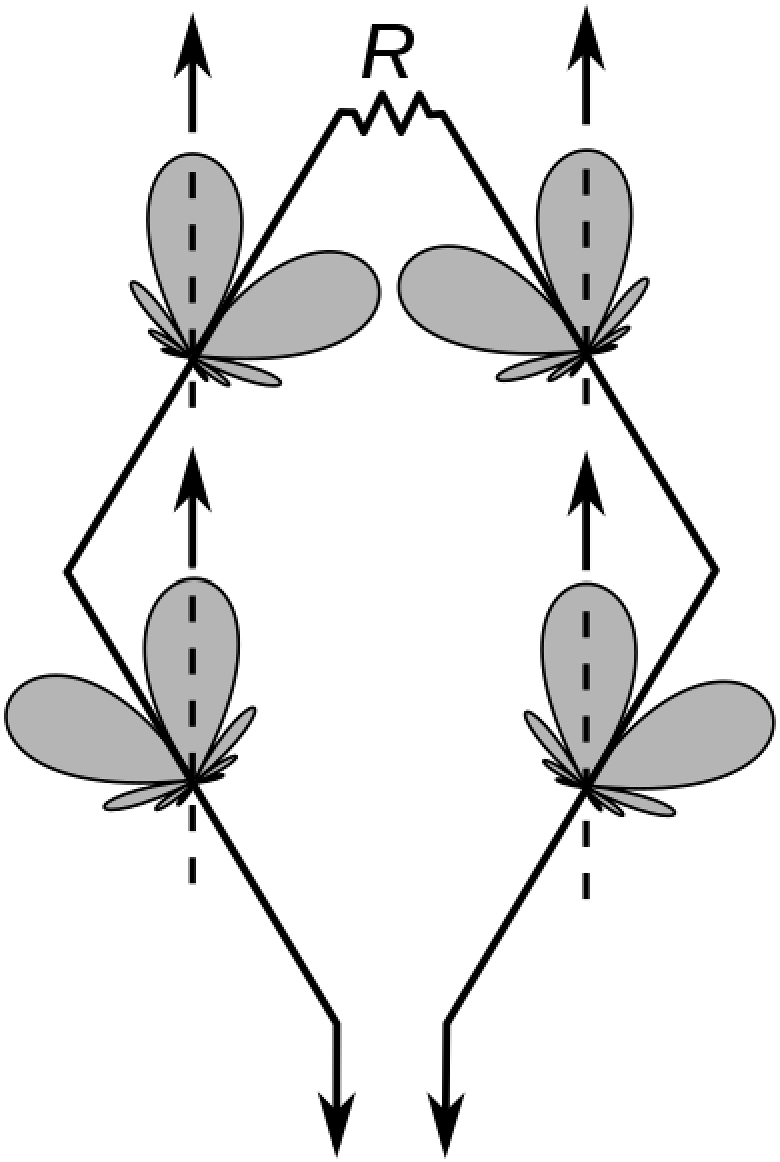


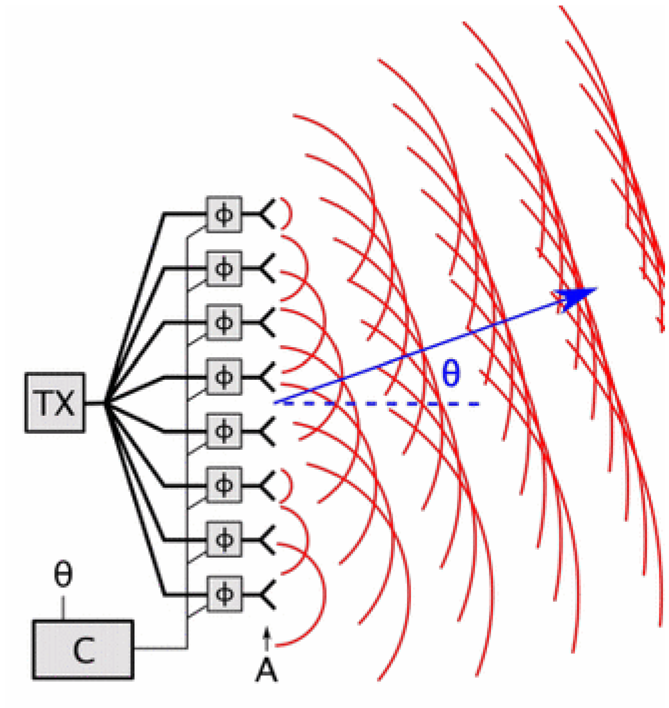
Terminated 3- wire Folded Dipole Antenna (T3FD)

Loop antenne for mottak av magnetisk felt

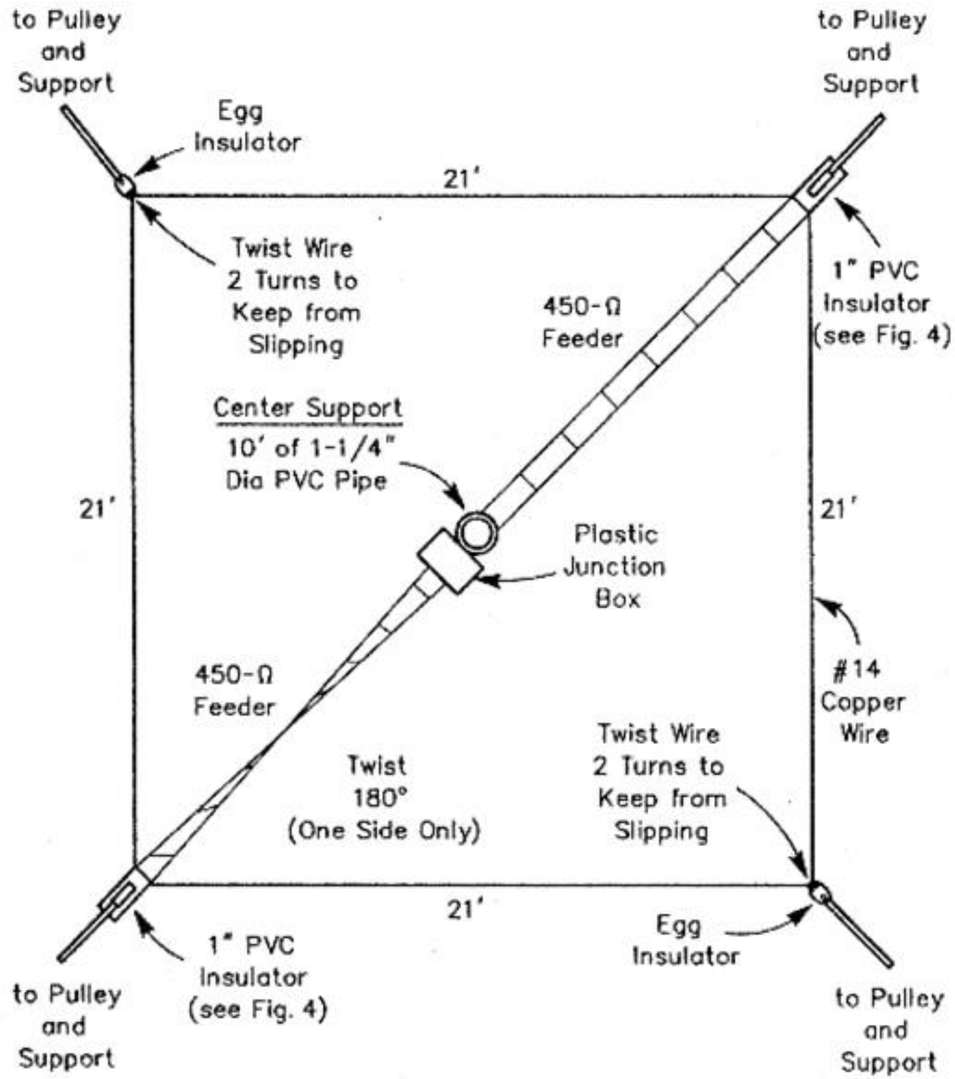


Rhombisk og faset antenne





Lav horisontal loop, K6STI



Looking down on the K6STI squarw - an 80 and 160 meter antenna that reduces interference from powerline noise. At W6KUT's location the antenna is installed at a height of 10 feet. A 10 foot long 1¼" diameter PVC pipe acts as a center support.

Doug DeMaw, W1FB, QST April 1988

On-Ground Low-Noise Receiving Antennas

There is much discussion about low-noise receiving antennas for 160 and 80 meters. Here are the results of some of my experiments with these antennas.

By Doug DeMaw, W1FB

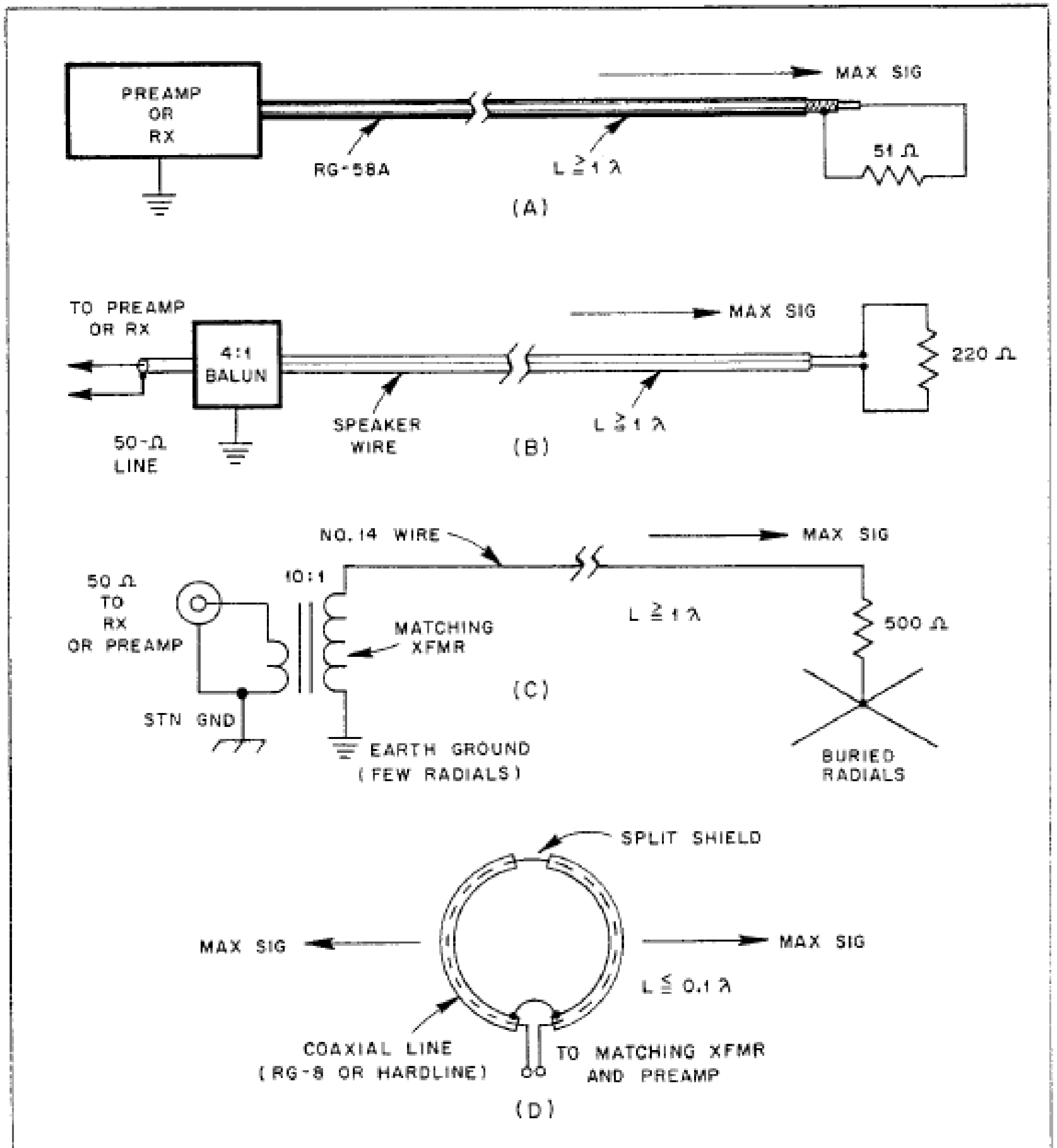


Fig 1—Examples of low-noise receiving antennas. The snake antenna with coaxial cable is shown at A. A 51-Ω terminating resistor is used rather than short-circuiting the far end of the line (see text). Example B shows the W1FB parallel-wire snake antenna that uses no. 22 speaker wire. A 220-Ω termination and a 4:1 balun transformer provide a 50-Ω match to a preamplifier or receiver. Antenna C is a classic Beverage antenna. The earth supplies the missing conductor for this two-wire transmission line. A shielded receiving loop is shown at D (see note 3).

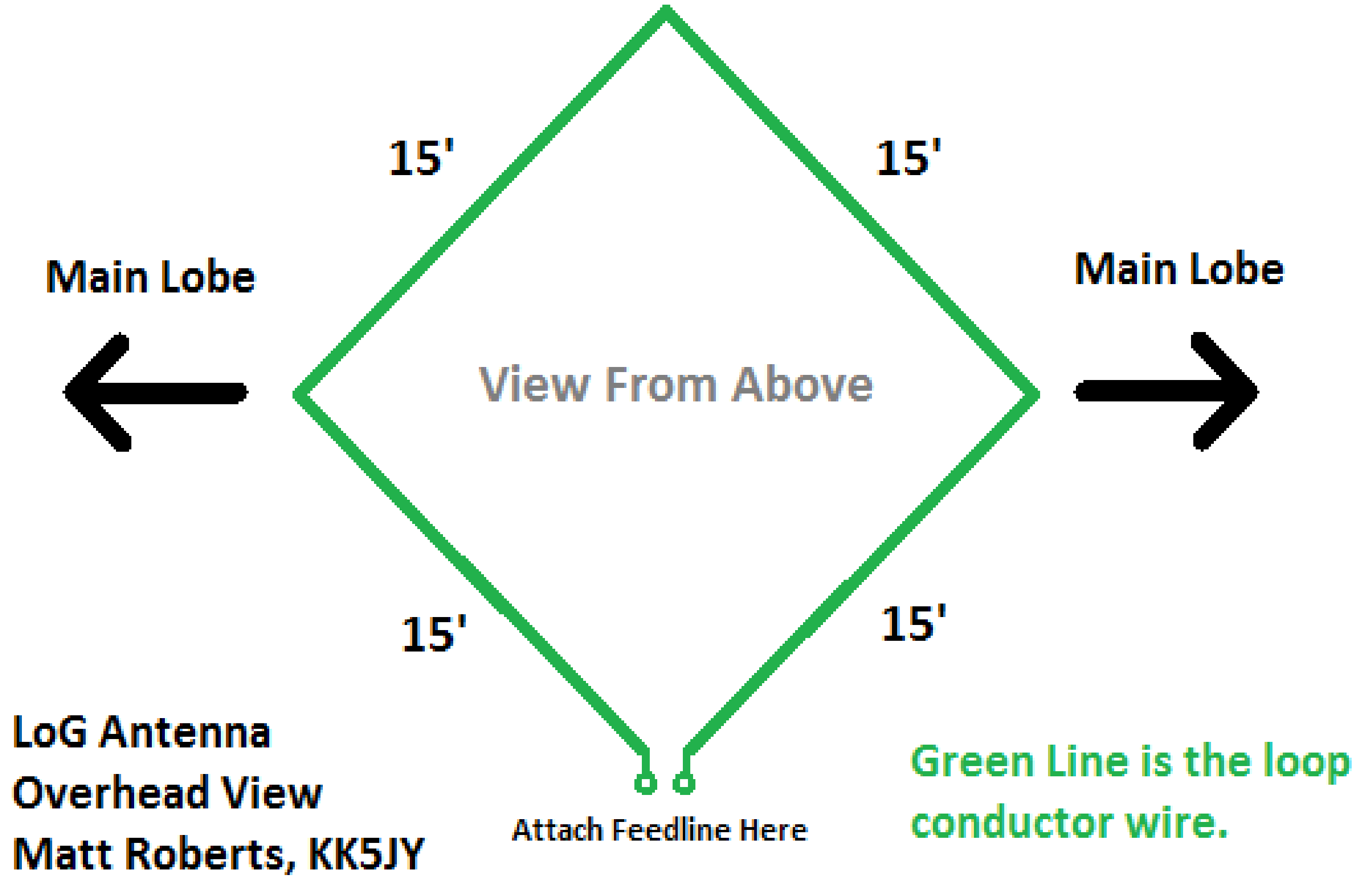
I find the performance of the parallel-wire snake to be as good as that of the coaxial snake antenna. Certainly the cost

I have also used large wire loops that were simply laid on the ground. Excellent results were obtained with these antennas on 160 meters. Don't hesitate to experiment. Use whatever system reduces the noise pickup without seriously degrading the level of the

Antenner på bakken

- Ingen ny ide.
- "Beverage on Ground" eller "BoG“ etc. finnes.
- Effektive for mottak av HF "skywave" signaler.
- Horisontale antenner (dipoler og lign.) blir vertikalt polarisert pga jordrefleksjoner som kansellerer horisontalt polariserte bølger.
- Store tap til jord og blir uegnet til sending.
- Lavere resonans for dipoler o.l.

Loop on Ground, LoG, KK5JY

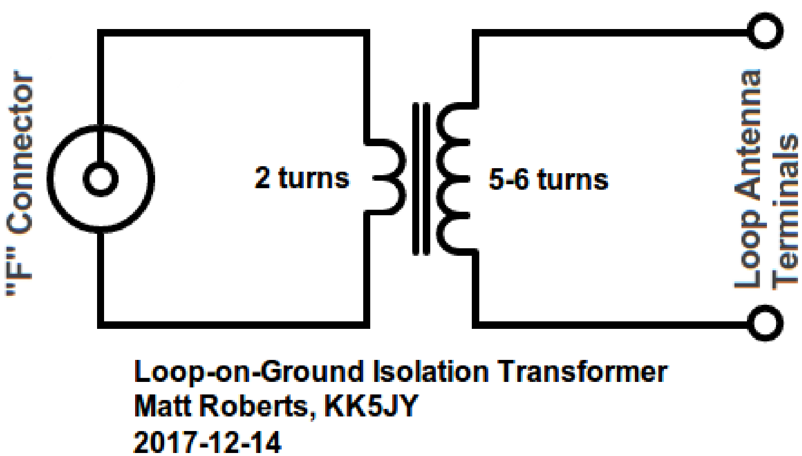


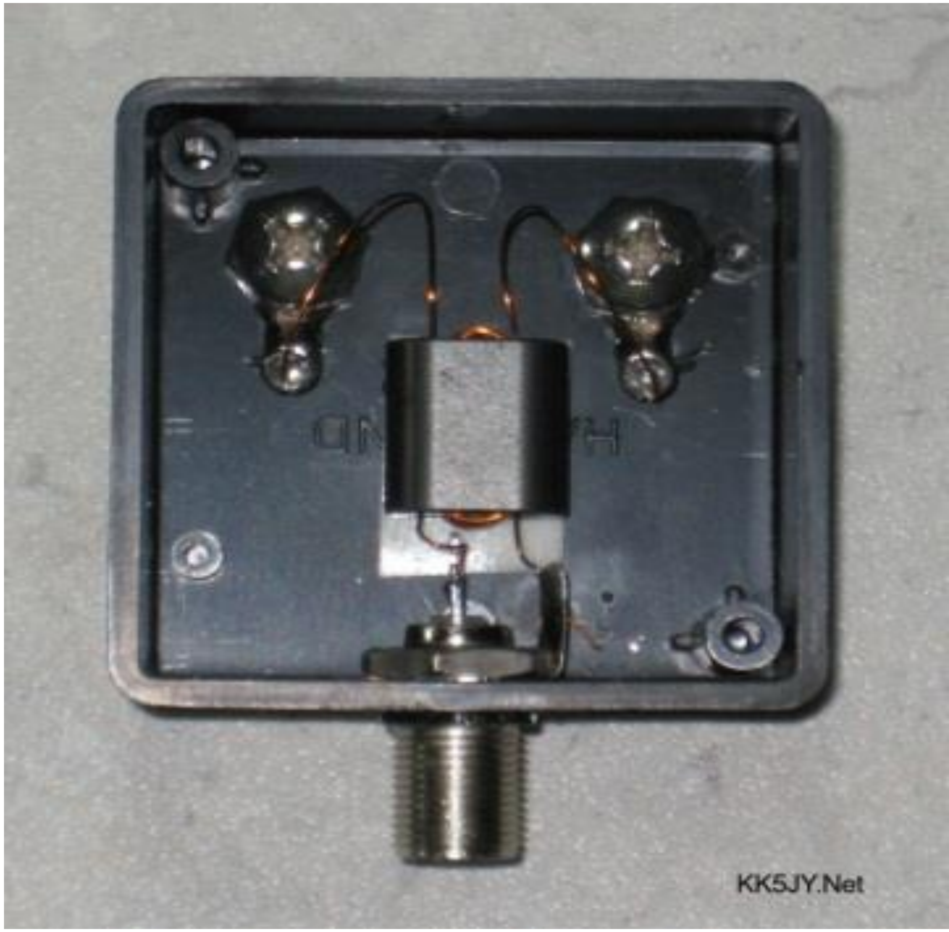
LoG KK5JY, karakteristikker

- Asimutresponsen for en enkelt loop er bidireksjonal ved lave elevasjonsvinkler og blir raskt mer uniform ved økende vinkel. Dette gir godt mottak for både DX og lokale stasjoner.
- Det beste DX mottaket ved lavest -3dB elevasjonsvinkel oppnås med en loop som er ca. 15% av bølgelengden.
- Retningen for maksimum asimutrespons ved lave elevasjonsvinkler står normalt (90°) på fødepunktet.
- Observert signal/støy forhold er lavt og lavt nok for de fleste vanlige mottakere uten bruk av forsterker ved antennen. Dette er en subjektiv observasjon og er ikke bekreftet ved målinger.

LoG, Balun

- Balun; 6.25:1 (75 ohm til 470 ohm)
- Ferrit; Fair-Rite#73

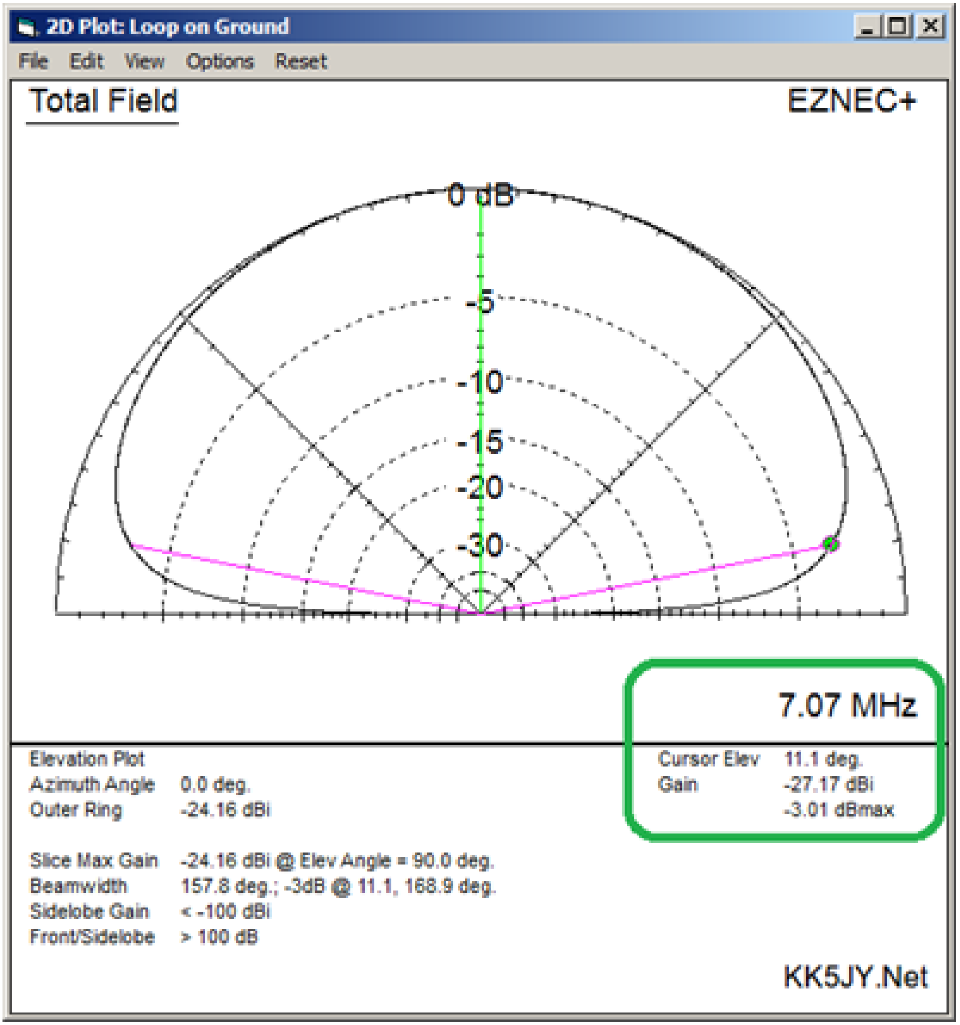


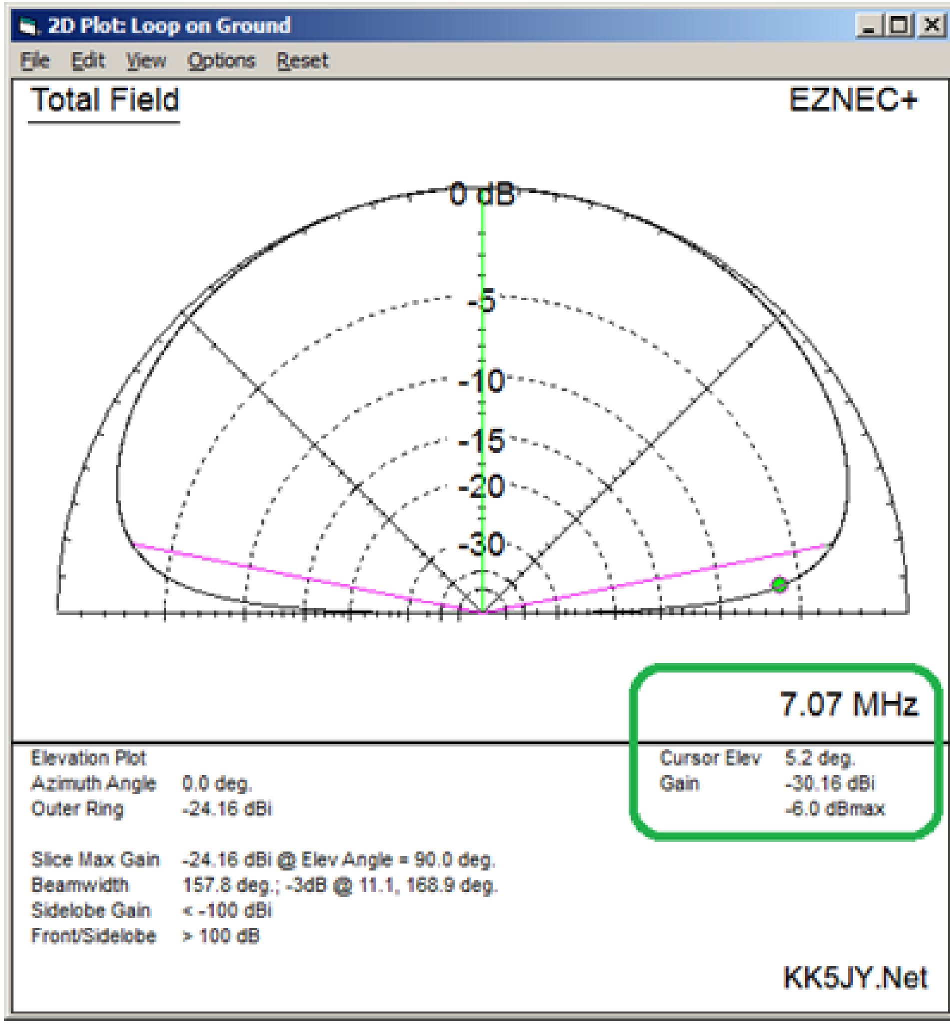


Modellering

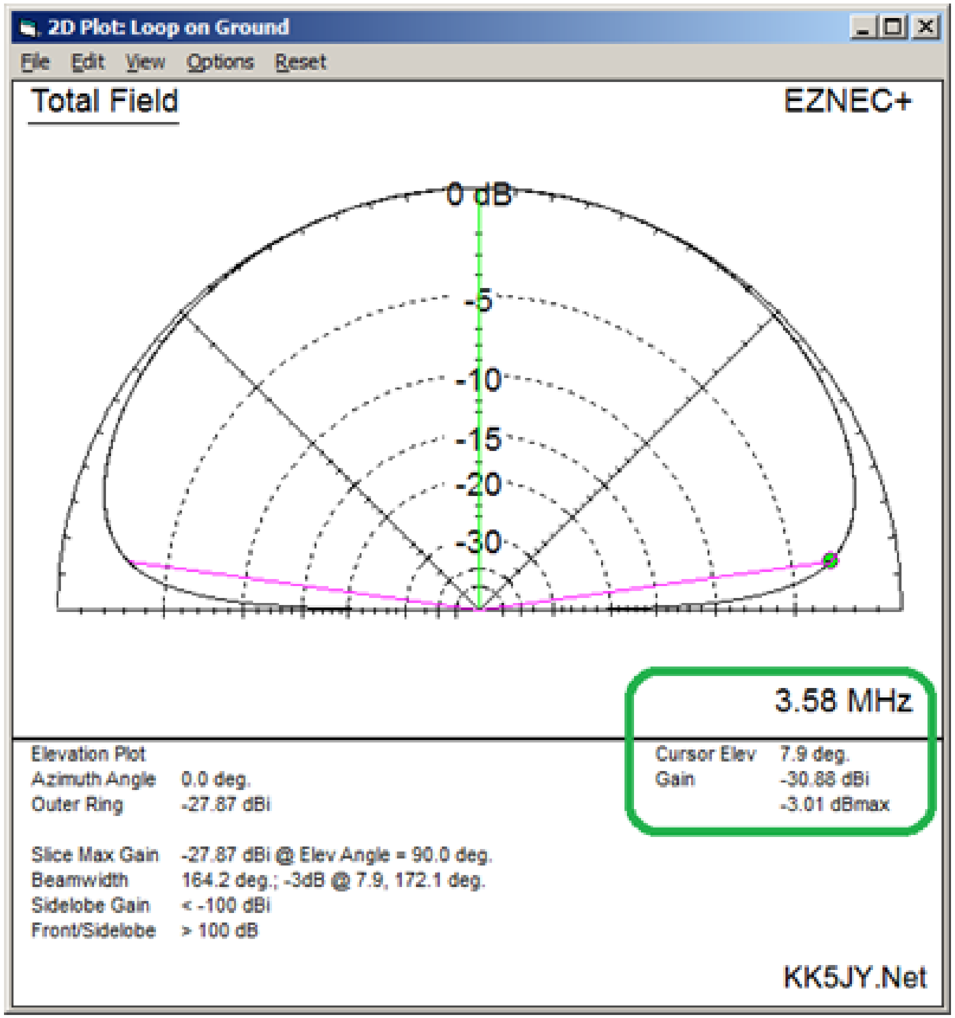
- EZNEC+ program
- -3 dB og -6 dB punktene (grønne punkter)
- -6 dB punktet er en S enhet lavere enn ved 90°

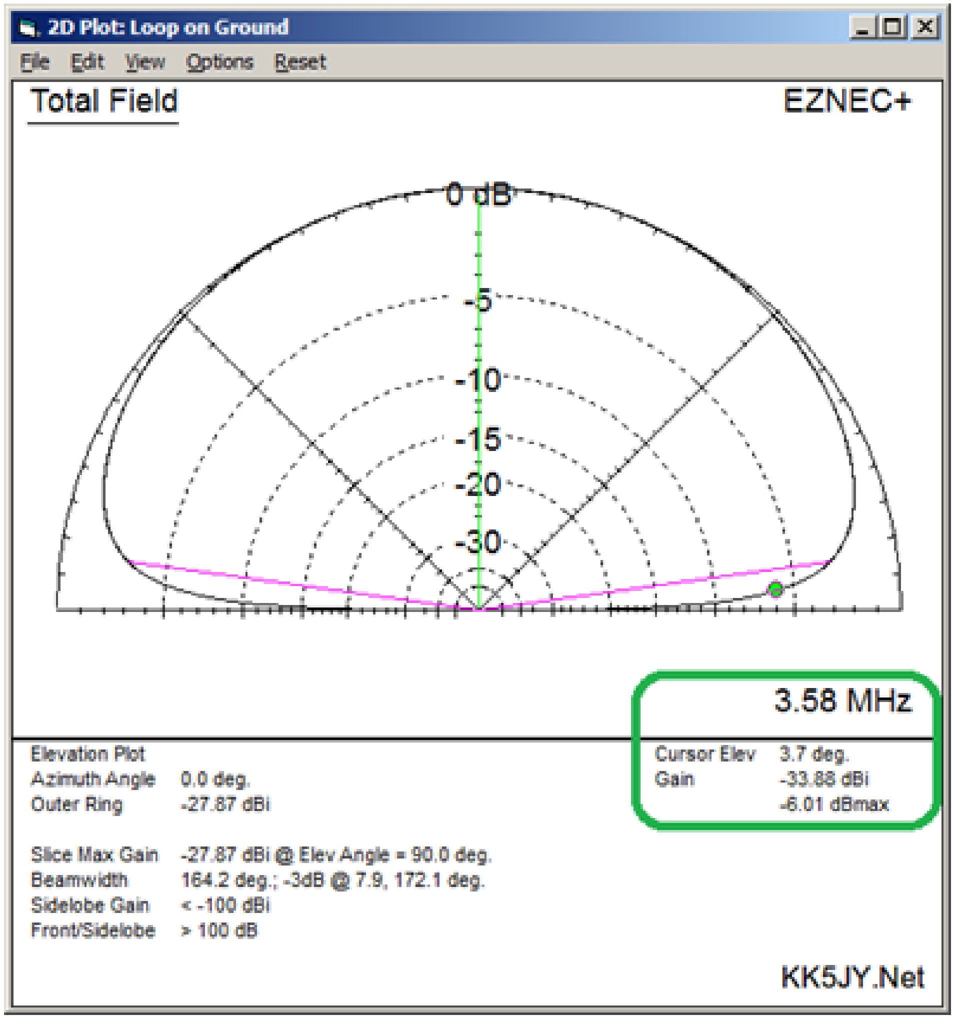
40 m


2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
7.07 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -24.16 dBi
Cursor Elev 11.1 deg.
Gain -27.17 dBi
-3.01 dBmax
Slice Max Gain -24.16 dBi @ Elev Angle = 90.0 deg.
Beamwidth 157.8 deg.; -3dB @ 11.1, 168.9 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net

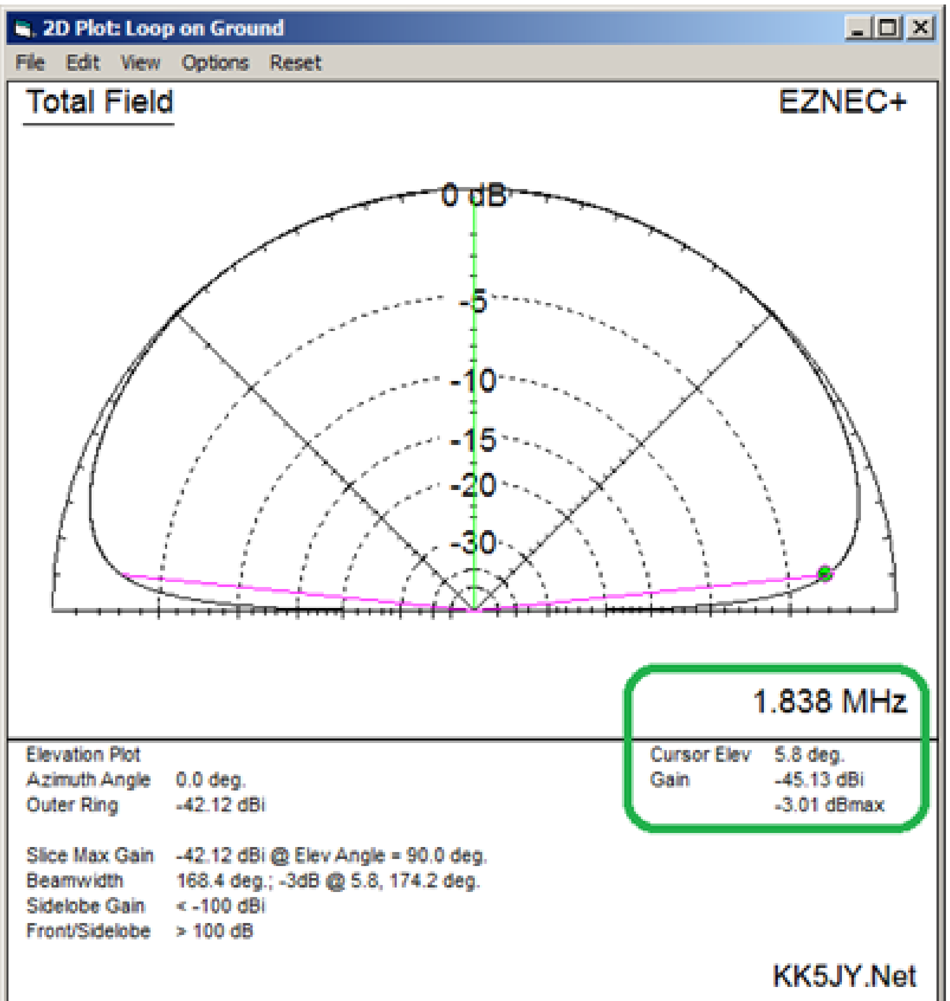

2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
7.07 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -24.16 dBi
Cursor Elev 5.2 deg.
Gain -30.16 dBi
-6.0 dBmax
Slice Max Gain -24.16 dBi @ Elev Angle = 90.0 deg.
Beamwidth 157.8 deg.; -3dB @ 11.1, 168.9 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net

80 m

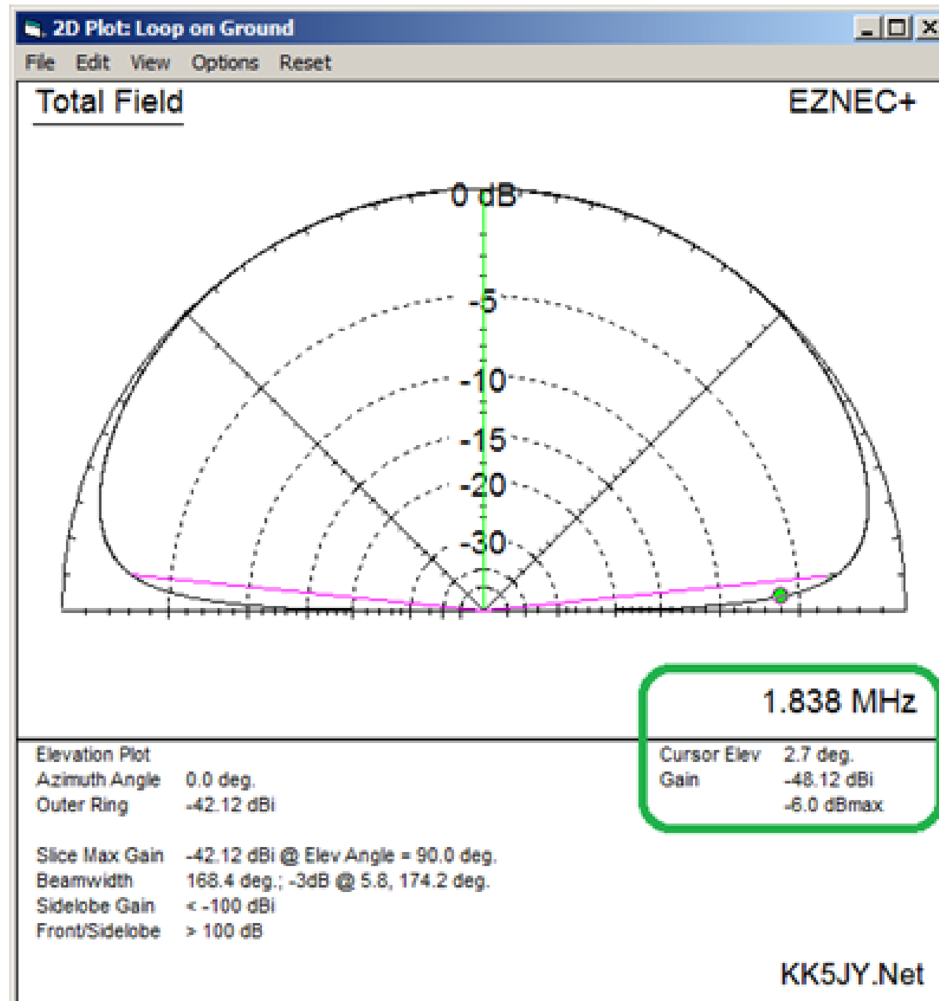

2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
3.58 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -27.87 dBi
Cursor Elev 7.9 deg.
Gain -30.88 dBi
-3.01 dBmax
Slice Max Gain -27.87 dBi @ Elev Angle = 90.0 deg.
Beamwidth 164.2 deg.; -3dB @ 7.9, 172.1 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net


2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
3.58 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -27.87 dBi
Cursor Elev 3.7 deg.
Gain -33.88 dBi
-6.01 dBmax
Slice Max Gain -27.87 dBi @ Elev Angle = 90.0 deg.
Beamwidth 164.2 deg.; -3dB @ 7.9, 172.1 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net

160 m



2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
1.838 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -42.12 dBi
Cursor Elev 5.8 deg.
Gain -45.13 dBi
-3.01 dBmax
Slice Max Gain -42.12 dBi @ Elev Angle = 90.0 deg.
Beamwidth 168.4 deg.; -3dB @ 5.8, 174.2 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net



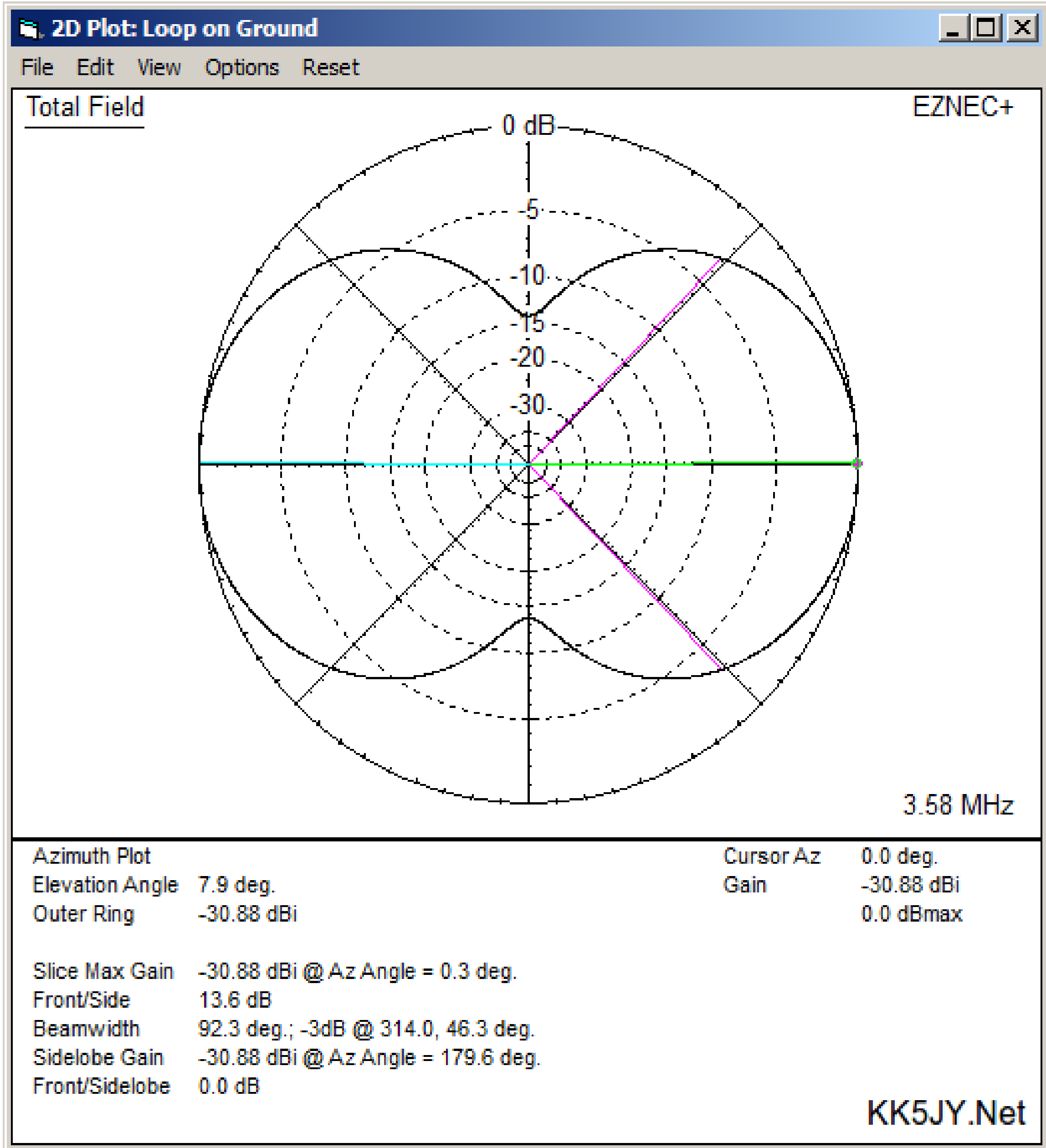
2D Plot: Loop on Ground
File Edit View Options Reset
Total Field
EZNEC+
0 dB
-5
-10
-15
-20
-30
1.838 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring -42.12 dBi
Cursor Elev 2.7 deg.
Gain -48.12 dBi
-6.0 dBmax
Slice Max Gain -42.12 dBi @ Elev Angle = 90.0 deg.
Beamwidth 168.4 deg.; -3dB @ 5.8, 174.2 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
KK5JY.Net

Modellering LoG oppsummert

	Gain, dBi	Gain, dBi
Bånd	-3dB	-6dB
40	-27,2	-30,2
80	-30,9	-33,9
160	-45,1	-48,1

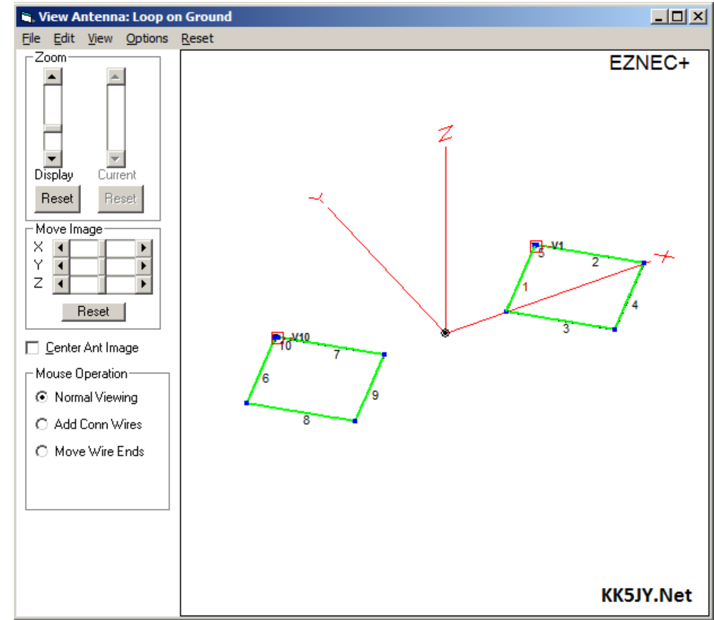
	Elevasjon °	Elevasjon °
Bånd	-3dB	-6dB
40	11,1	5,2
80	7,9	3,7
160	5,8	2,7

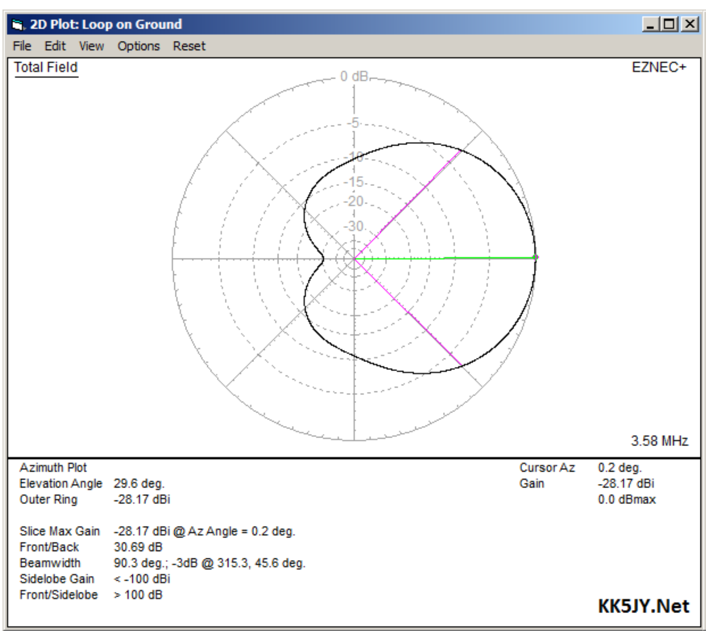
80 m, asimut respons ved 8° elev.

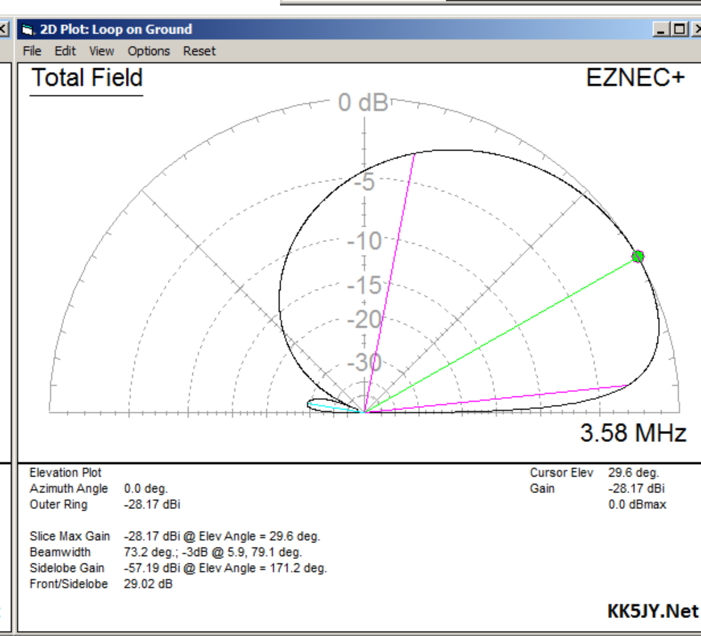


Faset 2xloop

- Fasing ved differanse i kabel lengde.
- Unidireksjonell (0°) (figur)
- Bidireksjonell (180°) fasing.







Beverage on Ground, N6LF, QST June, QEX July/Aug. 2016

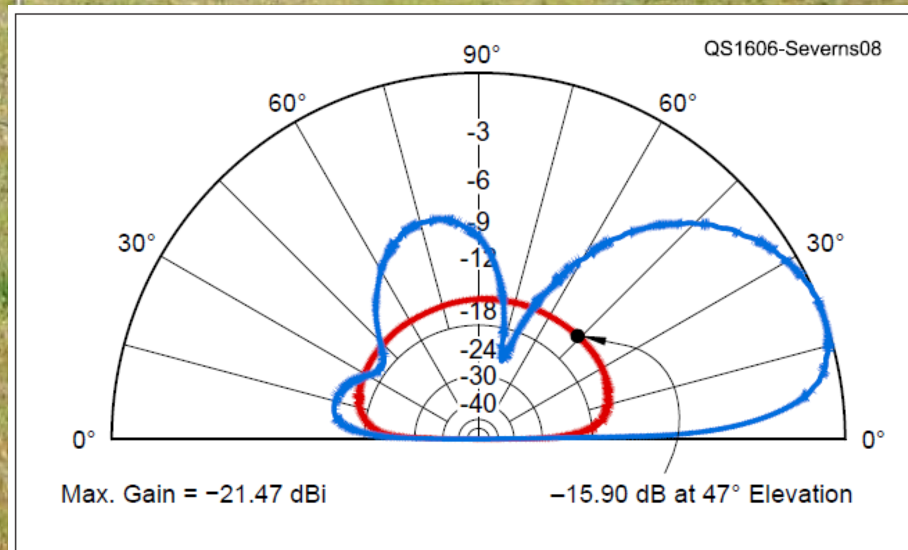
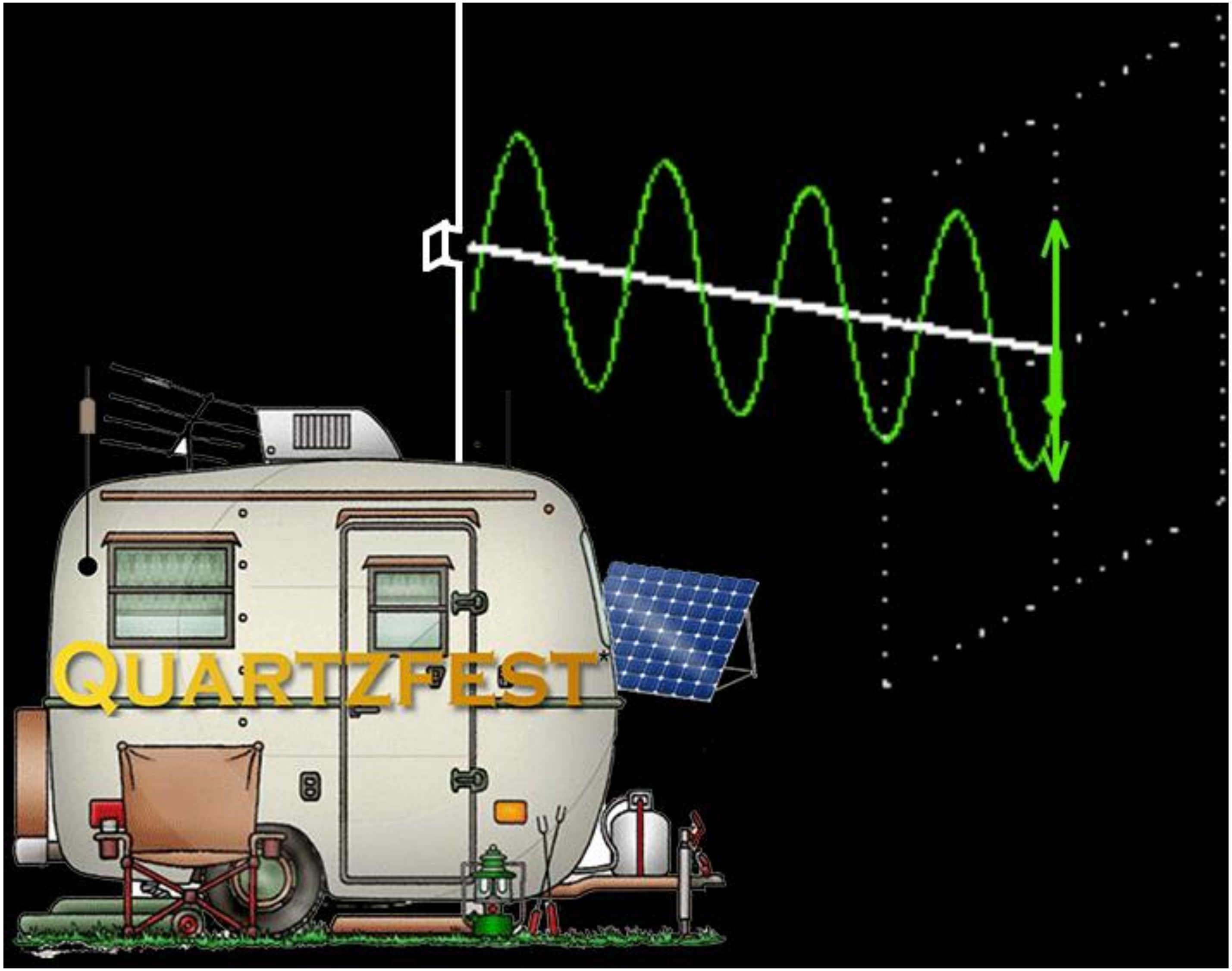


Figure 8 — Elevation radiation patterns for the BOG 1 inch above ground (blue) and 1 inch below ground (red).


QUARTZFEST*