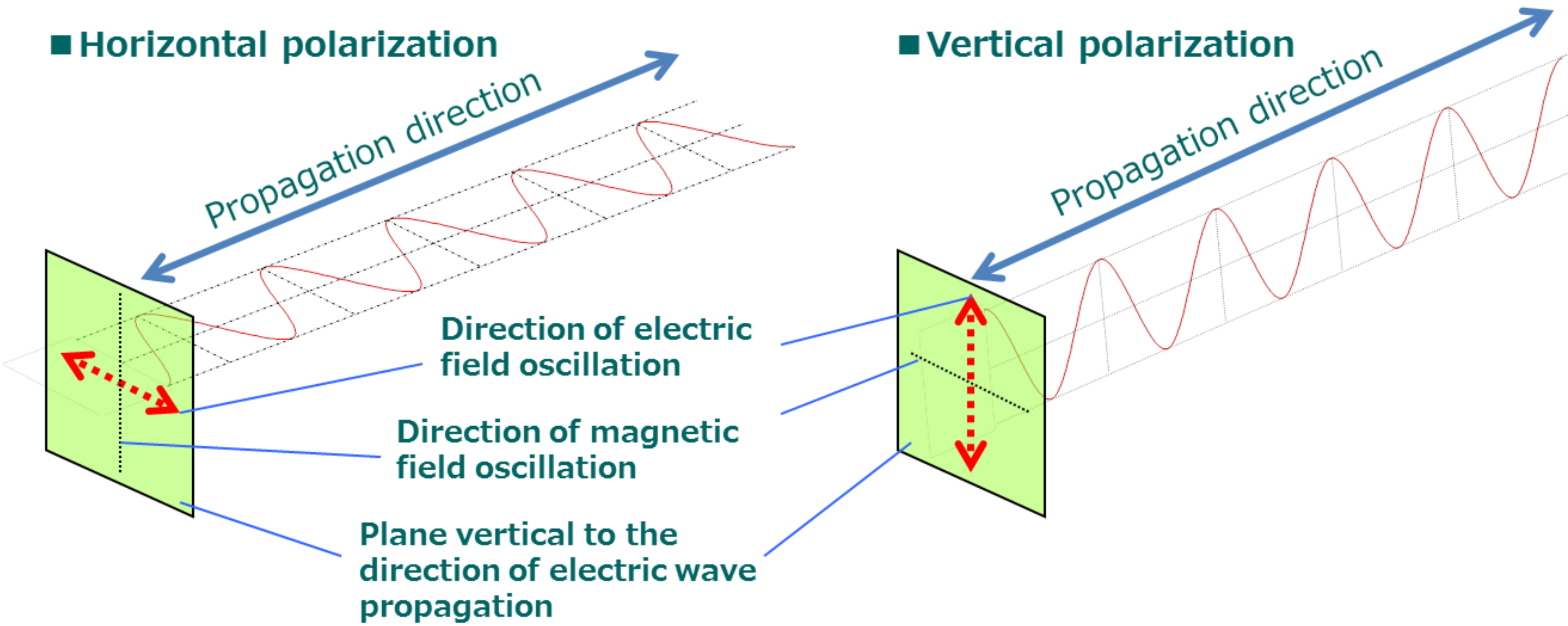
Horisontale antenner

LB9RE, oktober 2016

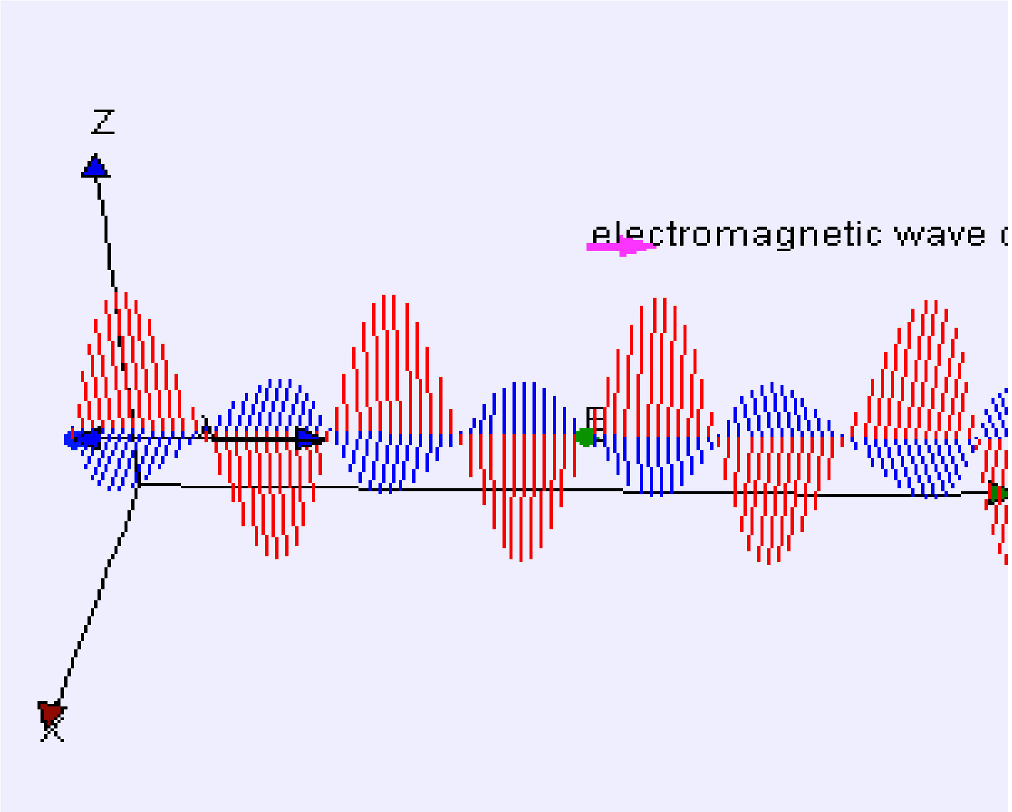
Typer

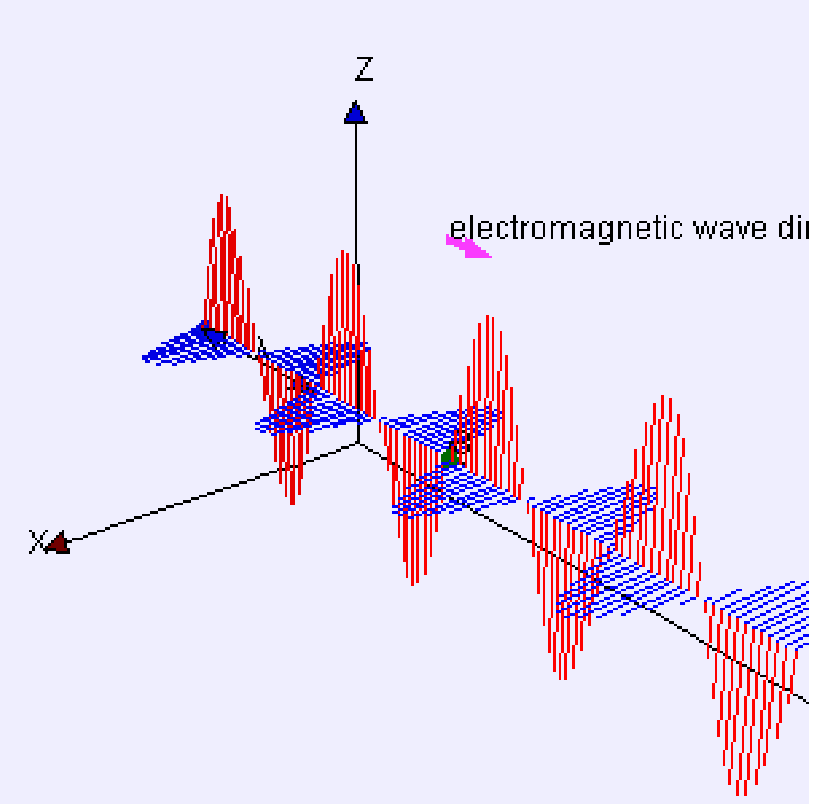
- Lang tråd (Longwire), eks. Zepp
- Dipoler
- Dipoler med forskjøvet føding; eks. Windom, G5RV
- Beam
- Logaritmisk
- Foldet dipol, T2F etc.
- Loop
- Big Weel
- Rombisk
- Beaveridge
- Og mange flere…..

Polarisering

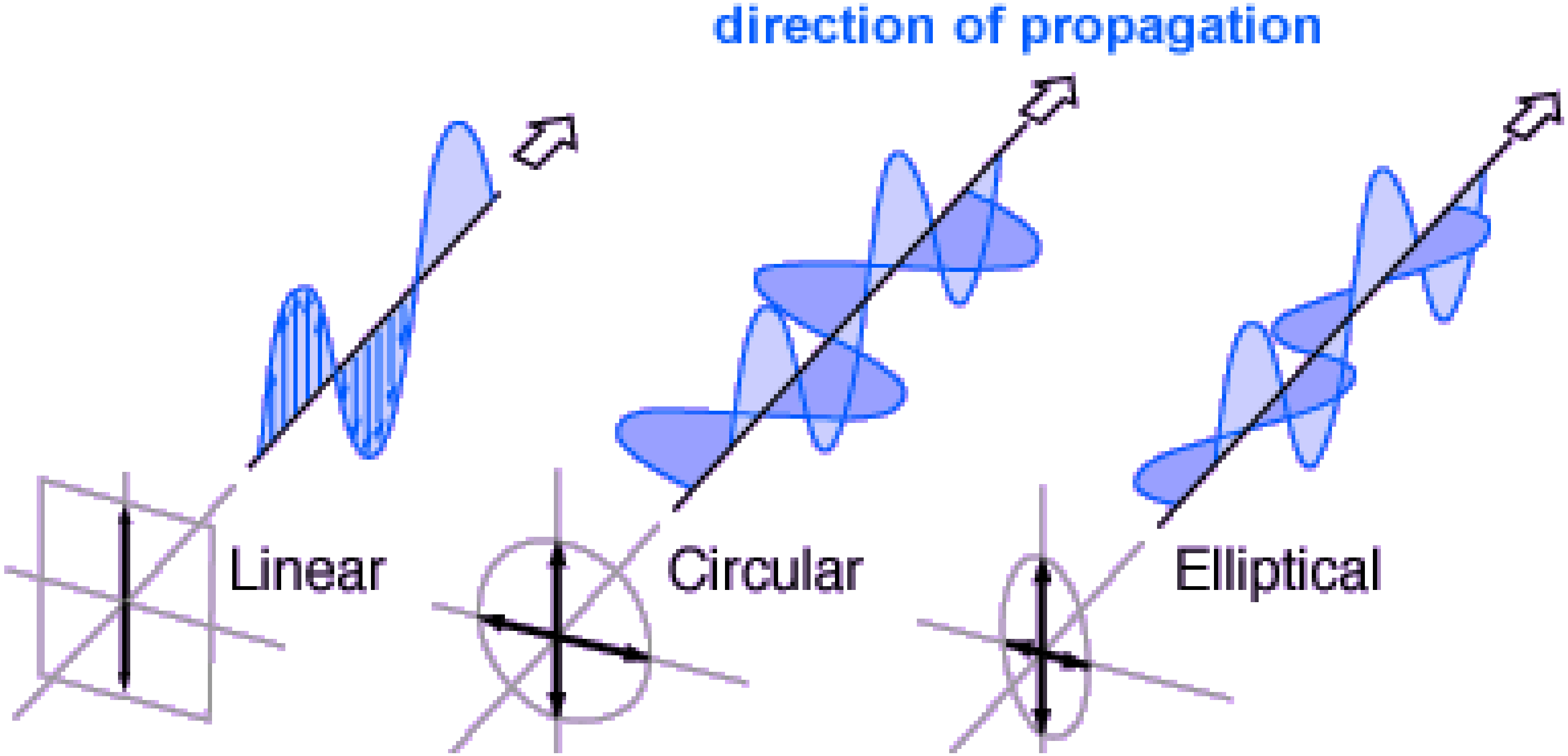


Elektrisk og magnetisk felt





Andre polariseringer



Helse Miljø og Sikkerhet

Table A — (From §1.1310) Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	*Electric Field Strength (V/m)*	*Magnetic Field Strength (A/m)*	*Power Density (mW/cm²)*	*Averaging Time (minutes)*
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	$(900/f^2)$*	6
30-300	61.4	0.163	1.0	6
300-1500	—	—	f/300	6
1500-100,000	—	—	5	6

f = frequency in MHz
* = Plane-wave equivalent power density (see Note 1).

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	*Electric Field Strength (V/m)*	*Magnetic Field Strength (A/m)*	*Power Density (mW/cm²)*	*Averaging Time (minutes)*
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	$(180/f^2)$*	30
30-300	27.5	0.073	0.2	30
300-1500	—	—	f/1500	30
1500-100,000	—	—	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density (see Note 1).
Note 1: This means the equivalent far-field strength that would have the E or H-field component calculated or measured. It does not apply well in the near field of an antenna. The equivalent far-field power density can be found in the near or far field regions from the relationships: $P_d = |E_{total}|^2 / 3770$ mW/cm² or from $P_d = |H_{total}|^2 \times 37.7$ mW/cm².

Table 1-2
Typical RF Field Strengths Near Amateur Radio Antennas

A sampling of values as measured by the Federal Communications Commission and Environmental Protection Agency, 1990

Antenna Type	*Freq (MHz)*	*Power (W)*	*E Field (V/m)*	*Location*
Dipole in attic	14.15	100	7-100	In home
Discone in attic	146.5	250	10-27	In home
Half sloper	21.5	1000	50	1 m from base
Dipole at 7-13 ft	7.14	120	8-150	1-2 m from Earth
Vertical	3.8	800	180	0.5 m from base
5-element Yagi	21.2	1000	10-20	In shack
			14	12 m from base at 60 ft
3-element Yagi	28.5	425	8-12	12 m from base at 25 ft
Inverted V	7.23	1400	5-27	Below antenna at 22-46 ft
Vertical on roof	14.11	140	6-9	In house
			35-100	At antenna tuner
Whip on auto roof	146.5	100	22-75	2 m antenna
			15-30	In vehicle
			90	Rear seat
5-element Yagi	50.1	500	37-50	10 m antenna at 20 ft

Eksponering for stråling

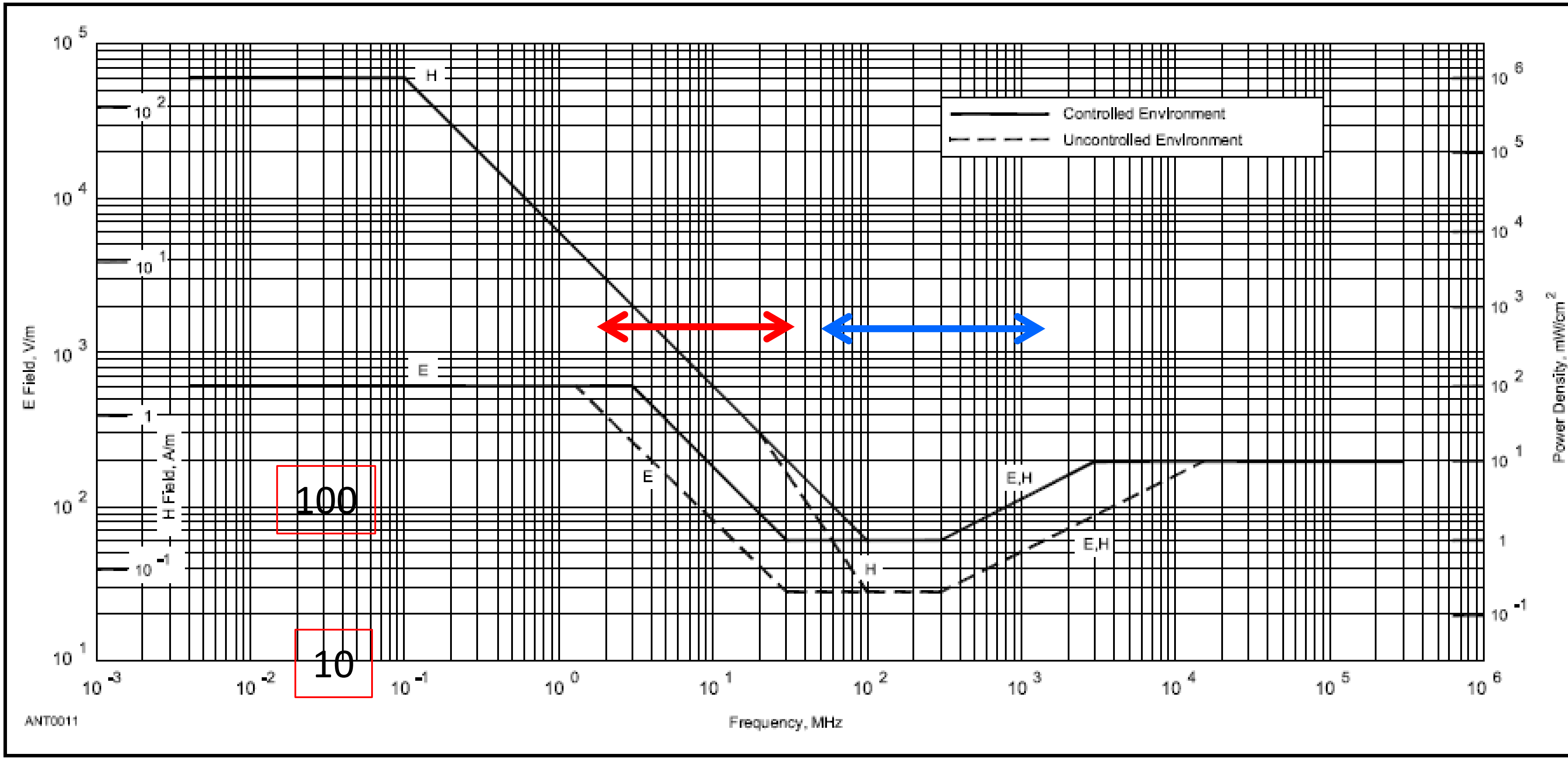


Figure 1.16 — 1991 RF protection guidelines for body exposure of humans. It is known officially as the "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz."

Introduction to the Decibel

The power gain and pattern measurements such as front-to-back ratio of an antenna system are usually expressed in decibels (dB). The decibel is a practical unit for measuring power ratios because it is more closely related to the actual effect produced at a distant receiver than the power ratio itself. One decibel represents a just-detectable change in signal strength, regardless of the actual value of the signal voltage. A 20-decibel (20 dB) increase in signal, for example, represents 20 observable steps in increased signal. The power ratio (100 to 1) corresponding to 20 dB gives an entirely exaggerated idea of the improvement in communication to be expected. The number of decibels corresponding to any power ratio is equal to 10 times the common logarithm of the power ratio, or

$$dB = 10 \log_{10} \frac{P_1}{P_2}$$

If the voltage ratio is given, the number of decibels is equal to 20 times the common logarithm of the ratio. That is,

$$dB = 20 \log_{10} \frac{V_1}{V_2}$$

When a voltage ratio is used, both voltages must be measured across the same value of impedance. Unless this is done the decibel figure is meaningless, because it is fundamentally a measure of a power ratio.

The main reason a decibel is used is that successive power gains expressed in decibels may simply be added together. Thus a gain of 3 dB followed by a gain of 6 dB gives a total gain of 9 dB. In ordinary power ratios, the ratios must be multiplied together to find the total gain.

A reduction in power is handled simply by subtracting the requisite number of decibels. Thus, reducing the power to ½ is the same as subtracting 3 decibels. For example, a power gain of 4 in one part of a system and a reduction to ½ in another part gives a total power gain of $4 \times ½ = 2$. In decibels, this is $6 - 3 = 3$ dB. A power reduction or loss is simply indicated by including a negative sign in front of the appropriate number of decibels.

When P_2 or V_2 are some fixed reference value, a letter is added to "dB" to indicate "decibels with respect to" the reference value. This allows absolute values of power and voltage to be expressed in dB, as well. You will often encounter dBm (P_2 = 1 mW) and dBμV (V_2 = 1 μV) in Amateur Radio.

For more information about the decibel, read "Power and Decibels" on the ARRL website at **www.arrl.org/files/file/Get%20Licensed/PowerAndDec.pdf**.

Dipolantennen

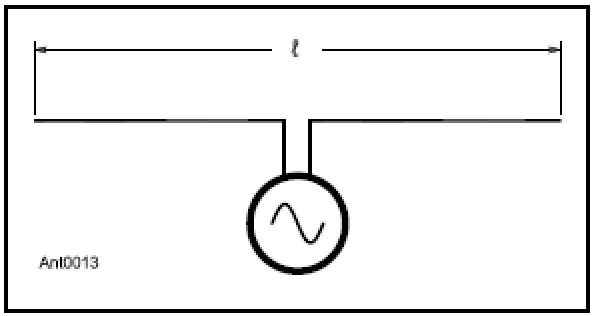


Figure 2.1 — The center-fed dipole antenna. It is assumed that the source of power is directly at the antenna feed point, with no intervening transmission line. Although λ/2 is the most common length for amateur dipoles, the length of a dipole antenna can be any fraction of a wavelength.

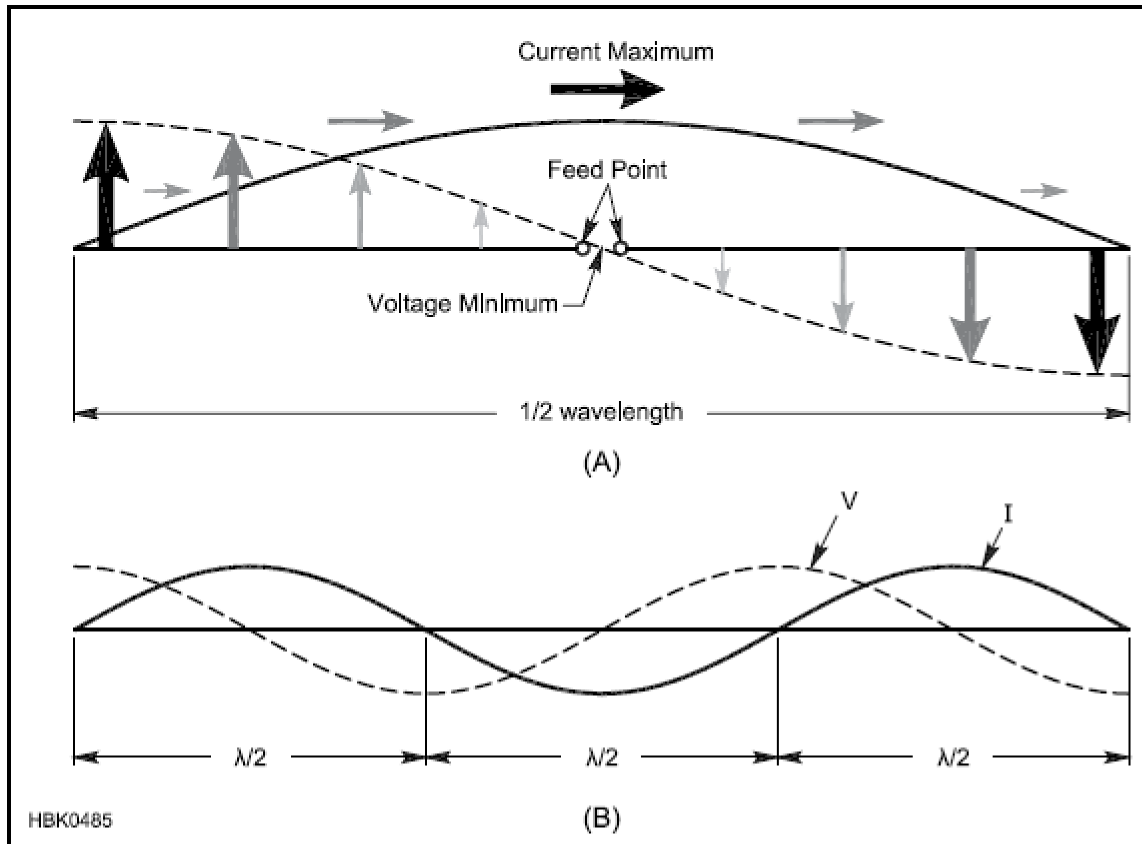
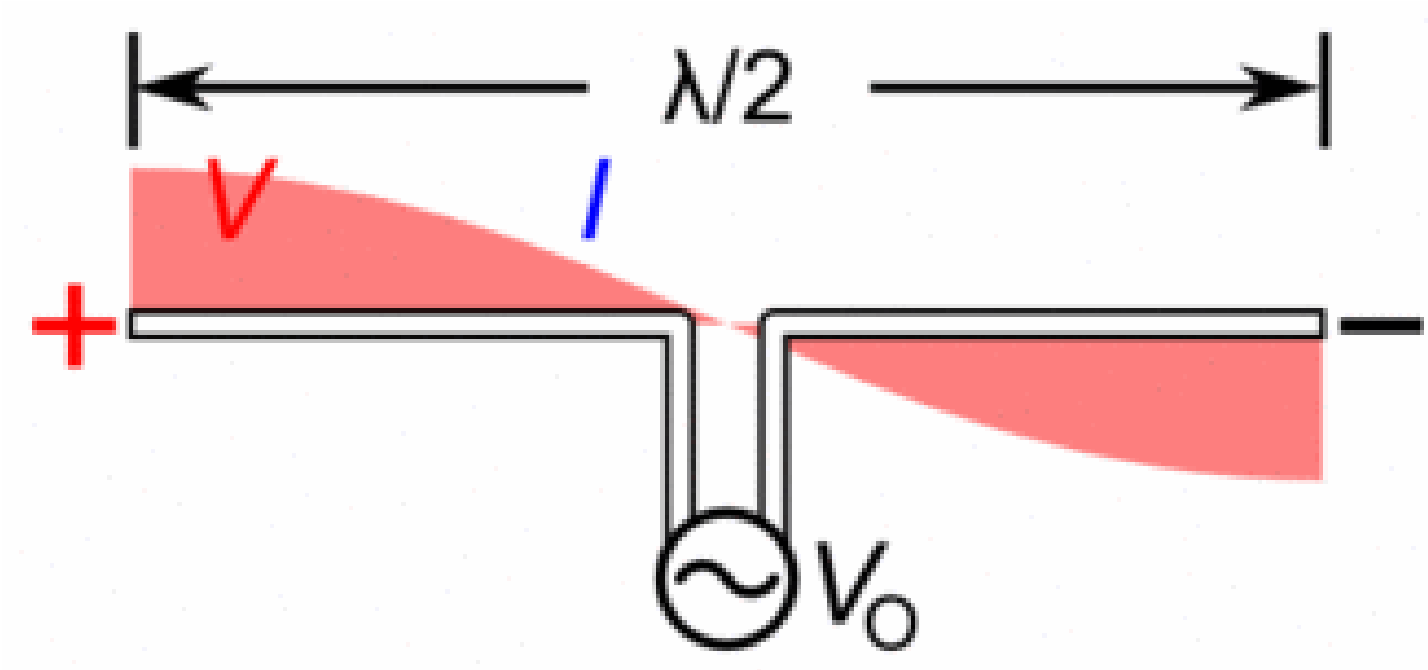
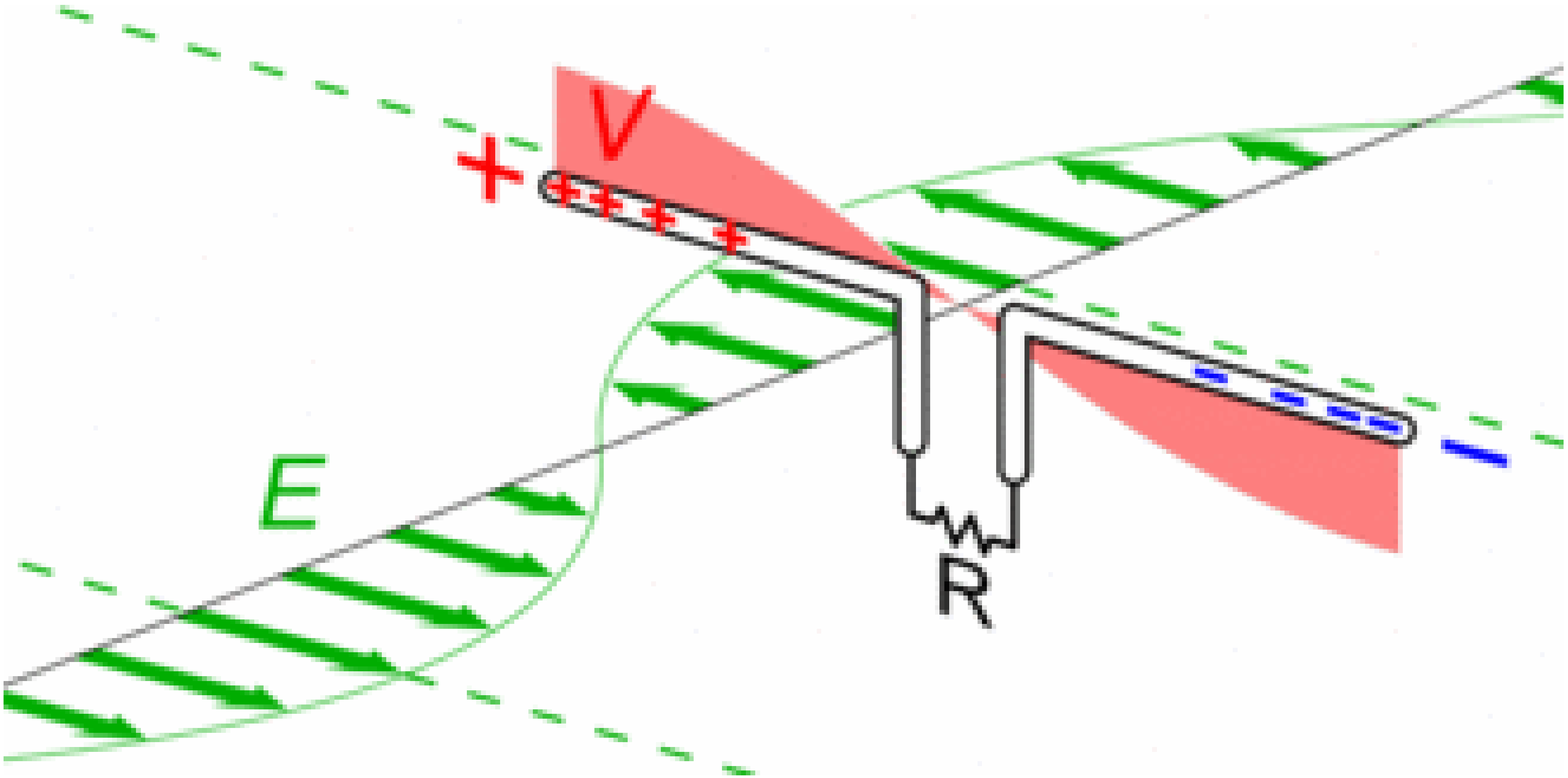


Figure 2.2 — The current and voltage distribution along a half-wave dipole (A) and for an antenna made from a series of half-wave dipoles (B).

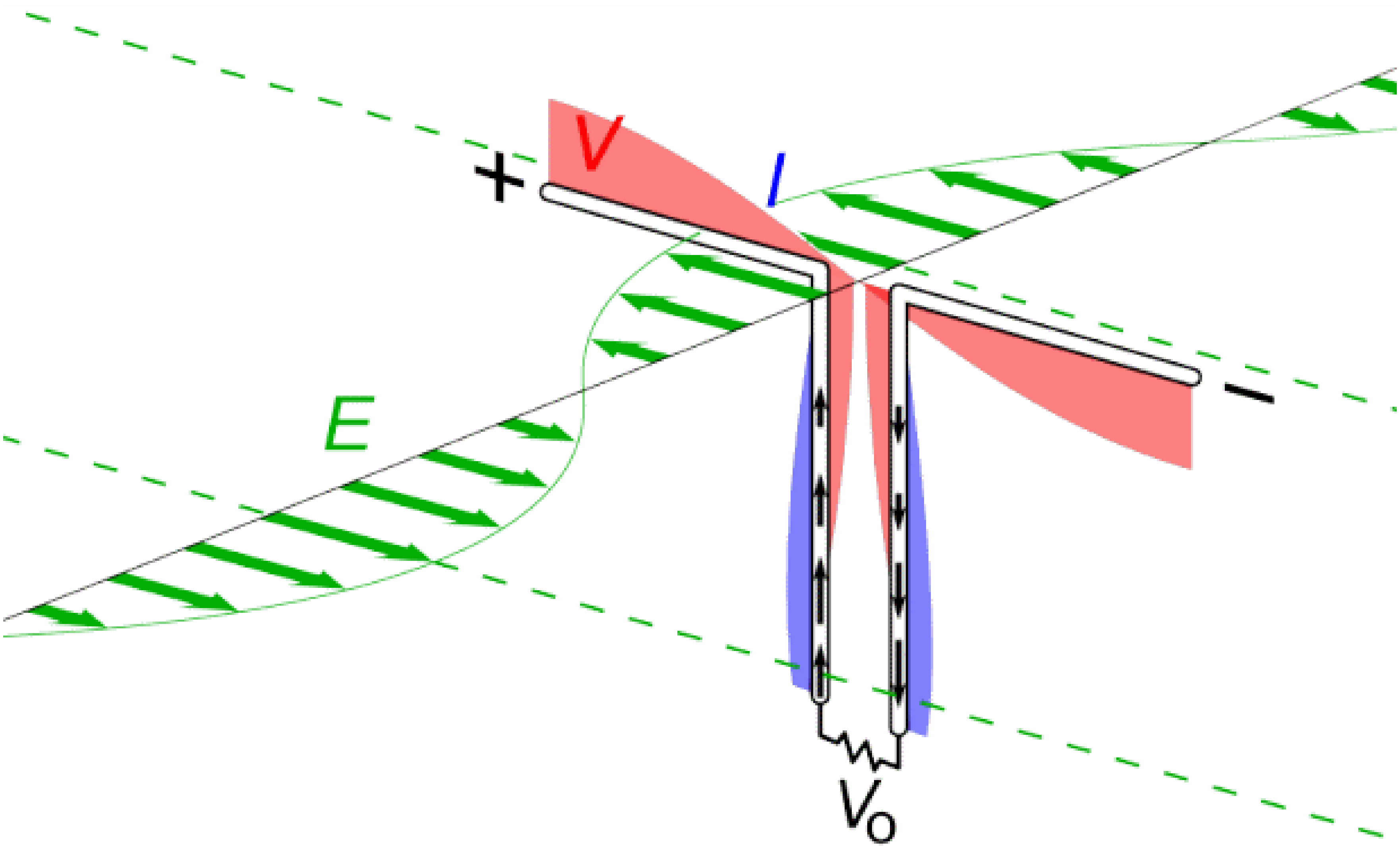
Spenning og strøm over en dipol



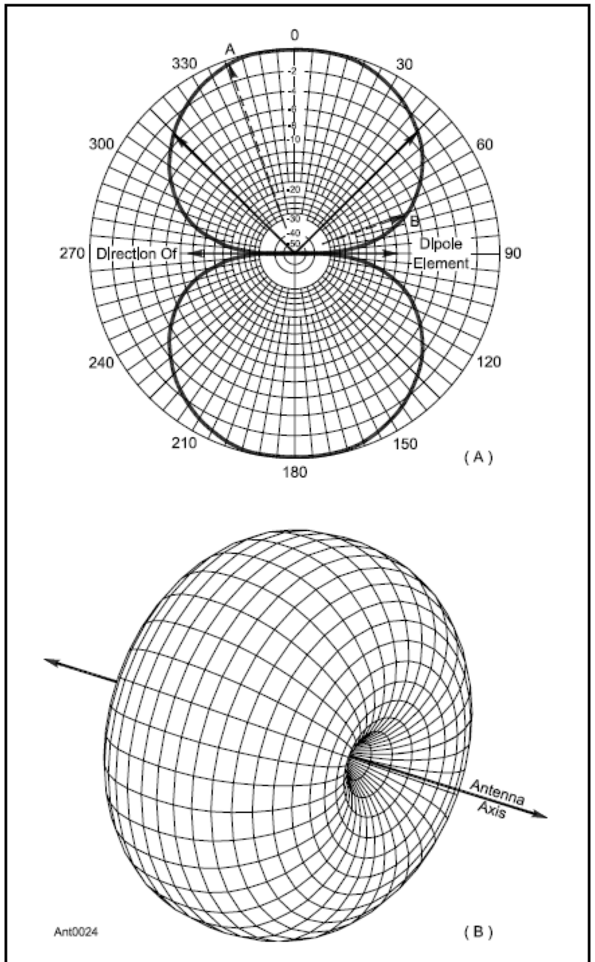
Elektrisk felt og spenning



Elektrisk felt, strøm og spenning



Utstråling fra en dipolantenne



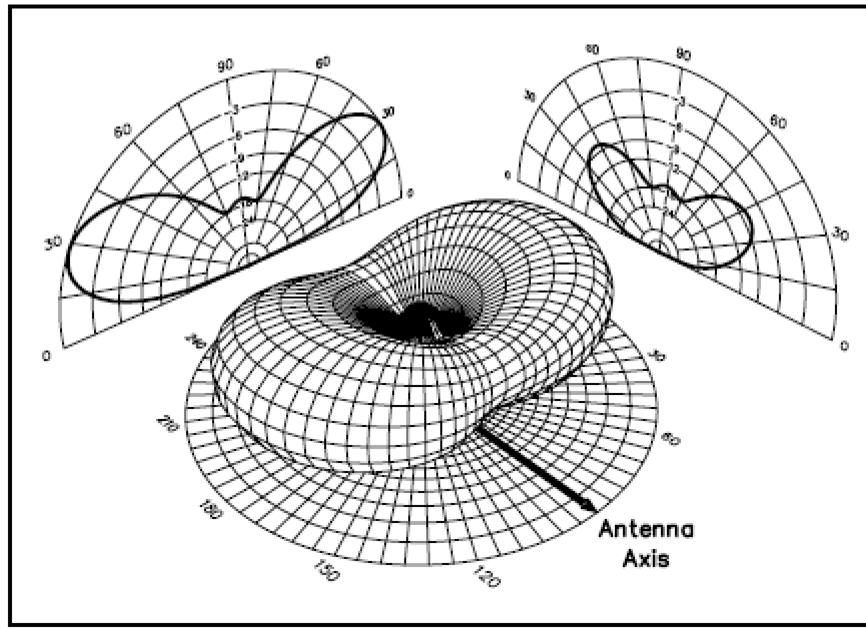


Figure 2.5 — Three-dimensional representation of the radiation patterns of a half-wave dipole, ½ λ above ground.

Impedans for dipoler

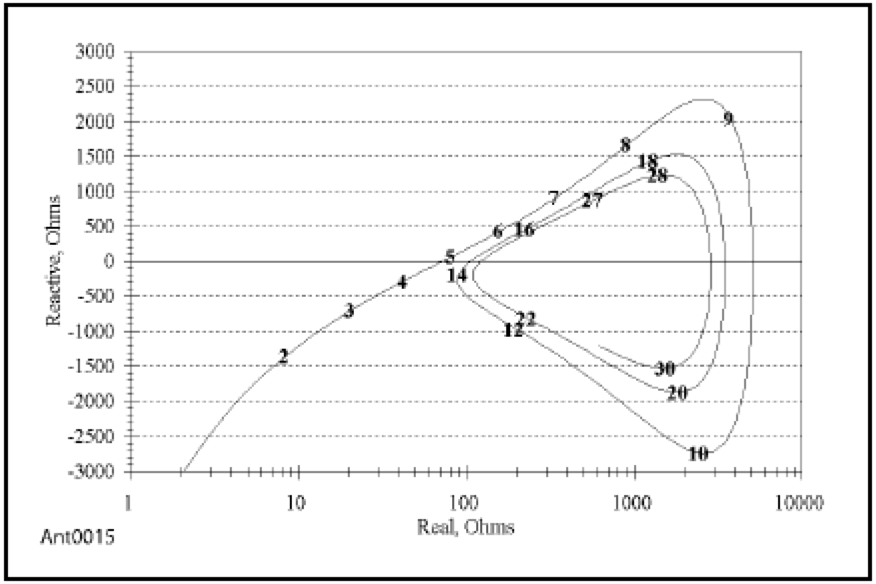


Figure 2.10 — Feed point impedance versus frequency for a theoretical 100-foot long dipole in free space, fed in the center and made of thin 0.1-inch (#10 AWG) diameter wire. Note that the range of change in reactance is less than that shown in Figure 2.9, ranging from –2700 Ω to +2300 Ω. At about 5000 Ω, the maximum resistance is also less than that in Figure 2.9 for the thinner wire, where it is about 10,000 Ω.

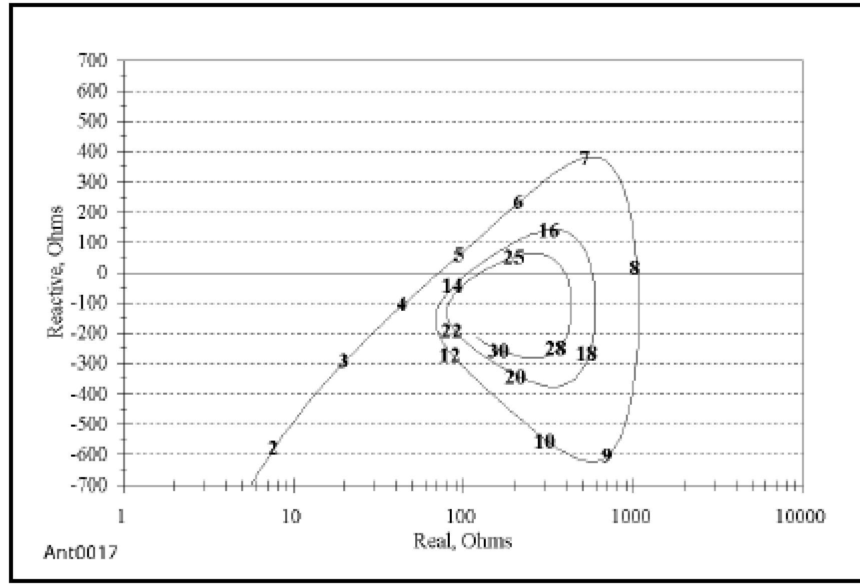
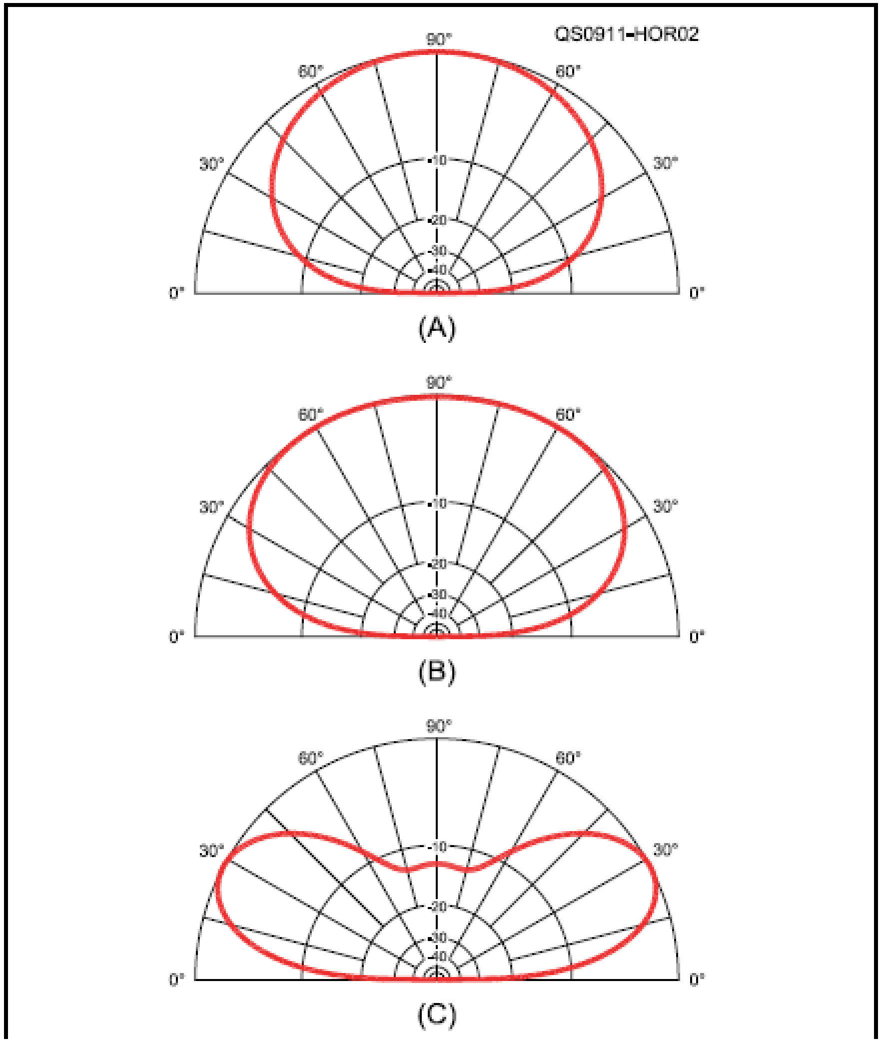


Figure 2.12 — Feed point impedance versus frequency for a theoretical 100-foot long dipole in free space, fed in the center and made of very thick 10.0-inch diameter wire. This ratio of length to diameter is about the same as a typical rod type of dipole element commonly used at 432 MHz. The maximum resistance is now about 1,000 Ω and the peak reactance range is from about –625 Ω to +380 Ω. This performance is also found in "cage" dipoles, where a number of paralleled wires are used to simulate a fat conductor.



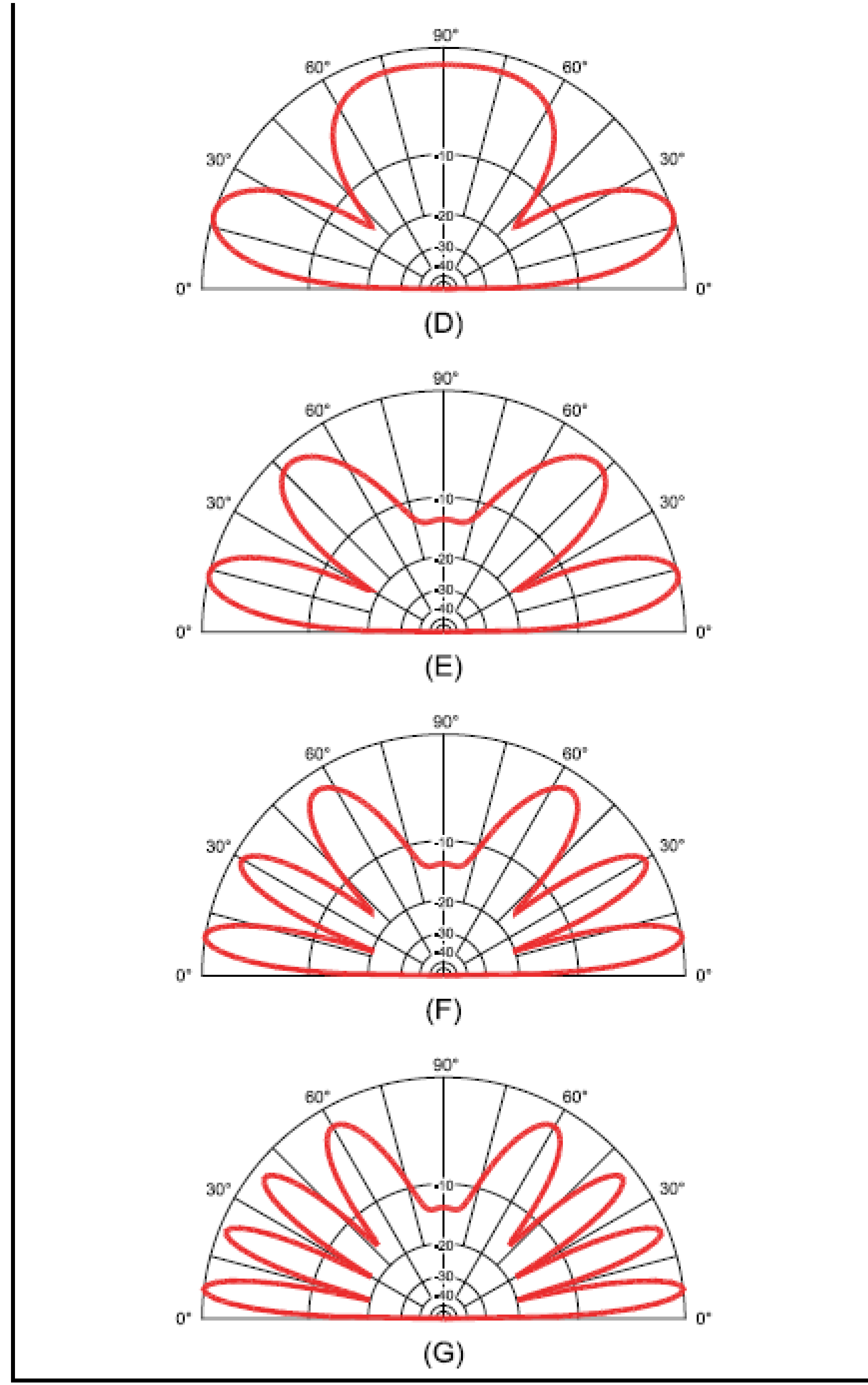


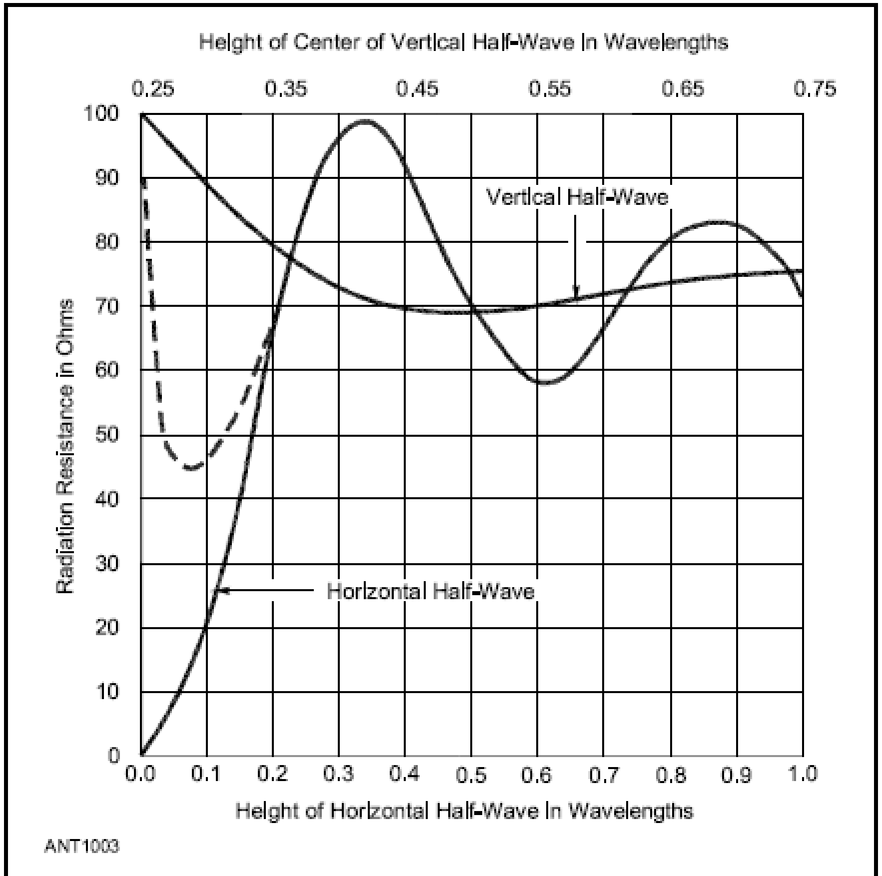
Figure 2.4 — Six radiation patterns for the dipole at different heights: (A) ⅛ λ, (B) ¼ λ, (C) ½ λ, (D) ¾ λ, E) 1 λ, (F) 1½ λ, (G) 2 λ.

Dipoler

Table 2-1
Variation in Dipole Performance with Height

Height in Wavelengths at 14.175 MHz (feet)	*Resonant Length in Feet (Lx/f)*	*Feed point Impedance in Ω (SWR)*	*Max Gain (dBi) at Angle (Degrees)*
⅛ (8.8)	33.0 (467.8)	31.5 (1.59)	7.4 @ 90
¼ (17.4)	32.9 (466.4)	81.7 (1.63)	5.6 @ 62
½ (34.7)	34.1 (483.4)	69.6 (1.39)	7.4 @ 28
¾ (52.0)	33.4 (473.4)	73.4 (1.47)	7.3 @ 18
1 (69.4)	33.9 (480.5)	71.9 (1.44)	7.7 @ 14
1½ (104.1)	33.8 (479.1)	72.0 (1.44)	7.8 @ 9
2 (138.8)	33.8 (479.1)	72.3 (1.45)	7.9 @ 7

Dipol og egenskaper ved høyde



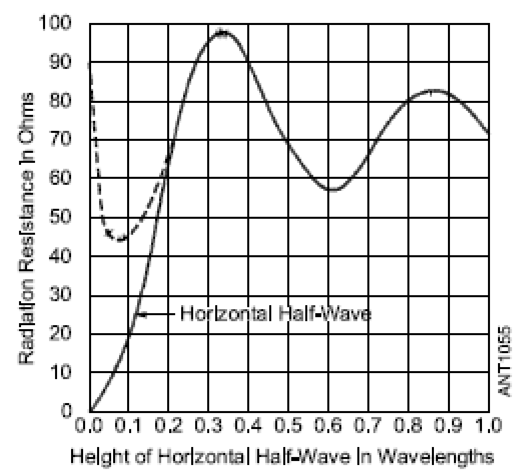
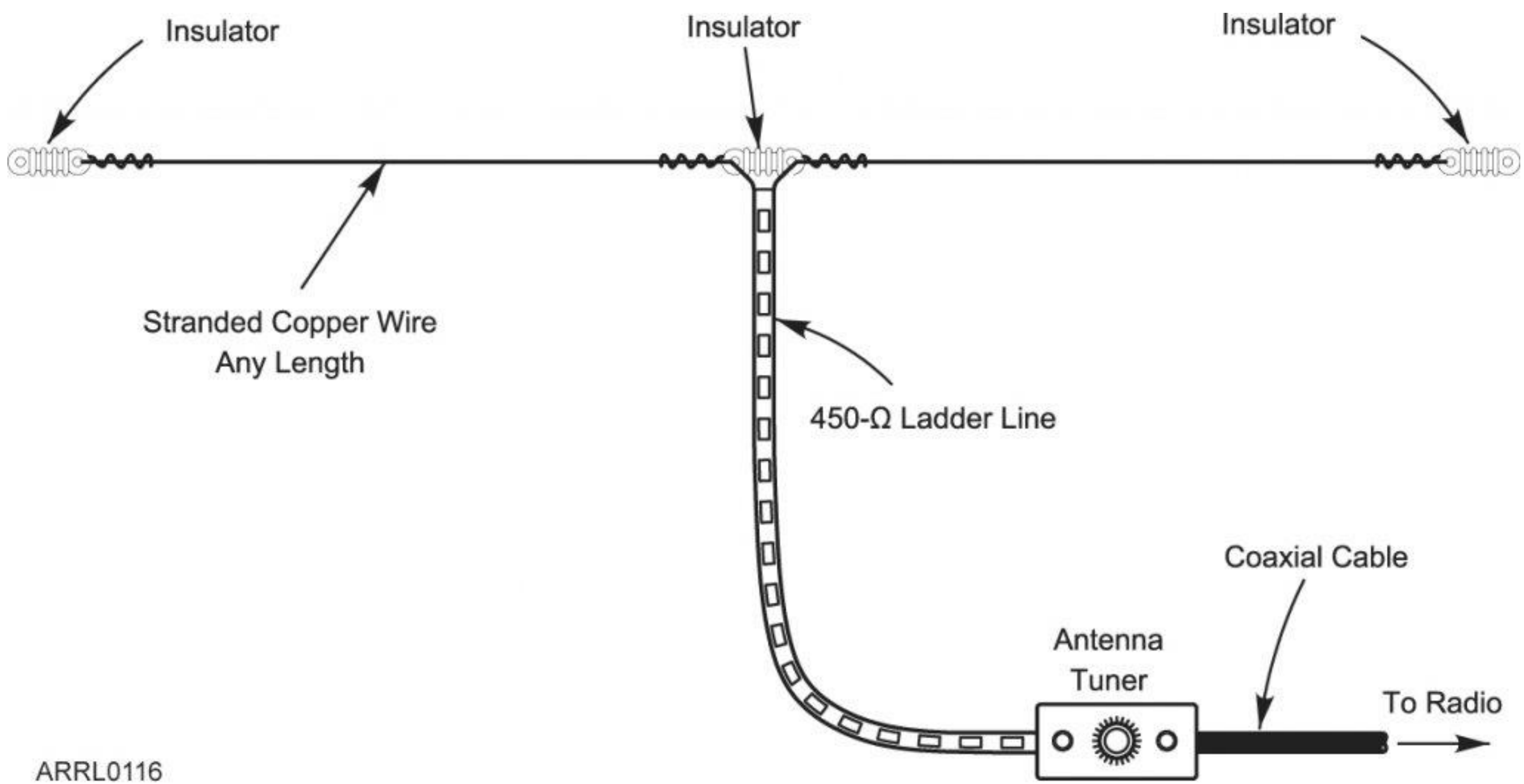
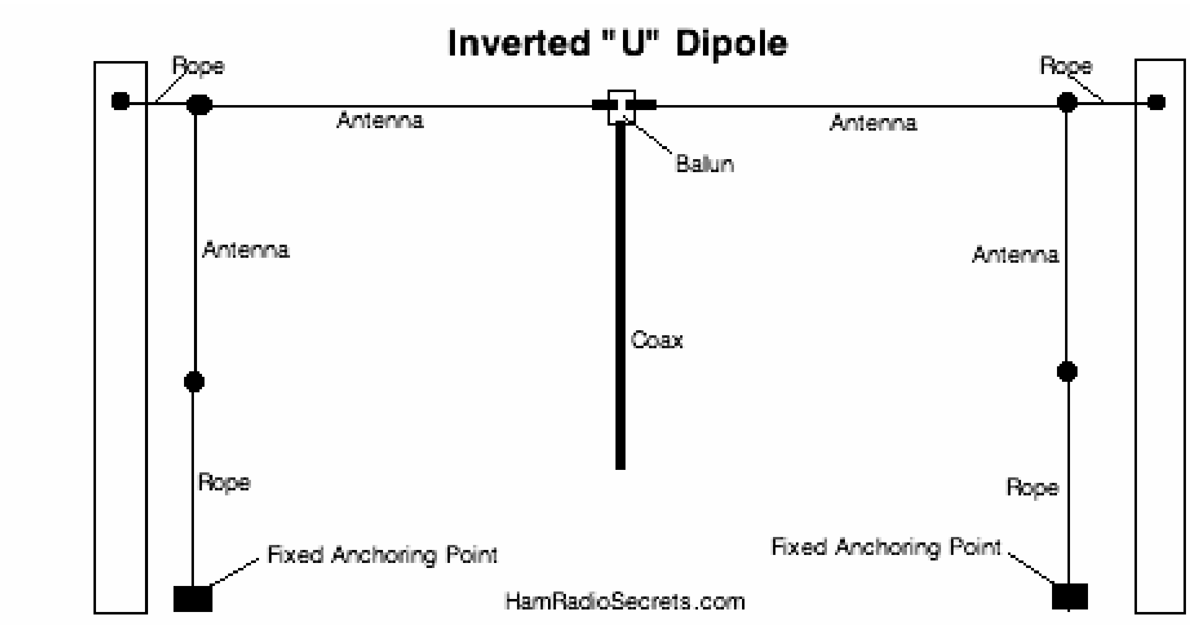


Figure 2.15 — Curves showing the radiation resistance of a horizontal half-wavelength dipole at various heights above ground. The broken-line portion of the curve for a horizontal dipole shows the resistance over *average* real earth, the solid line for perfectly conducting ground.

Dipolantenne for tuning



Moxon metoden



Foldet dipol

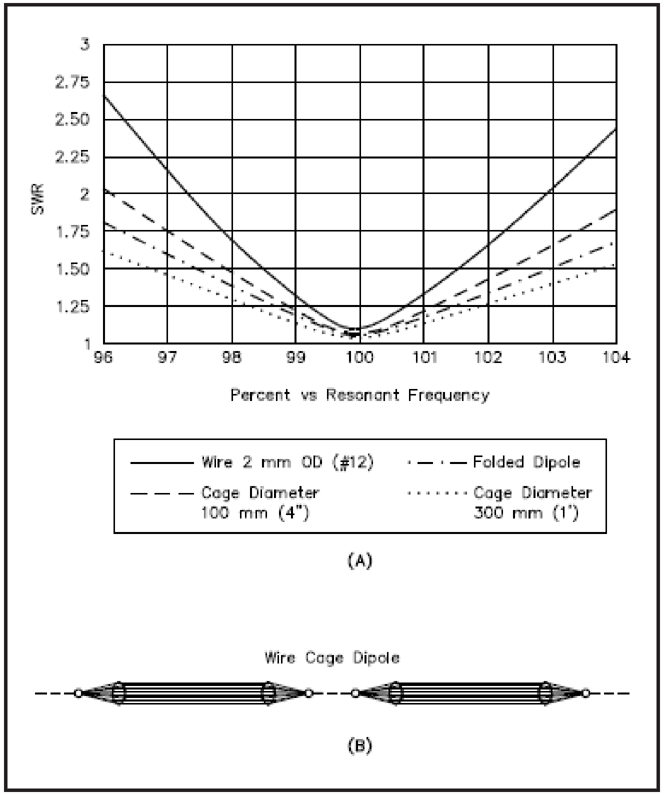
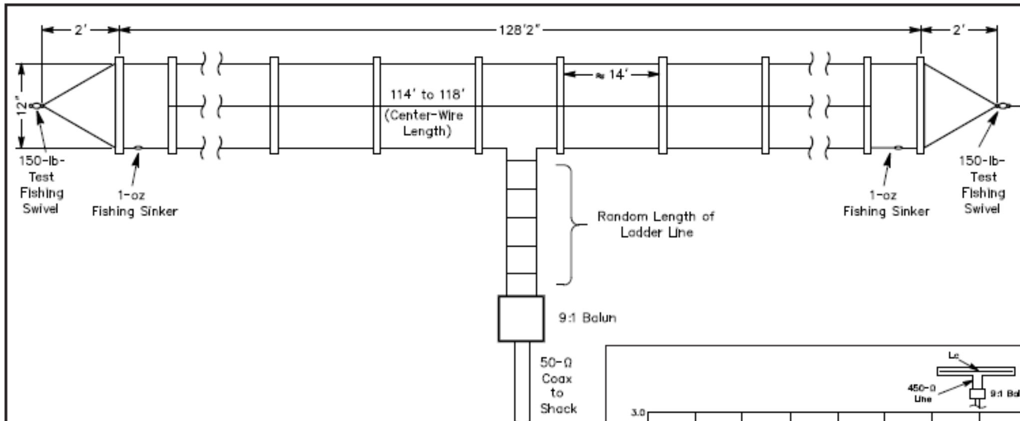


Fig 8-8—At A, SWR plots for 3.75-MHz half-wave dipoles in free space of various conductor diameters. The total bandwidth of the 80-meter band (3.5 to 3.8 MHz) is 8%. The 100-mm (4-inch) and 300-mm (12-inch) diameter conductors can be made as a cage of wires, as shown at B. Note that the SWR bandwidth of a folded dipole is substantially better than for a straight dipole. The spacing between the wires of the folded dipole does not influence the bandwidth to a large extent.



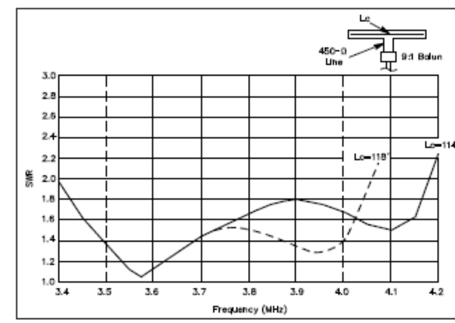


Fig 8-12—At A, the open-sleeve N6LF folded dipole. The antenna is fed with a random length of 450-Ω open-wire transmission line through a 9:1 balun. At B, SWR curve of the open-sleeve dipole, showing curves for different lengths of the center wire L_C.

Foldet dipol

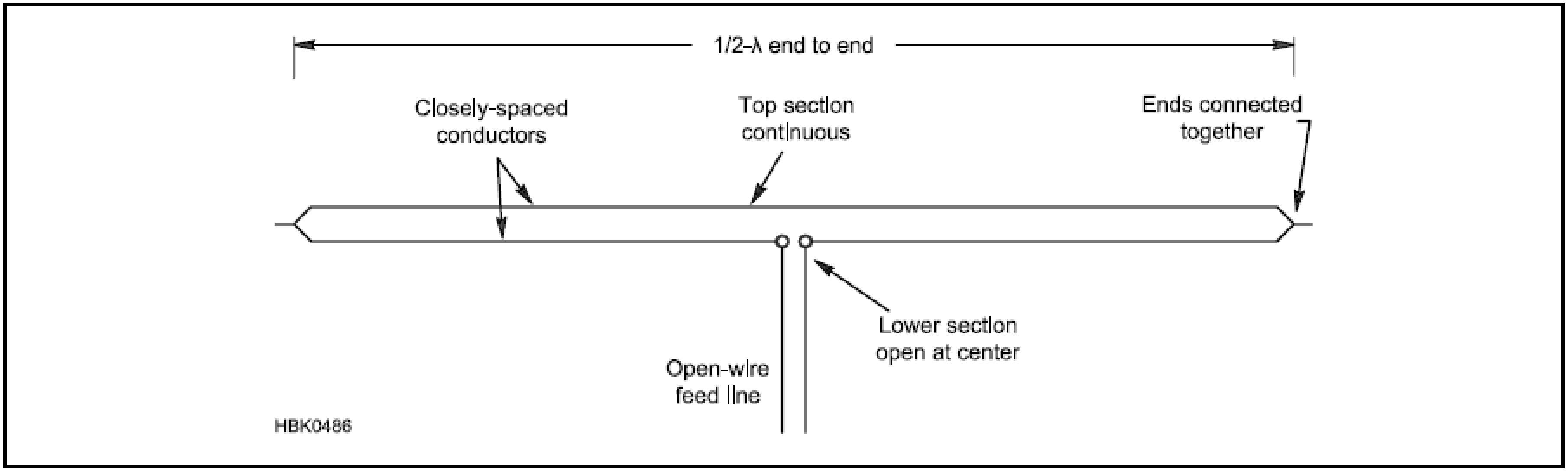
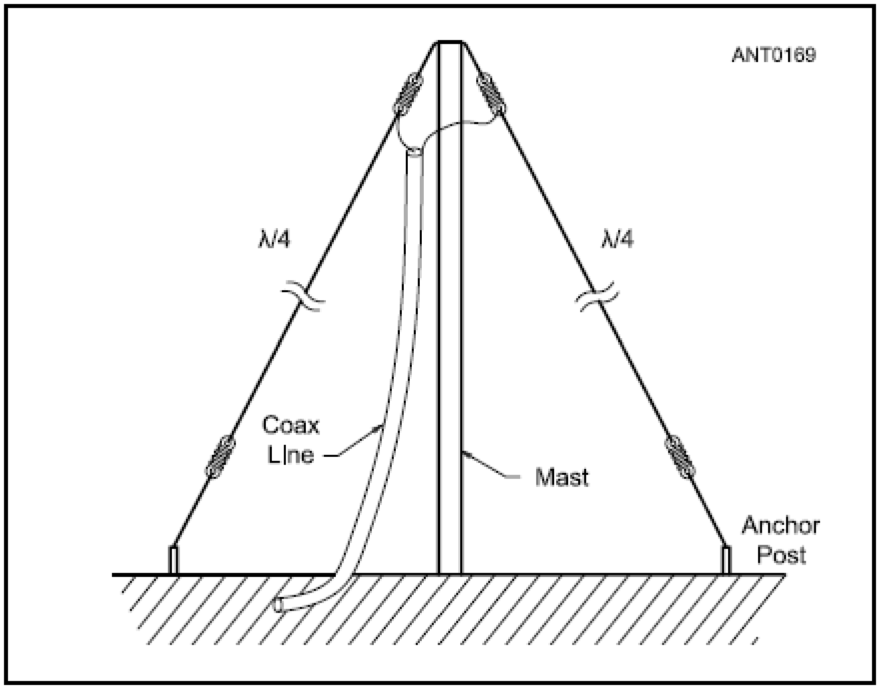
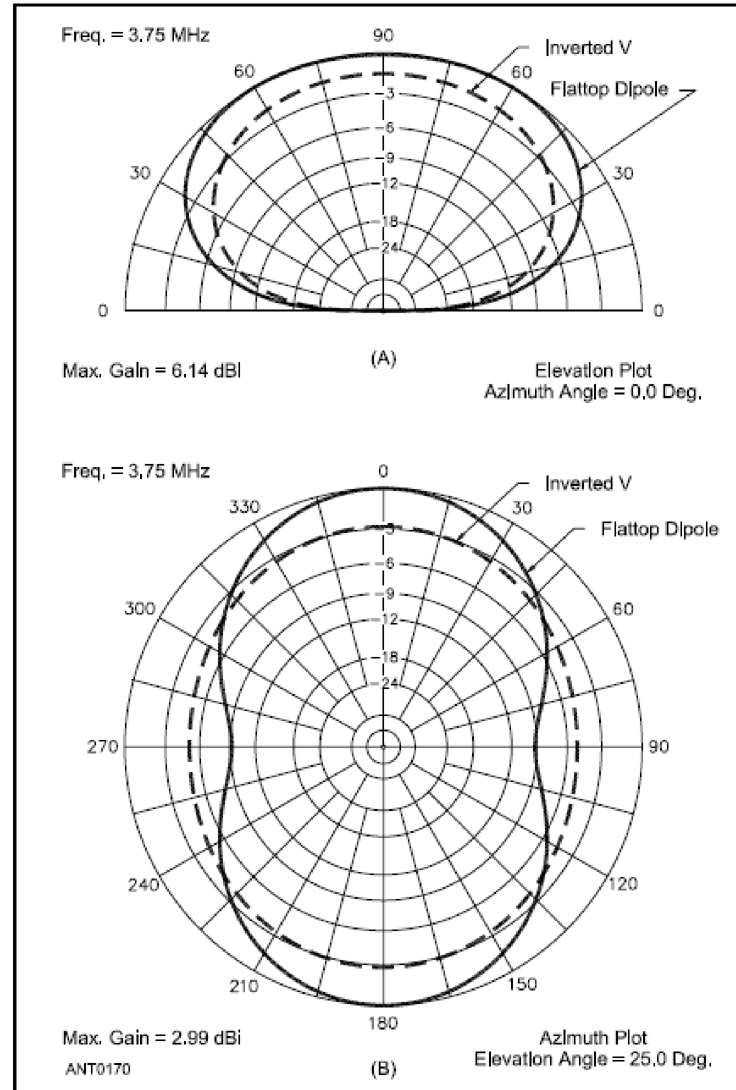


Figure 2.22 — The folded dipole is most often constructed from open-wire transmission line with the ends connected together. The close proximity of the two conductors and the resulting coupling act as an impedance transformer to raise the feed point impedance over that of a single-wire dipole by the square of the number of conductors used.

Kvadratloven:
2 tråder, Z= 4xZ-dipol
3 tråder, Z= 9xZ-dipol

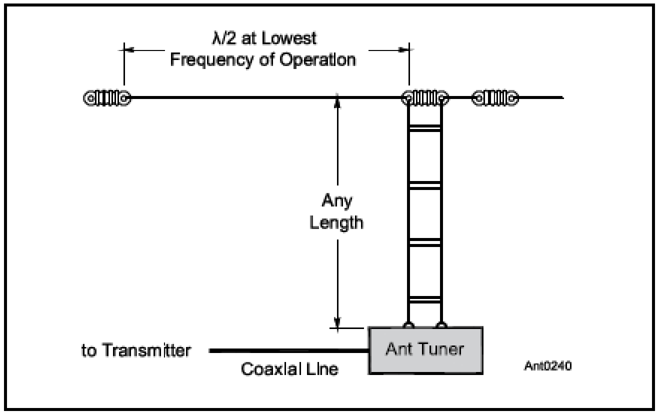
Inverted V





Lavere Z enn horisontal dipol
Smalere båndbredde
Kortere lengder; ca. 5% ved 45°

Zepp



Høy fødeimpedans, 3000-5000 ohm!
Denne kan være vanskelig å avstemme!
OBS! Utstråling fra fødelinjen!

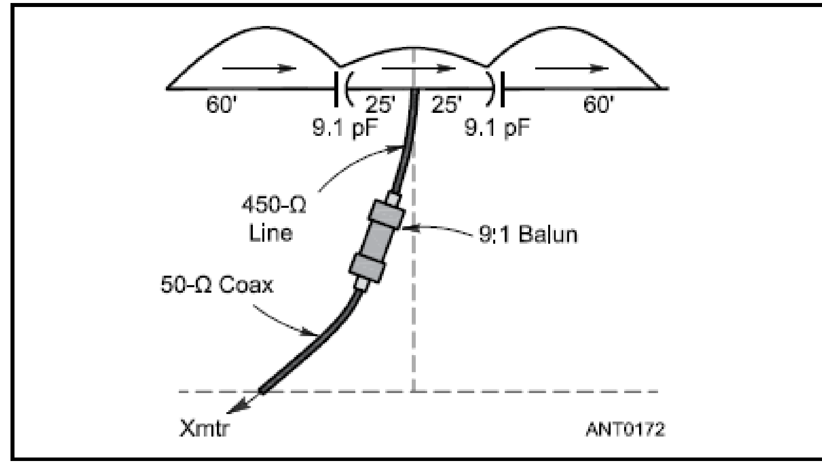


Figure 12.8 — Schematic for modified N6LF Double Extended Zepp. Overall length is 170 feet, with 9.1 pF capacitors placed 25 feet each side of center.

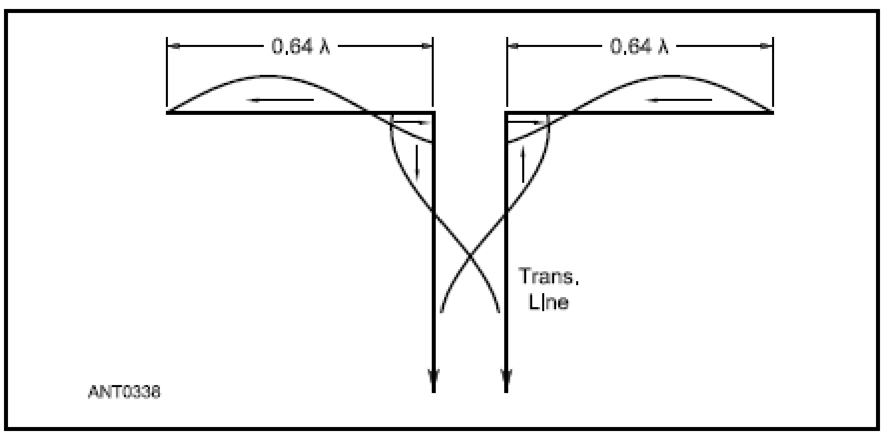


Figure 12.5 — The extended double Zepp. This system gives somewhat more gain than two λ-sized collinear elements.

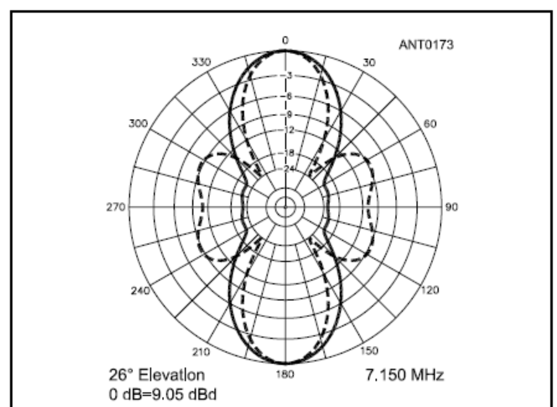
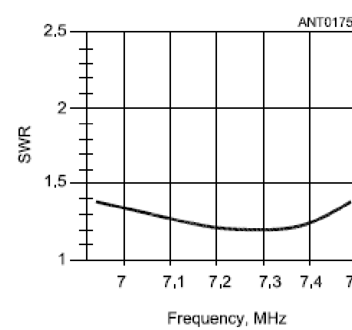
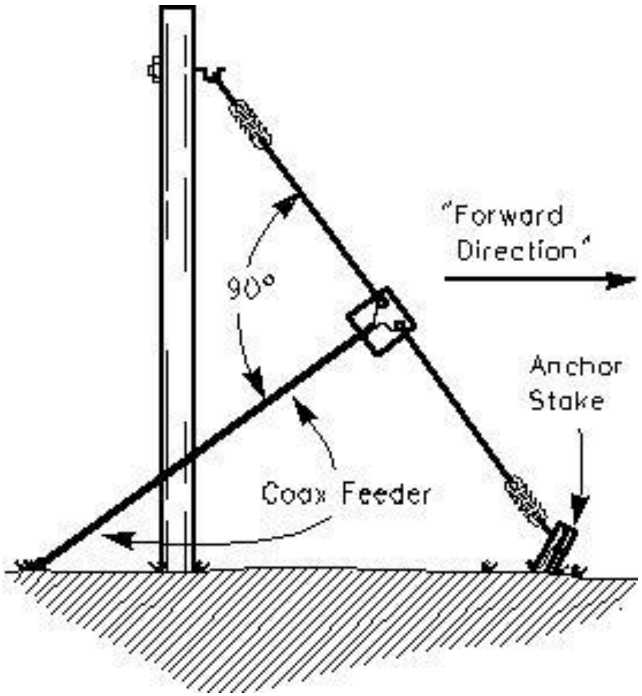
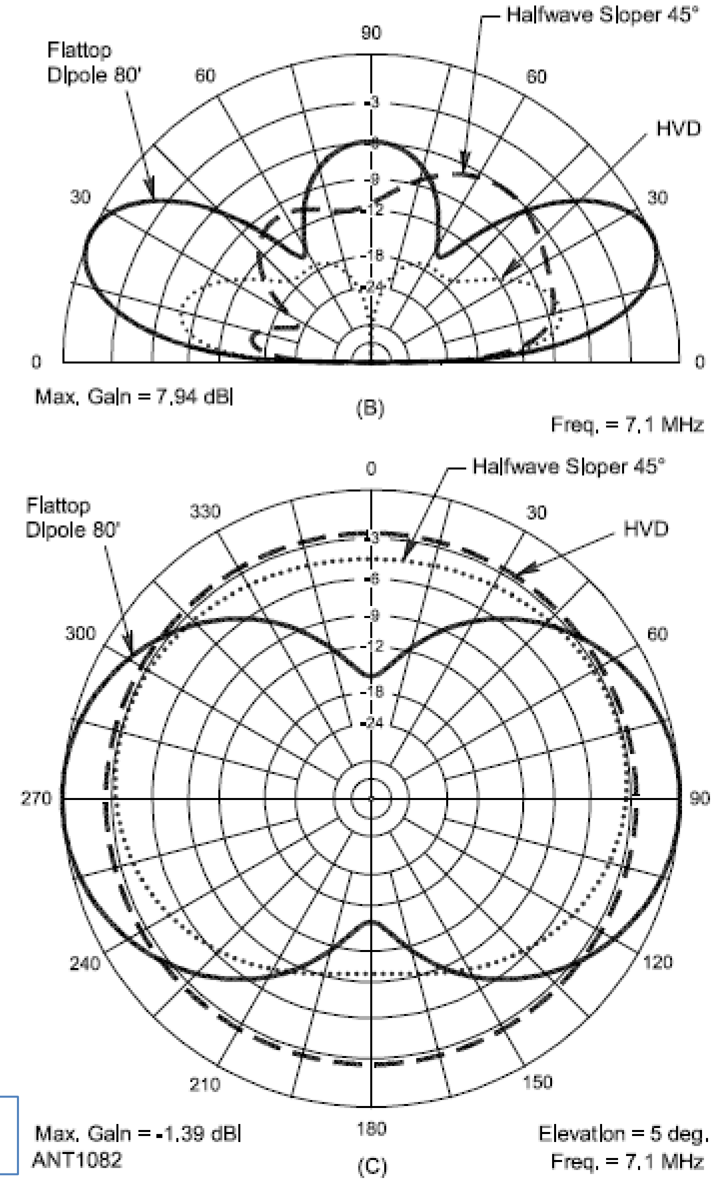


Figure 12.9 — Azimuth pattern for N6LF Double Extended Zepp (solid line), compared to classic Double Extended Zepp (dashed line). The main lobe for the modified antenna is slightly broader than that of the classic model, and the sidelobes are suppressed better.



Helende dipoler





HVD –half-wave vertical dipol

Bredbåndet dipol

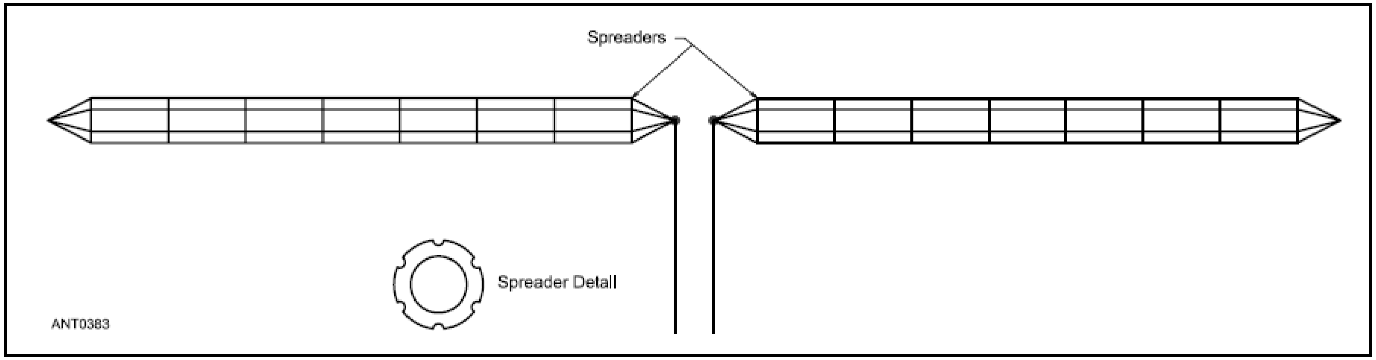


Figure 9.9 — Construction of a cage dipole. The spreaders need not be of conductive material and should be lightweight. Between adjacent conductors, the spacing should be 0.02 ℓ or less. The number of spreaders and their spacing along the dipole should be sufficient to maintain a relatively constant separation of the radiator wires. The spreaders can be round as shown in the detail or any suitable cross arrangement.

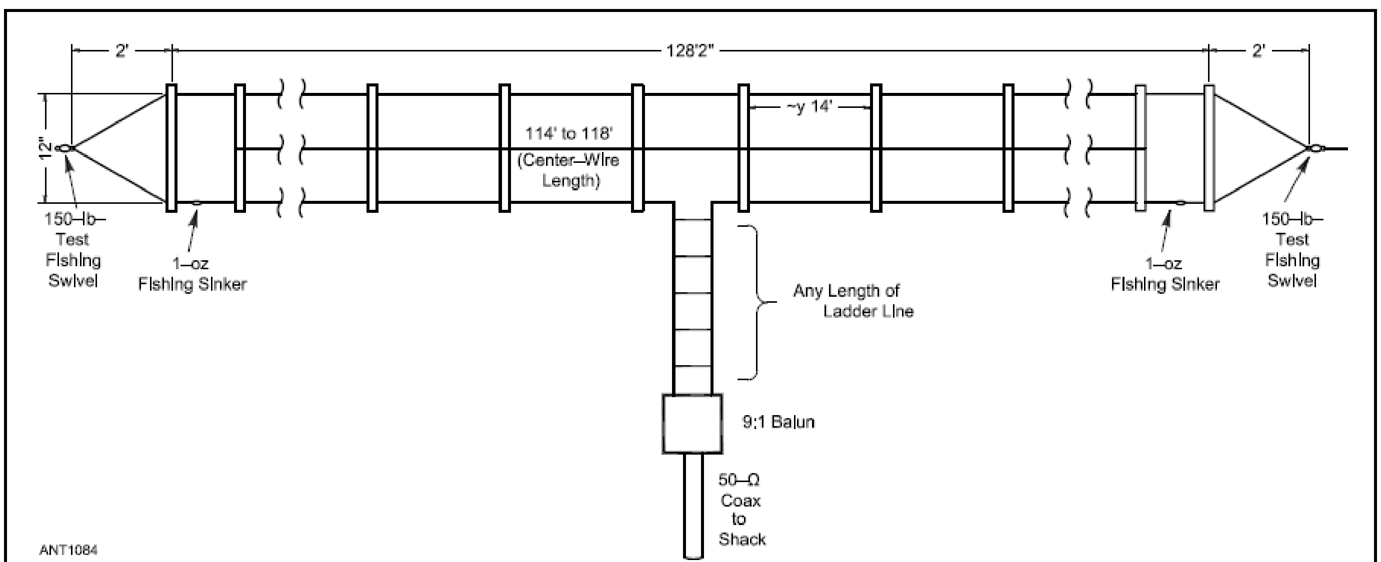
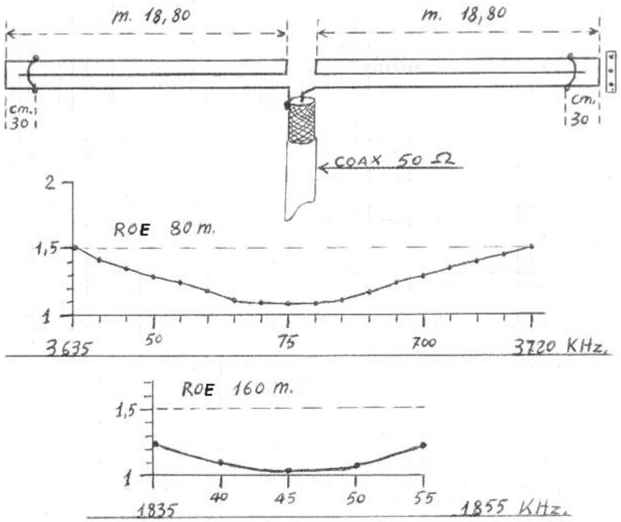
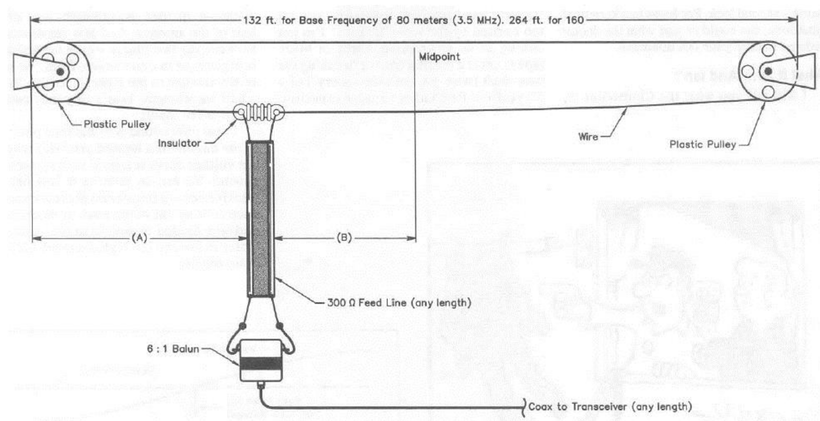


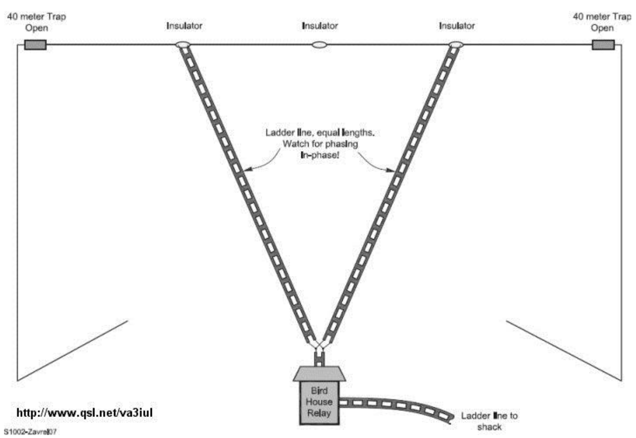
Figure 9.11 — The open-sleeve folded dipole designed by N6LF. The center wire is not connected to the folded dipole but couples to it and acts as the radiator at the upper end of the band.

2:1 SWR
3.30 – 4.25

Ymse andre dipoler



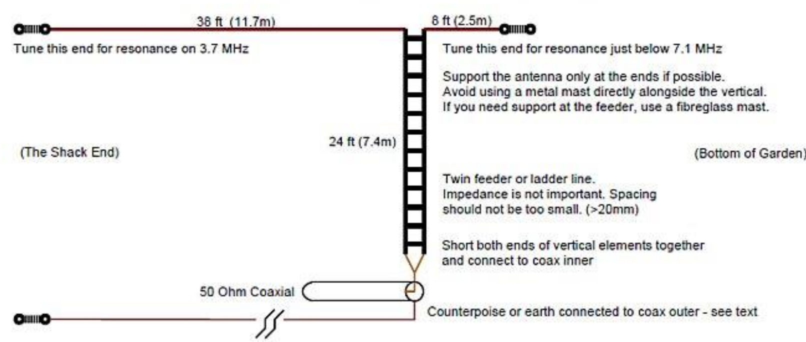




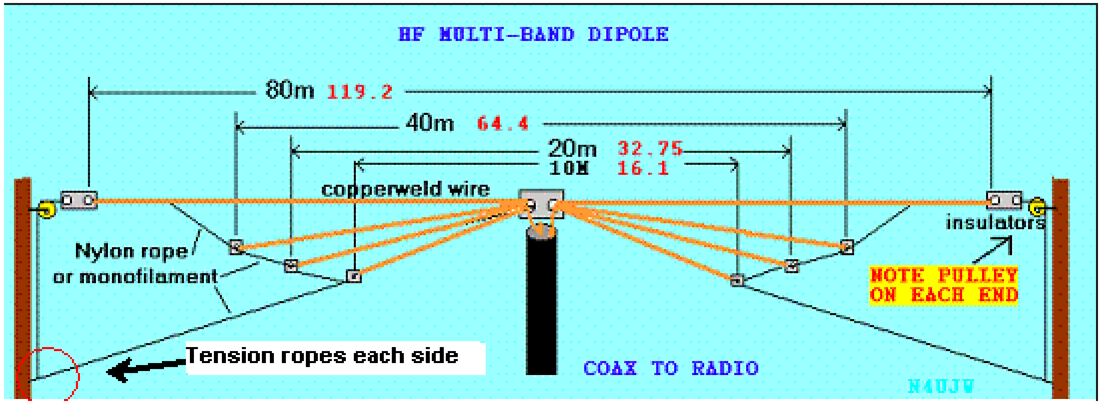
G7FEK Limited Space Antenna

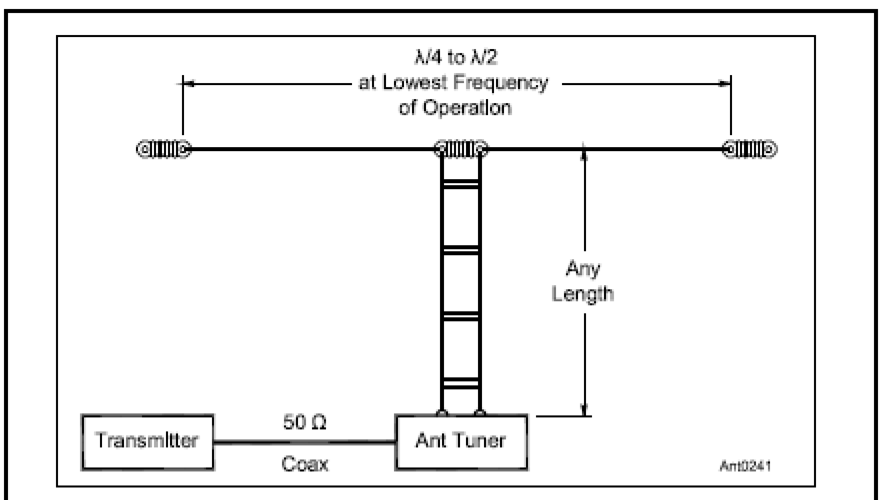
G7FEK Multi-band "Nested Marconi" Antenna - 2008 Version (rev 5)

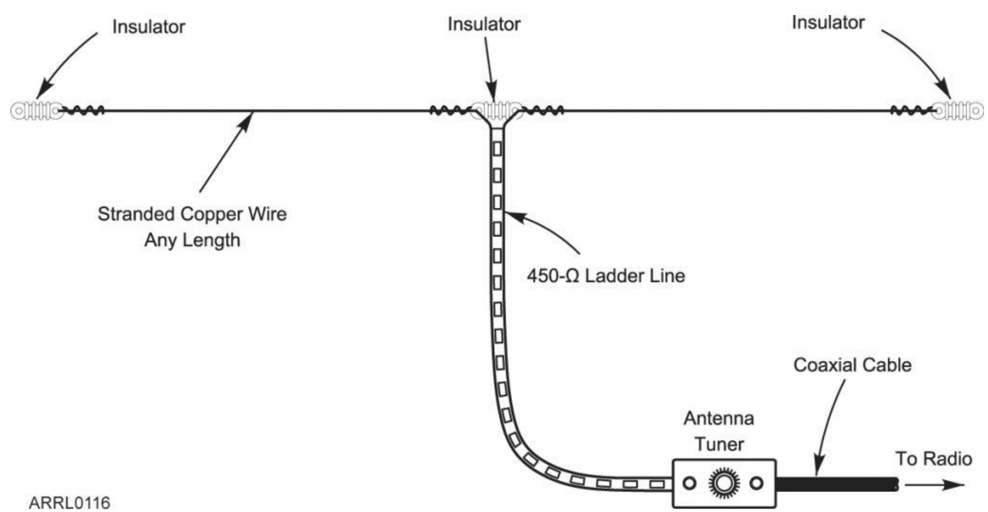
A 46 ft multi band antenna for small gardens that works well on 80 meters
Main bands (@~50 ohm) are 80m / 40m / 30m / 17m / 15m / 12m
Other bands (see text): 20m / 10m



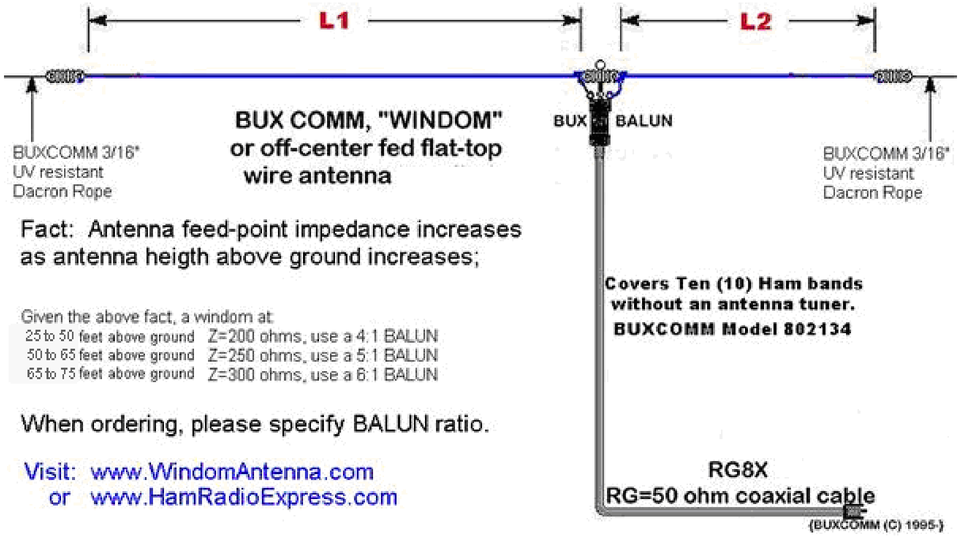
Flerbånds antenner

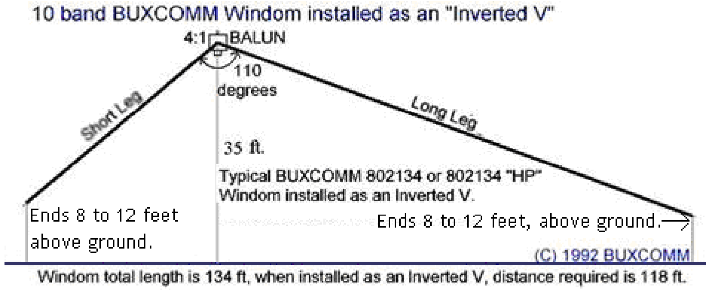


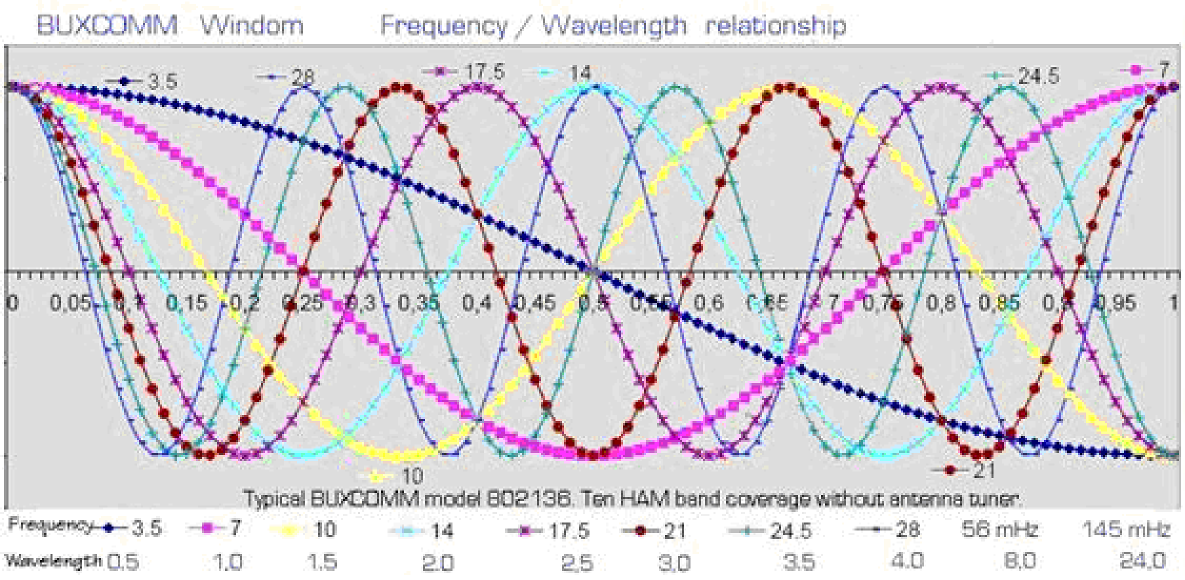


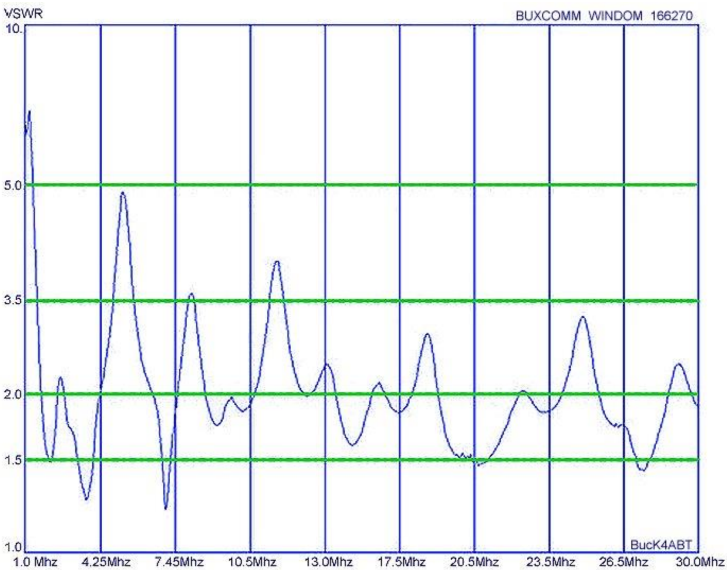


Windom

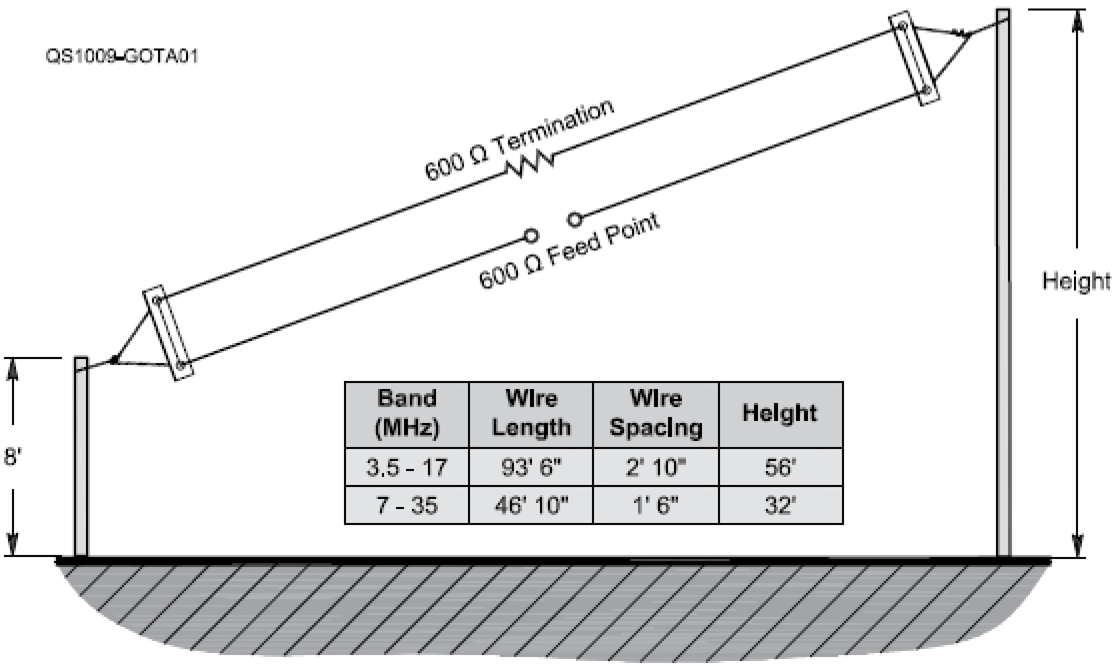

L1
L2
BUX COMM, "WINDOM"
or off-center fed flat-top
wire antenna
BUX BALUN
BUXCOMM 3/16"
UV resistant
Dacron Rope
BUXCOMM 3/16"
UV resistant
Dacron Rope
Fact: Antenna feed-point impedance increases
as antenna heigth above ground increases;
Given the above fact, a windom at
25 to 50 feet above ground Z=200 ohms, use a 4:1 BALUN
50 to 65 feet above ground Z=250 ohms, use a 5:1 BALUN
65 to 75 feet above ground Z=300 ohms, use a 6:1 BALUN
When ordering, please specify BALUN ratio.
Visit: www.WindomAntenna.com
or www.HamRadioExpress.com
Covers Ten (10) Ham bands
without an antenna tuner.
BUXCOMM Model 802134
RG8X
RG=50 ohm coaxial cable
(BUXCOMM (C) 1995-)


10 band BUXCOMM Windom installed as an "Inverted V"
4:1 BALUN
110
degrees
Short Leg
Long Leg
35 ft.
Typical BUXCOMM 802134 or 802134 "HP"
Windom installed as an Inverted V.
Ends 8 to 12 feet
above ground.
Ends 8 to 12 feet, above ground.
(C) 1992 BUXCOMM
Windom total length is 134 ft, when installed as an Inverted V, distance required is 118 ft.


BUXCOMM Windom Frequency / Wavelength relationship
3.5
28
17.5
14
24.5
7
10
21
0 0,05 0,1 0,15 0,2 0,25 0,3 0,35 0,4 0,45 0,5 0,55 0,6 0,65 0,7 0,75 0,8 0,85 0,9 0,95 1
Typical BUXCOMM model 802136. Ten HAM band coverage without antenna tuner.
Frequency 3.5 7 10 14 17.5 21 24.5 28 56 mHz 145 mHz
Wavelength 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 8.0 24.0


VSWR
BUXCOMM WINDOM 166270
10.
5.0
3.5
2.0
1.5
1.0
BucK4ABT
1.0 Mhz
4.25Mhz
7.45Mhz
10.5Mhz
13.0Mhz
17.5Mhz
20.5Mhz
23.5Mhz
26.5Mhz
30.0Mhz

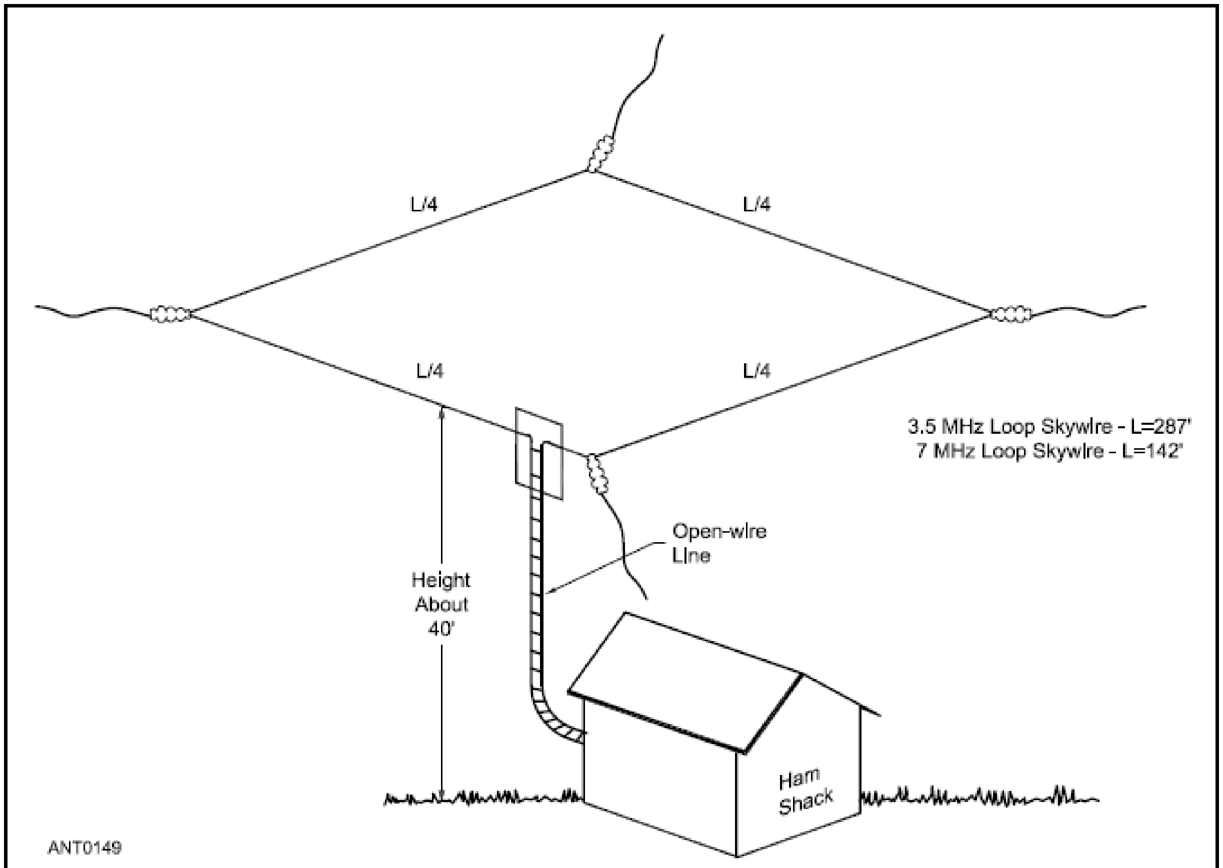
TFD
Terminated Folded Dipole

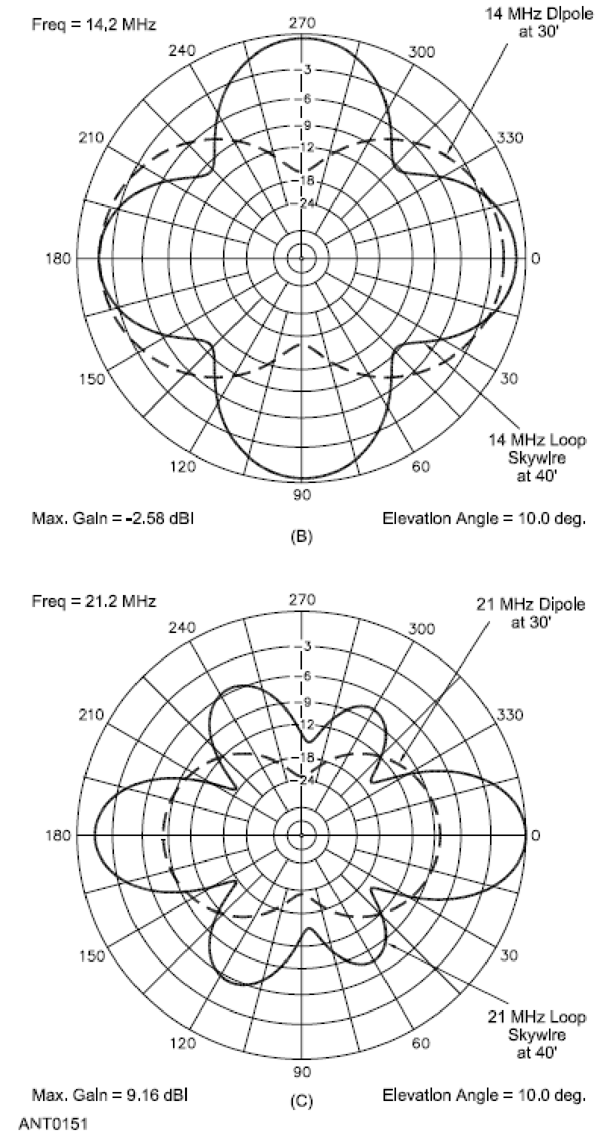


Band (MHz)	Wire Length	Wire Spacing	Height
3.5 - 17	93' 6"	2' 10"	56'
7 - 35	46' 10"	1' 6"	32'

Figure 10.18 — The terminated folded dipole adds a 600-Ω terminating resistor to smooth out the feed point impedance variations over a wide range. The terminating resistor dissipates some of the input power in order to provide a consistent match.

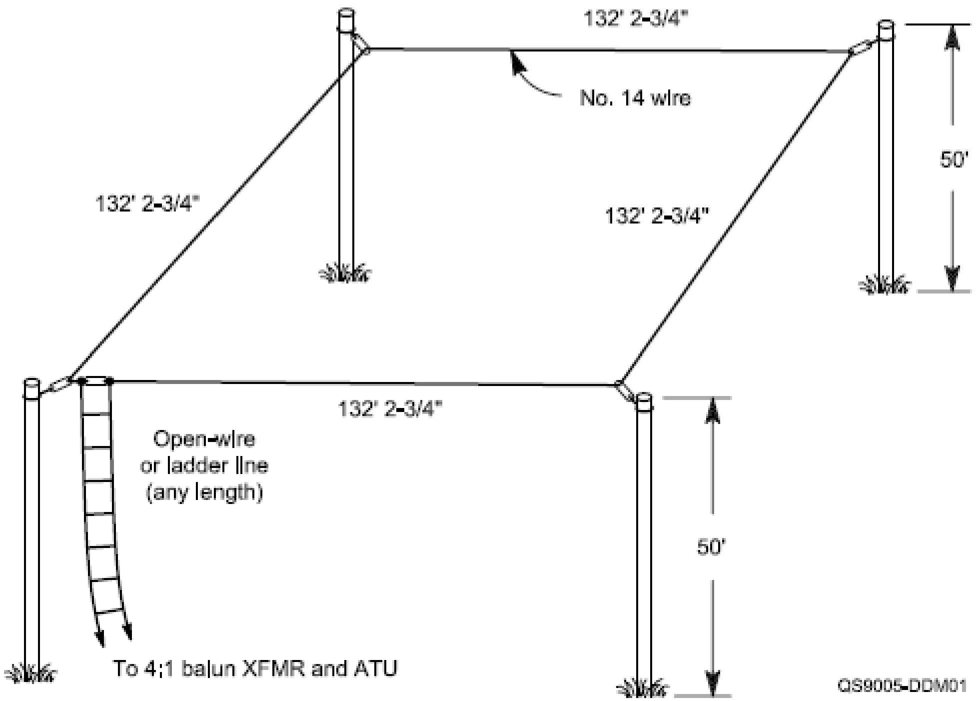
Loop Skywire





Loop for 160 m

Figure 5.17 — Construction of the W1FB full-wave 1.9-MHz loop. The antenna can be fed with any length of open-wire or ladder line from 300 to 600 Ω.



Rhombisk antenne

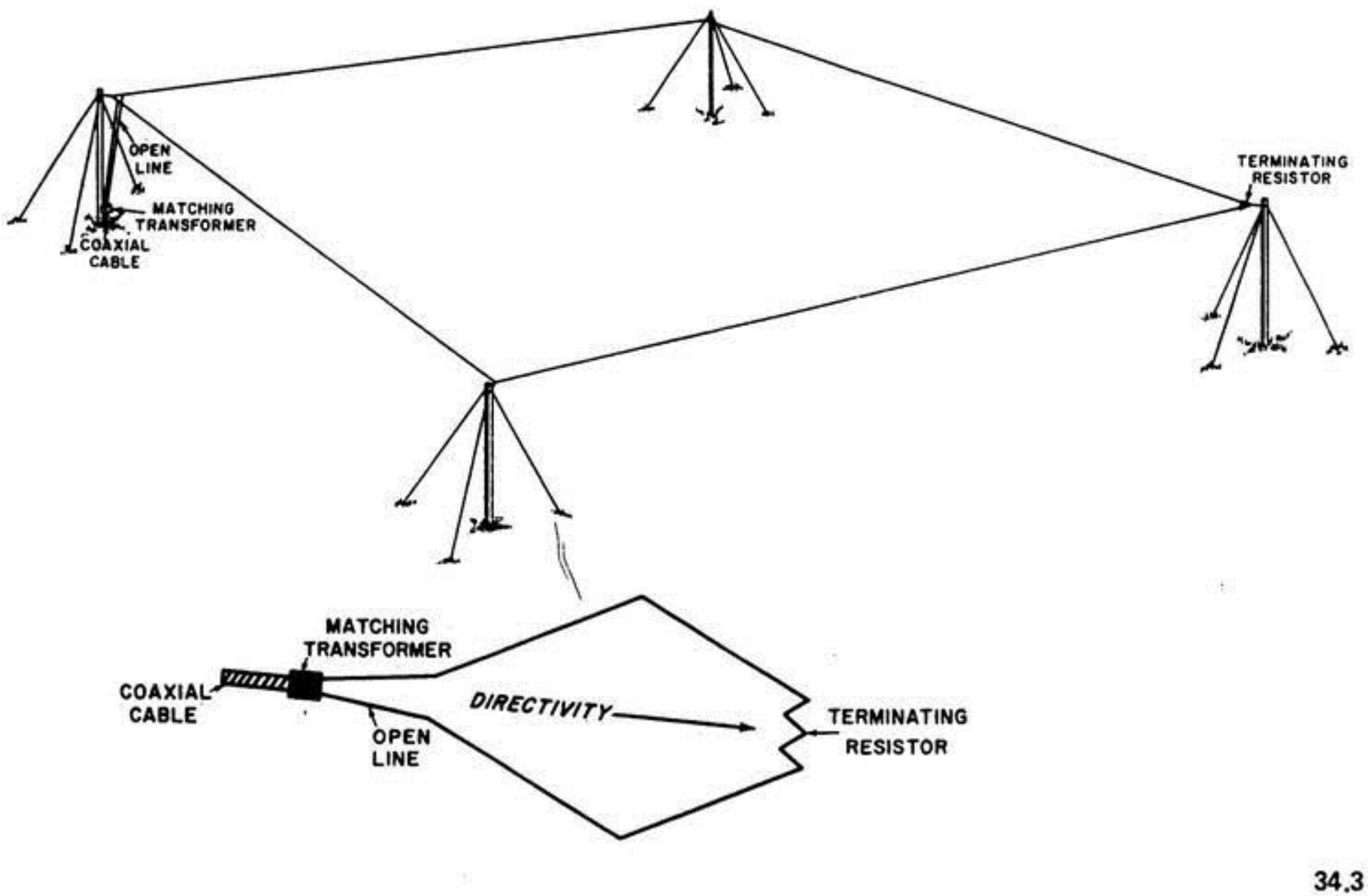
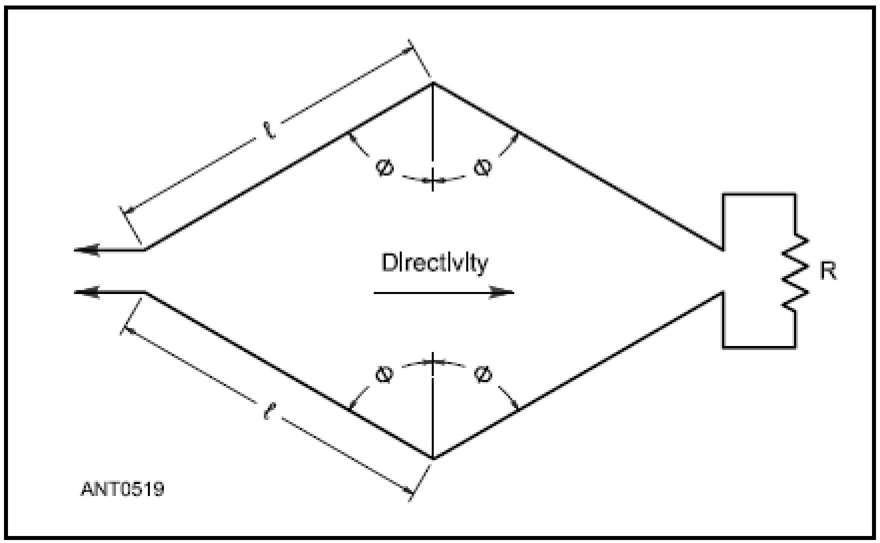


Figure 3-26.—Rhombic Antenna.

Egenskaper for Rhombisk antenne



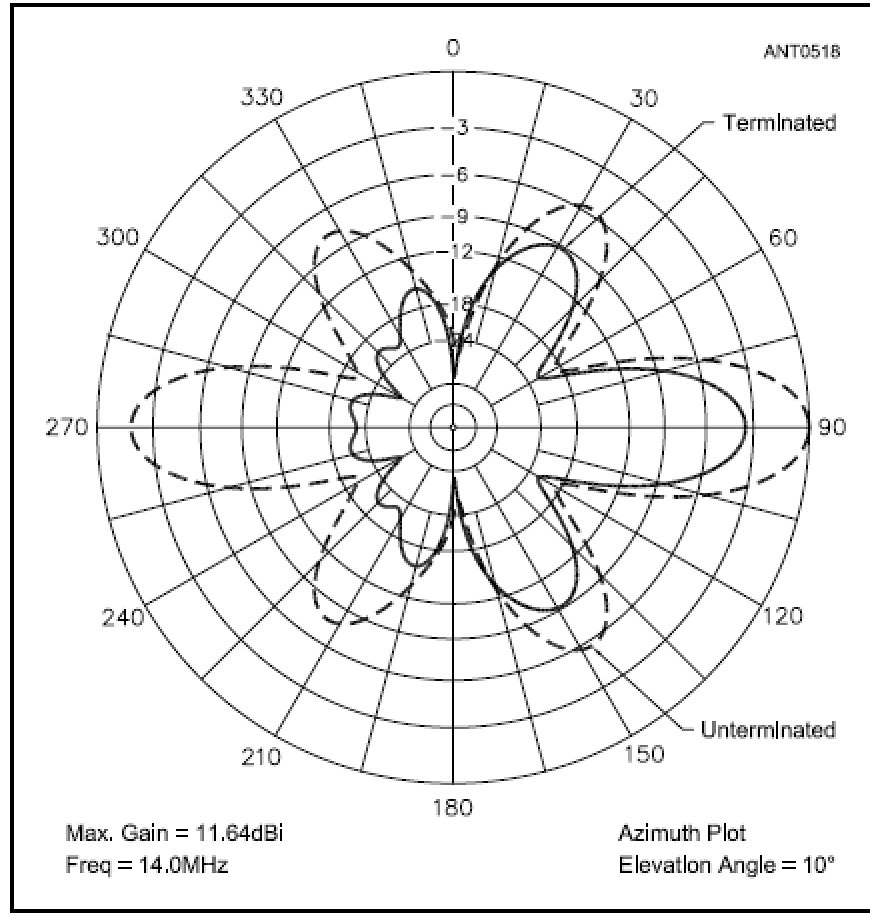
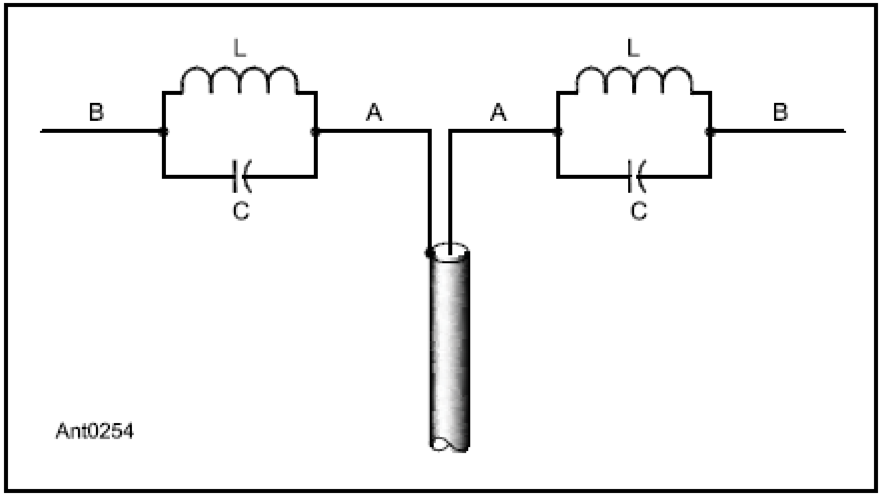
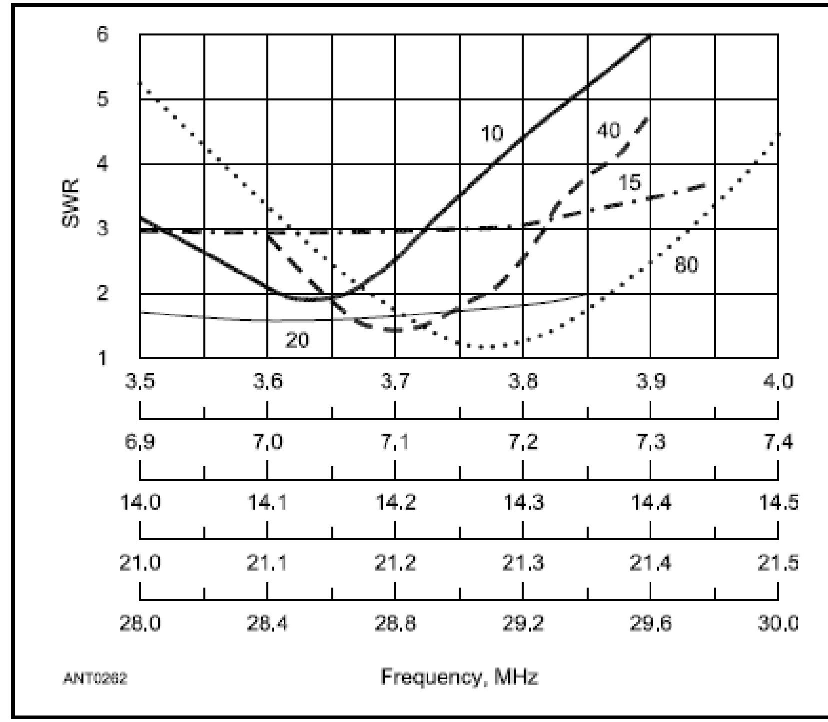


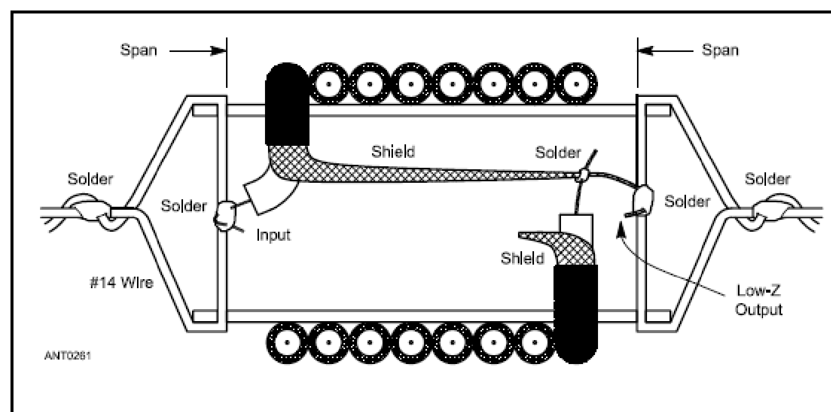
Figure 13.23 — The azimuthal patterns for a shorter-leg V-beam (2-λ legs) when it is terminated (solid line) and un-terminated (dashed line). With shorter legs, the terminated V-beam loses about 3.5 dB in forward gain compared to the unterminated version, while suppressing the rearward lobes as much as 20 dB.

Trap antenner

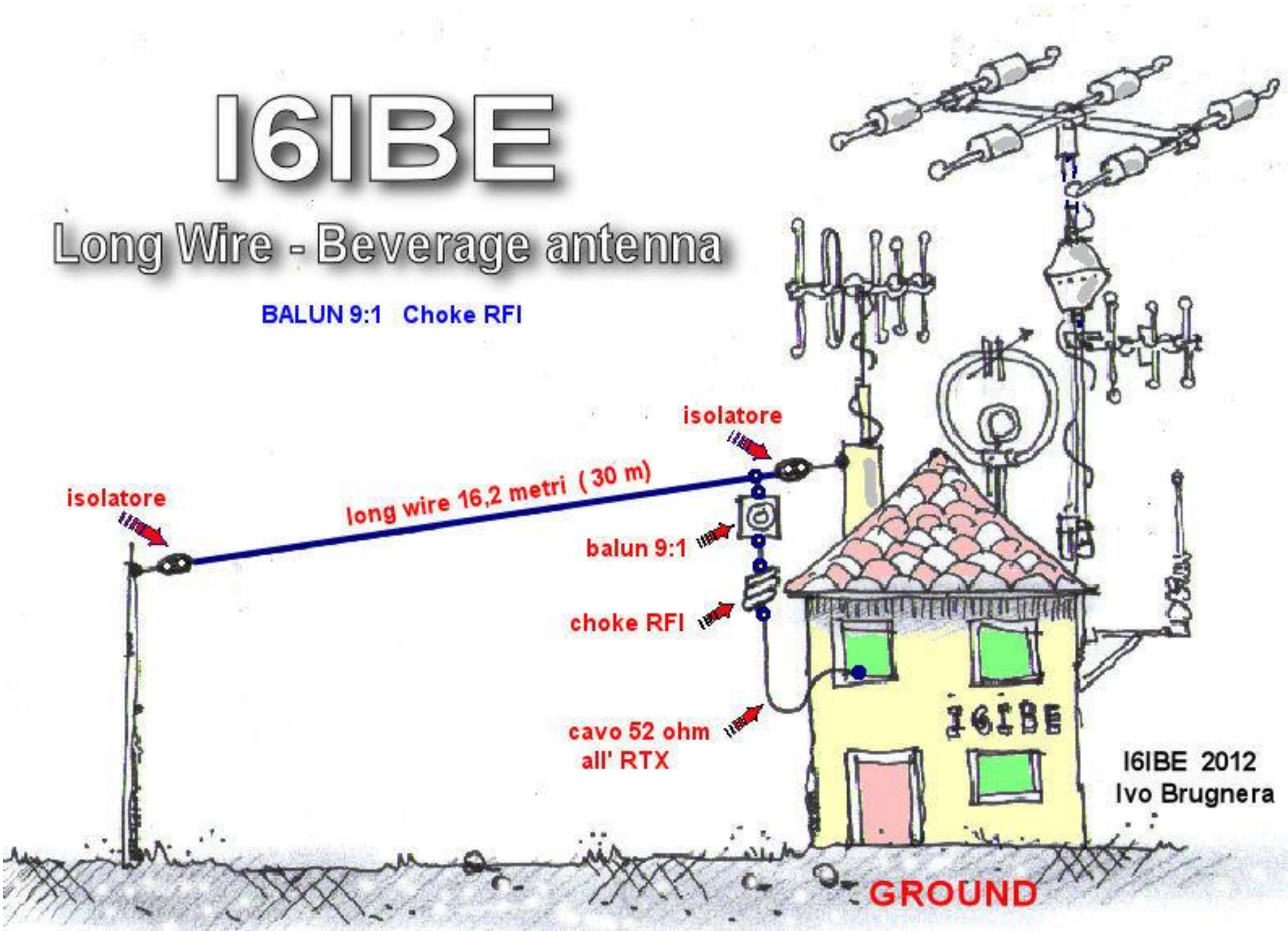




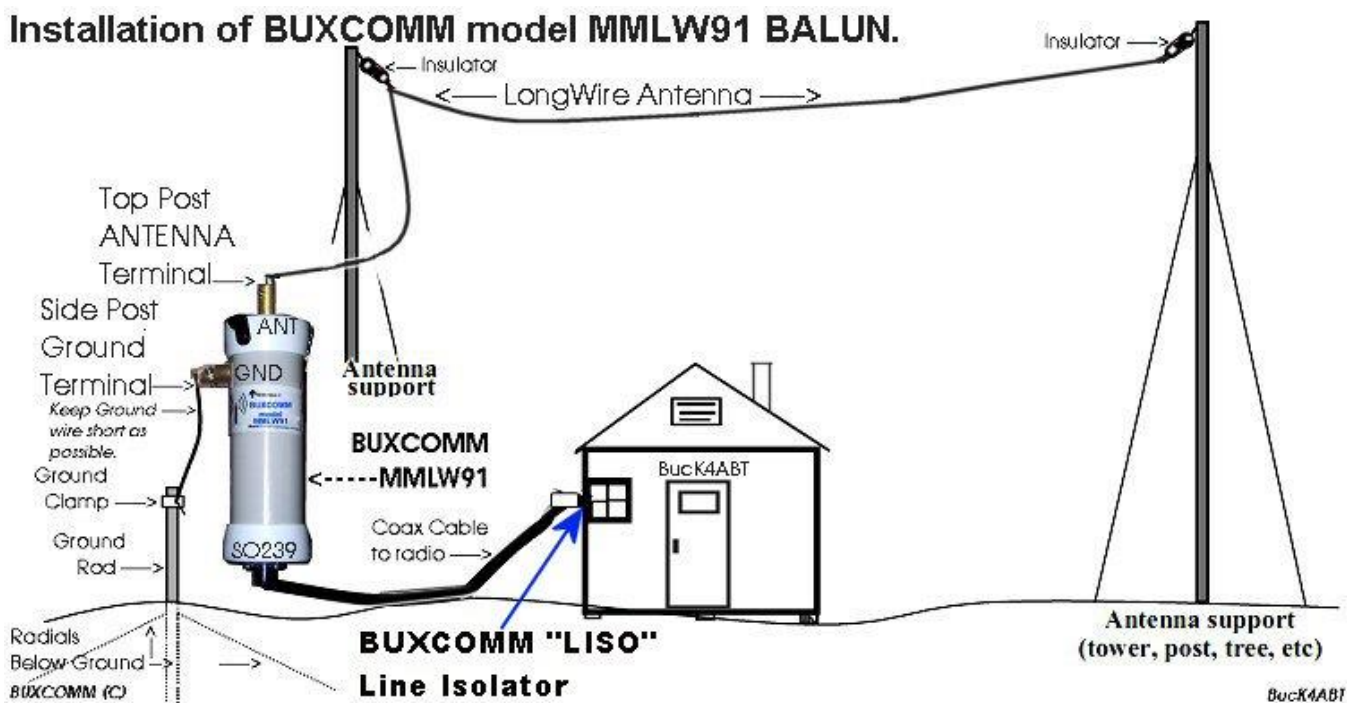
Mange varianter av disse antennene
Noe tap av effekt i traps på enkelte bånd.
Fødes best med balansert kabel.
C konstrueres fra to Al-rør.
L er viklet på utsiden av Al rør.
Alternativt: Koaksial trap



Lang tråd (Long Wire)



Longwire


Installation of BUXCOMM model MMLW91 BALUN.
Insulator
Insulator
<— LongWire Antenna —>
Top Post
ANTENNA
Terminal
Side Post
Ground
Terminal
Keep Ground wire short as possible.
Ground Clamp
Ground Rod
Radials Below Ground
BUXCOMM (C)
ANT
GND
SO239
Antenna support
BUXCOMM
MMLW91
Coax Cable to radio
BucK4ABT
BUXCOMM "LISO"
Line Isolator
Antenna support
(tower, post, tree, etc)
BucK4ABT


WINRADIO

Longwire utstrålning

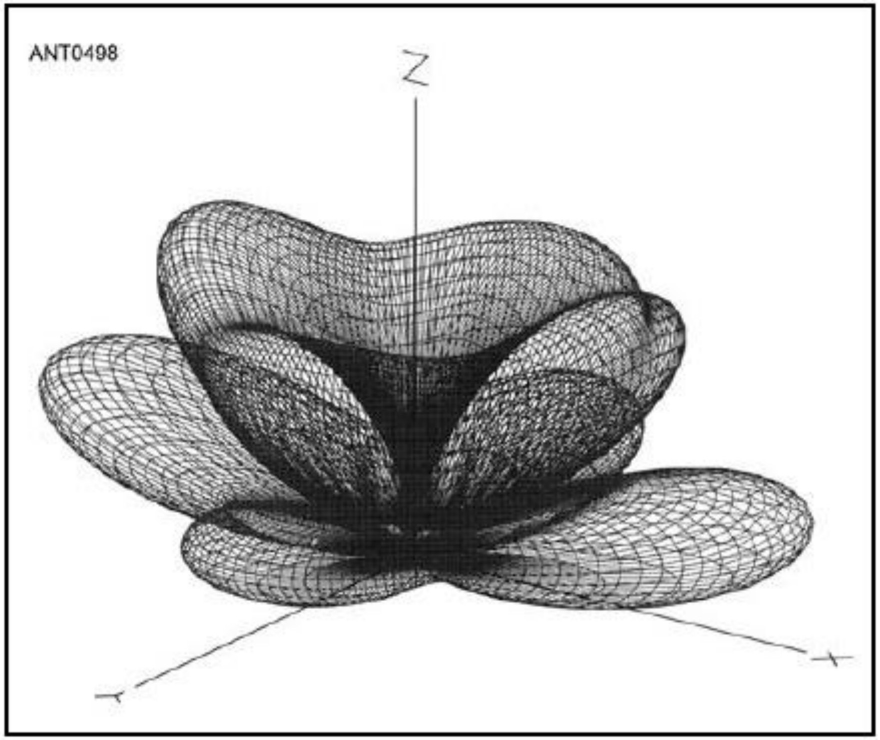


Figure 13.3 — A 3-D representation of the radiation pattern for the 1-λ long-wire shown in Figure 13.2. The pattern is obviously rather complex. It gets even more complicated for wires longer than 1 λ.

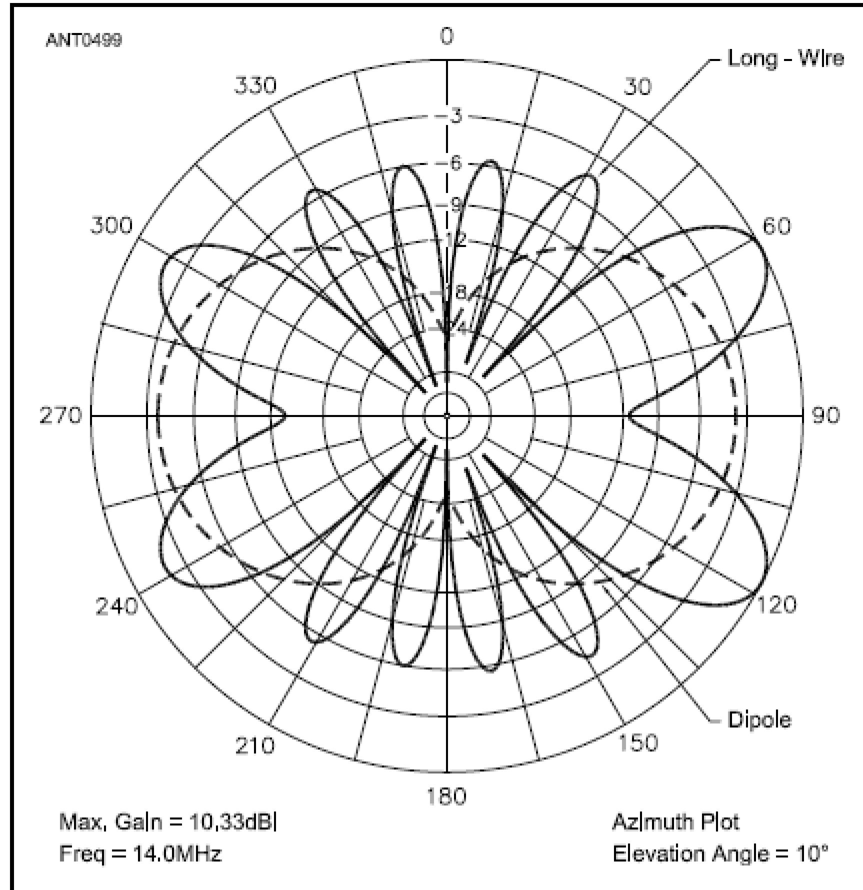
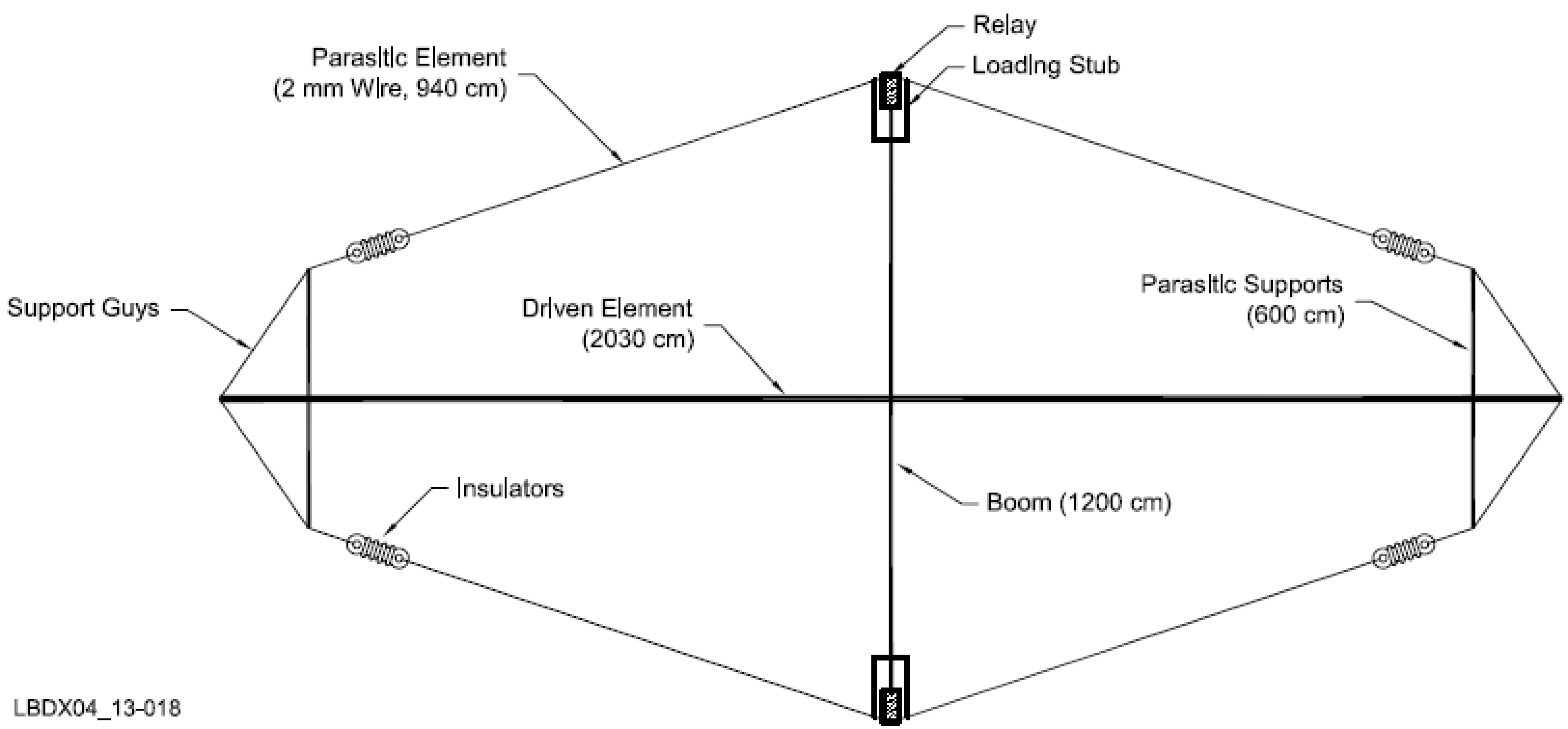


Figure 13.4 — An azimuthal-plane comparison between a 3-λ (209 feet long) long-wire (solid line) and the comparison ½-λ dipole (dashed line) at 70 feet high (1 λ) at 14 MHz.

Beam antenner

- Dipol med minst en reflektor eller en direktor

NW3Z 40 m beam



Beam forkortede elementer

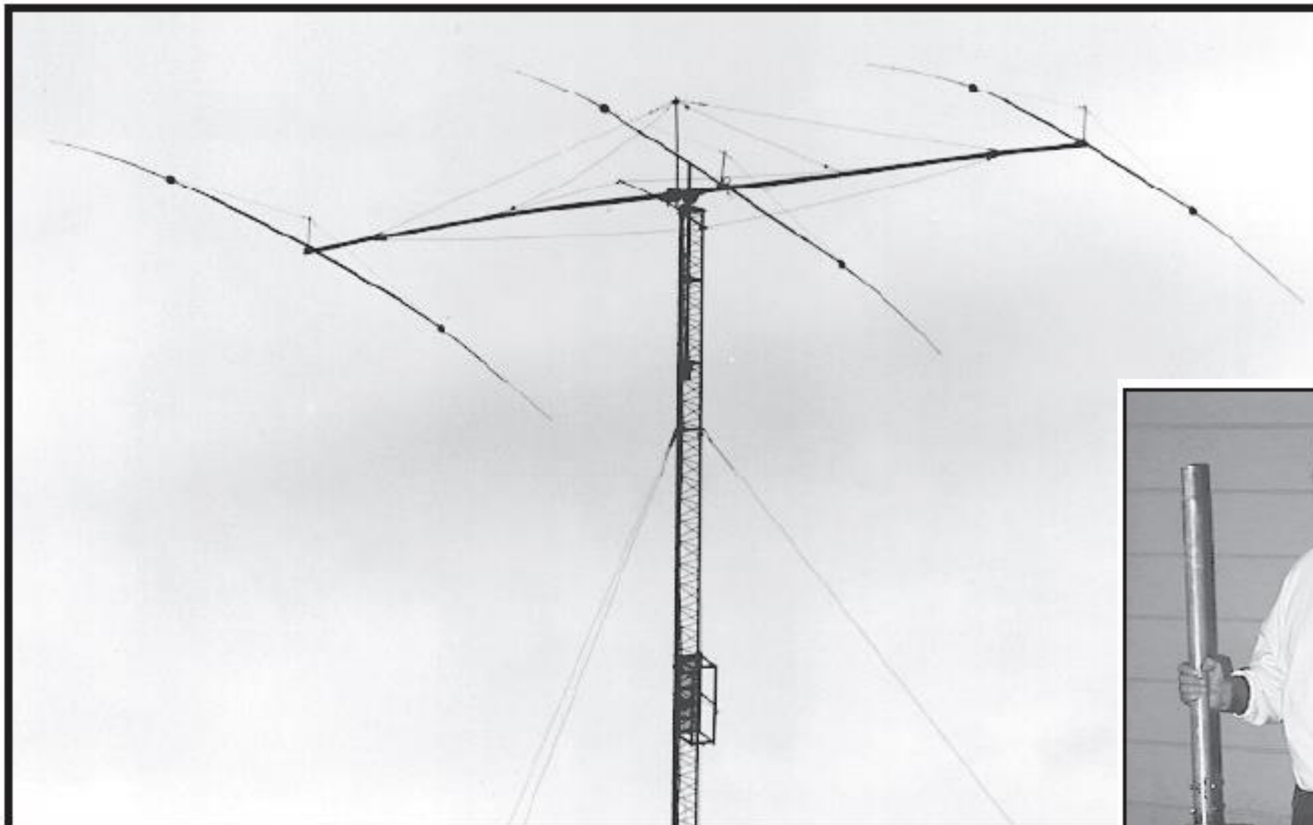
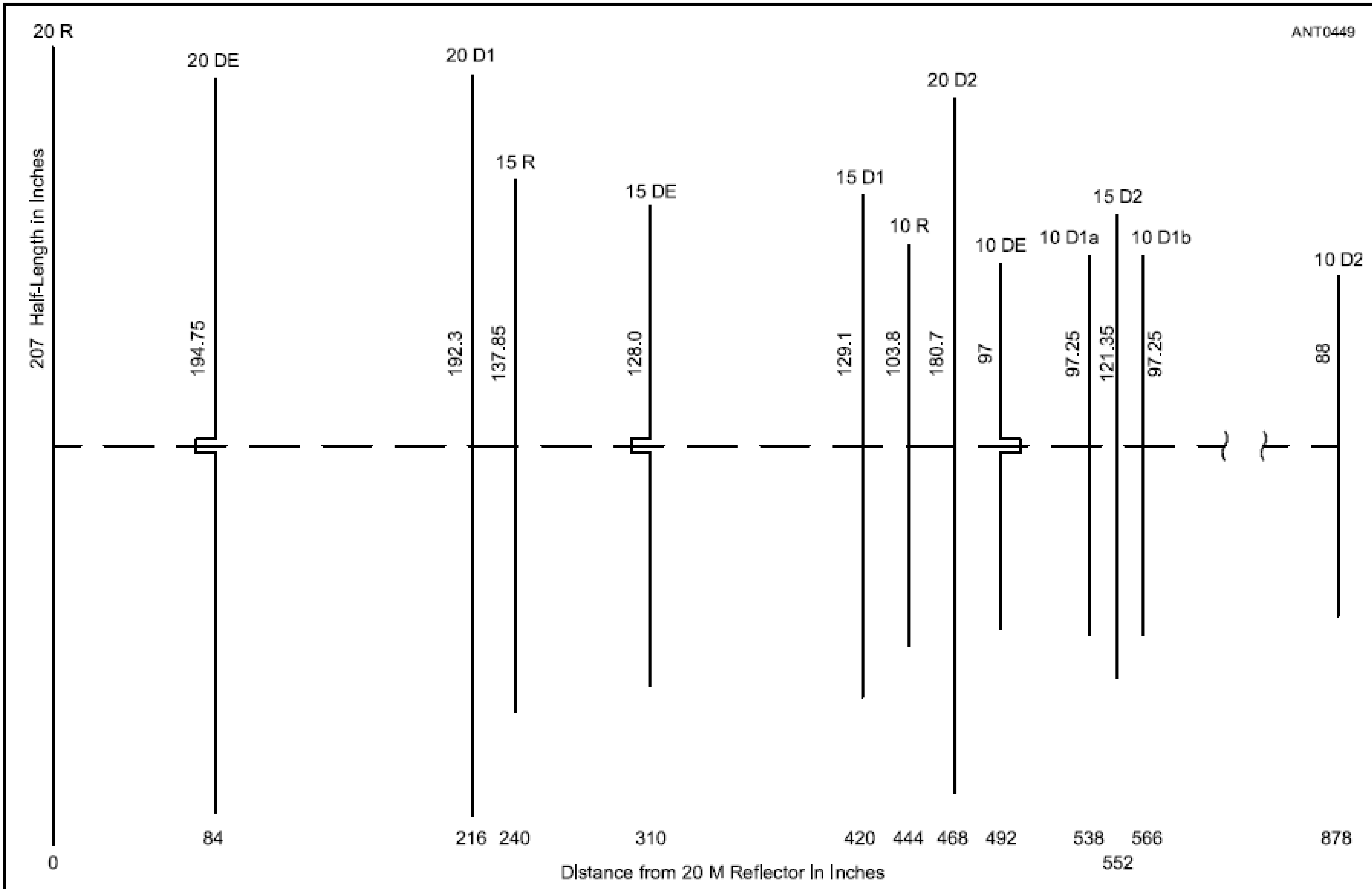


Fig 13-24—W6KW holding two of the coils for his new 80-meter Yagi, as developed by W6ANR. These loading coils measure 7 inches in diameter and exhibit an unloaded Q of nearly 700!

Multielement beam



JK-Navassa

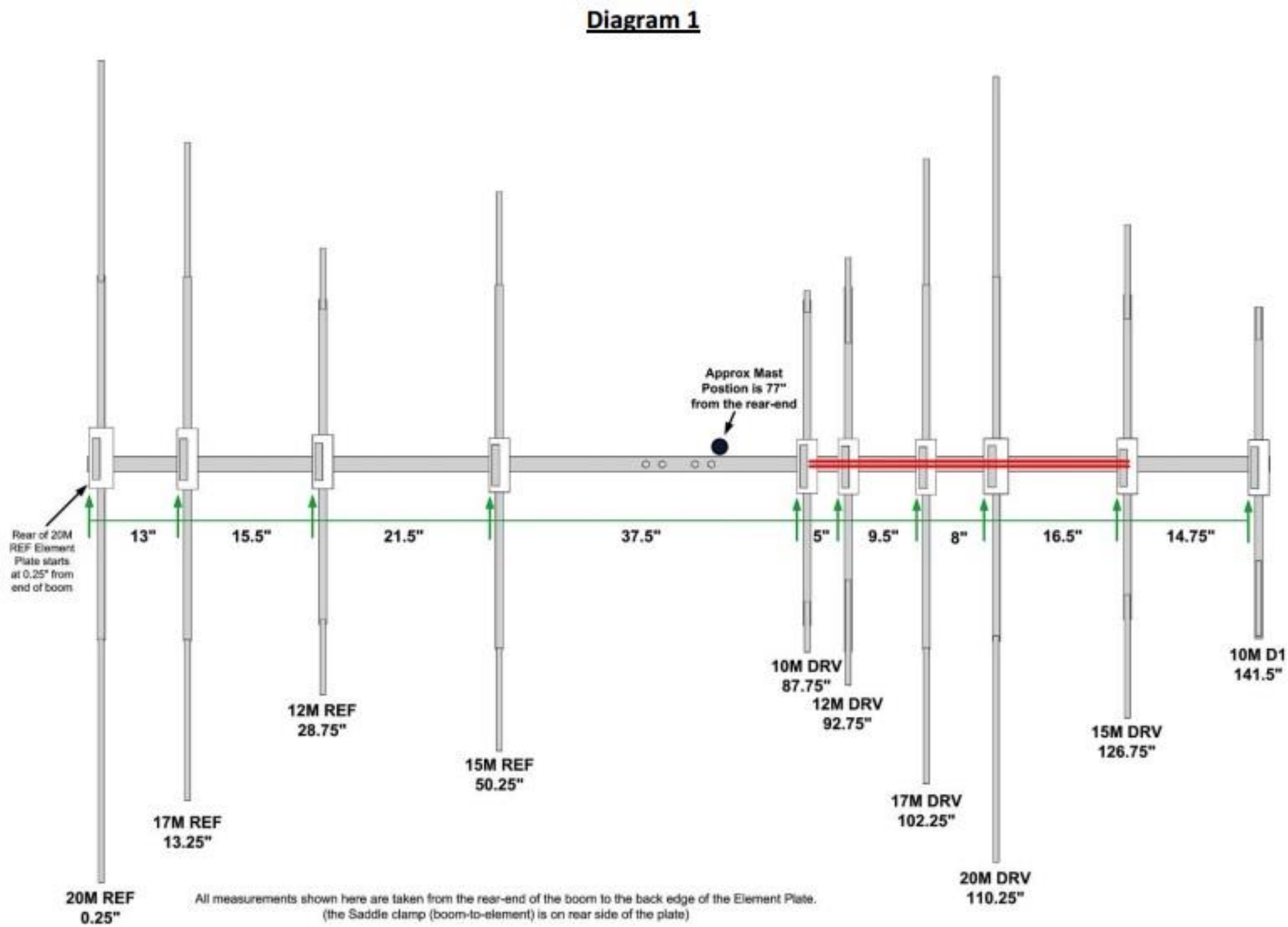
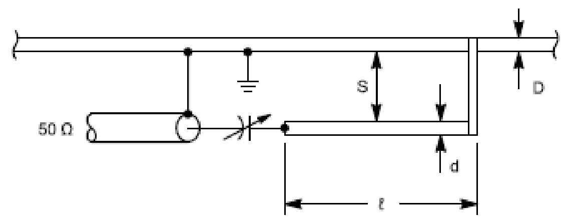
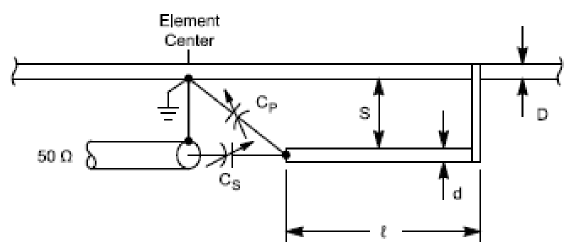


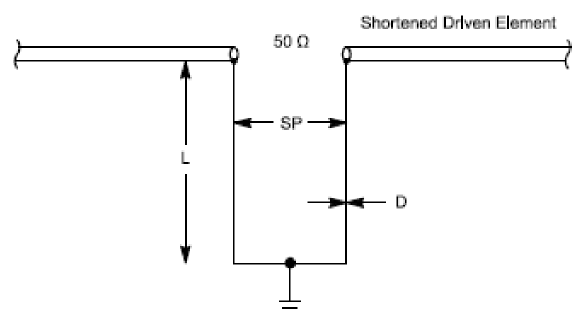
Diagram 1
Approx Mast Postion is 77" from the rear-end
Rear of 20M REF Element Plate starts at 0.25" from end of boom
13"
15.5"
21.5"
37.5"
5"
9.5"
8"
16.5"
14.75"
20M REF 0.25"
17M REF 13.25"
12M REF 28.75"
15M REF 50.25"
10M DRV 87.75"
12M DRV 92.75"
17M DRV 102.25"
20M DRV 110.25"
15M DRV 126.75"
10M D1 141.5"
All measurements shown here are taken from the rear-end of the boom to the back edge of the Element Plate.
(the Saddle clamp (boom-to-element) is on rear side of the plate)

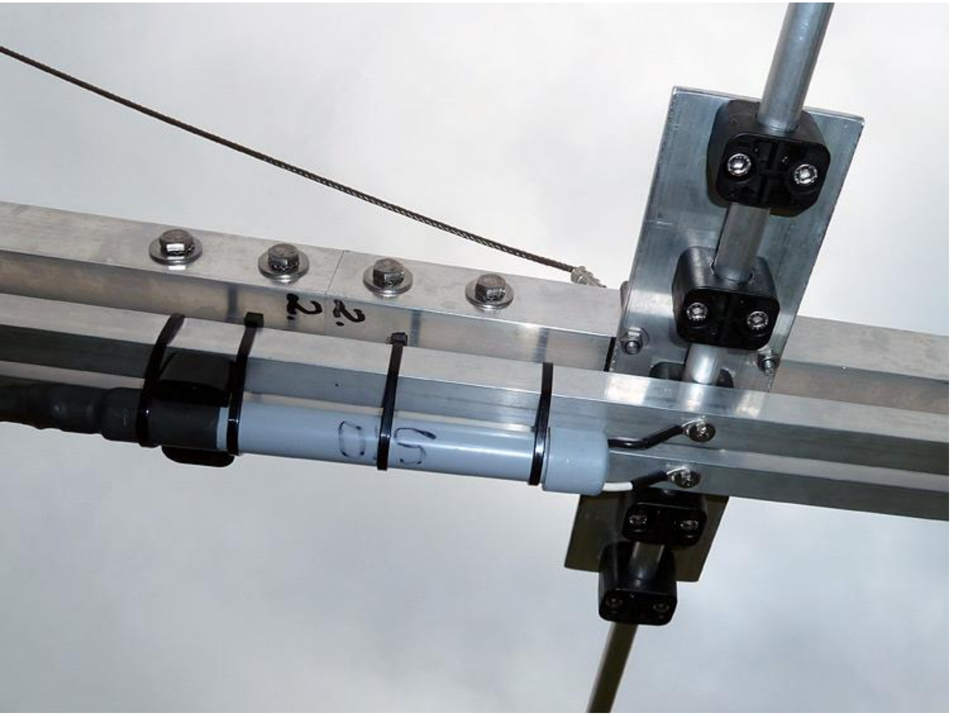
Beam tilpasning og føding

- Gamma
- Omega
- Hairpin
- Direkte



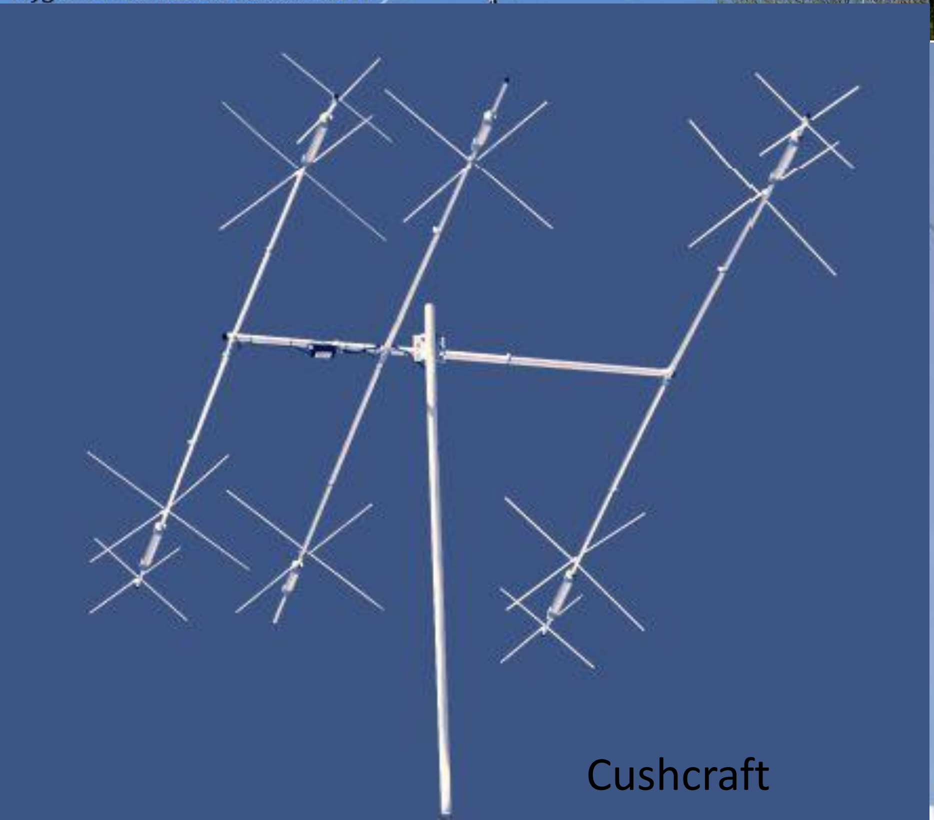








Hygain TH3Mk3 at KE6D QTH


Cushcraft


Optibeam

Beam med justerbare element

- Steppir, USA
- Ultrabeam, Italia

SteppIR

UltraBeam is proud to announce a new 3 elements yagi operating from 6 to 40 mt.
The design come from the famous 3 elements 6-20, we add a new driver from the Vertical Loop series extending the frequencies till the 7Mhz.
This is our new proposal for amateurs need to extend their operating frequencies from 6 to 40 mt.
This new model highlight the UltraBeam commitment to expand and enhance the actual antenna's offer to meet the most exigent OM in our market.

Logperiodiske antenner

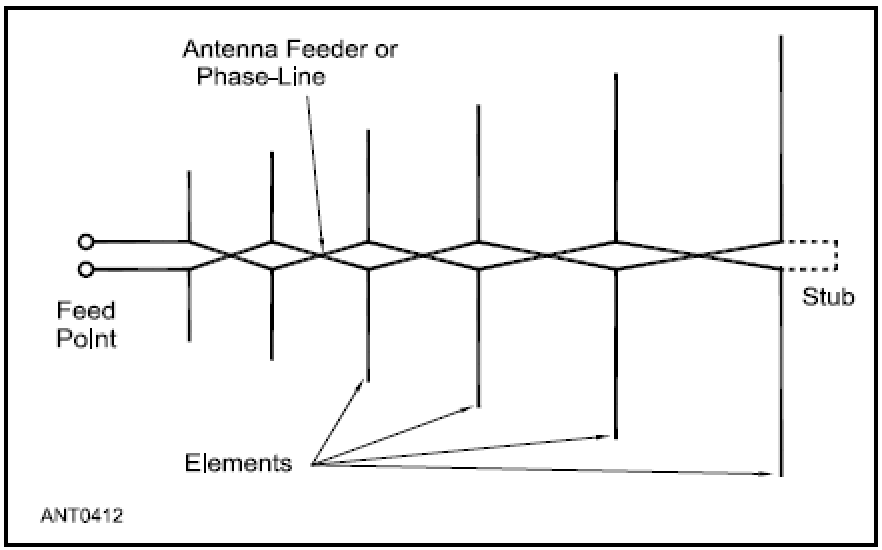
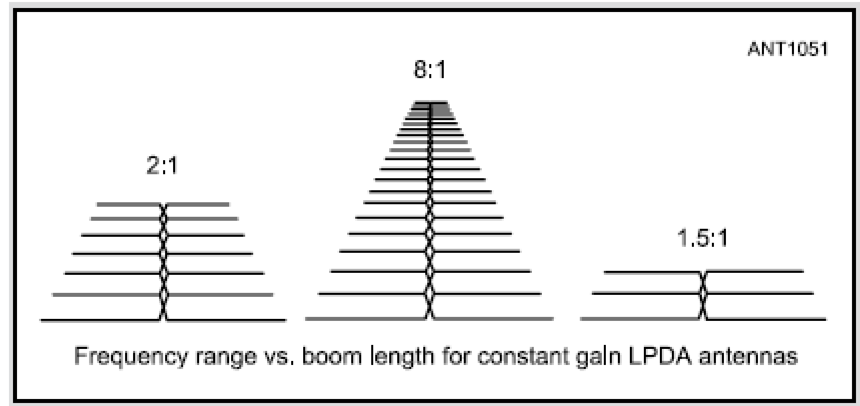


Figure 7.1 — The basic components of a log periodic dipole array (LPDA). The forward direction is to the left in this sketch. Many variations of the basic design are possible.



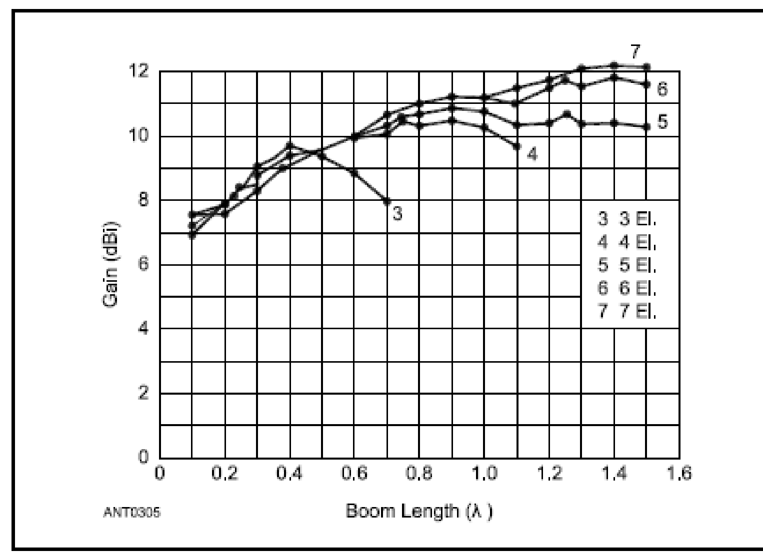
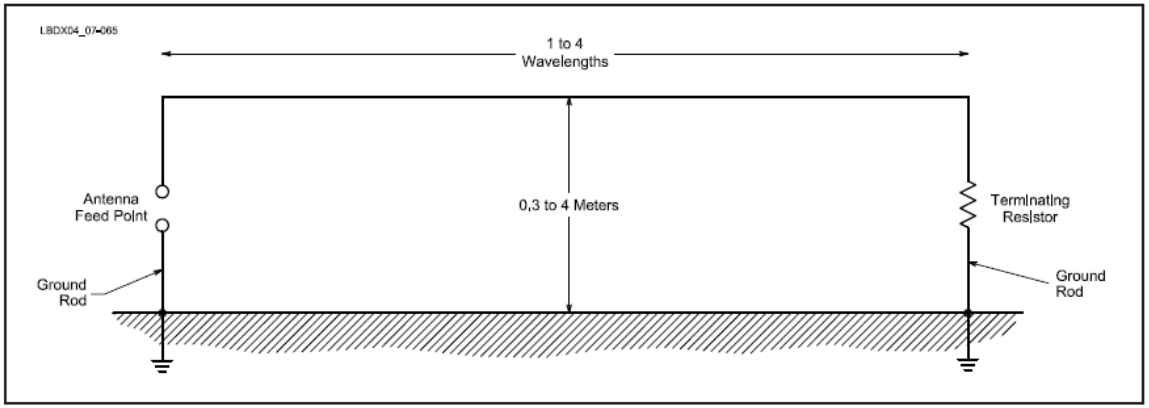
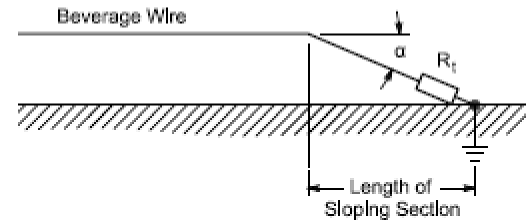


Figure 6.10 — Yagi gain for 3, 4, 5, 6 and 7-element beams as a function of boom length. (From *Yagi Antenna Design*, J. Lawson, W2PV.)

Beaveridge





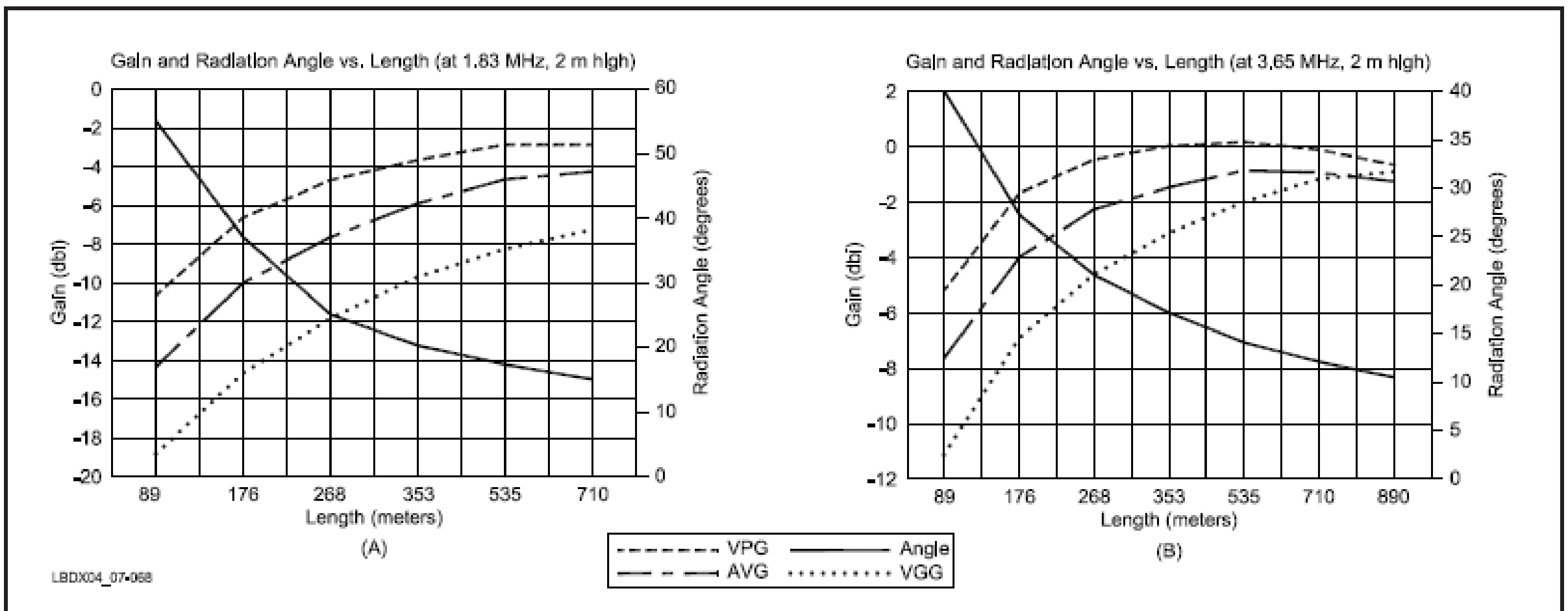
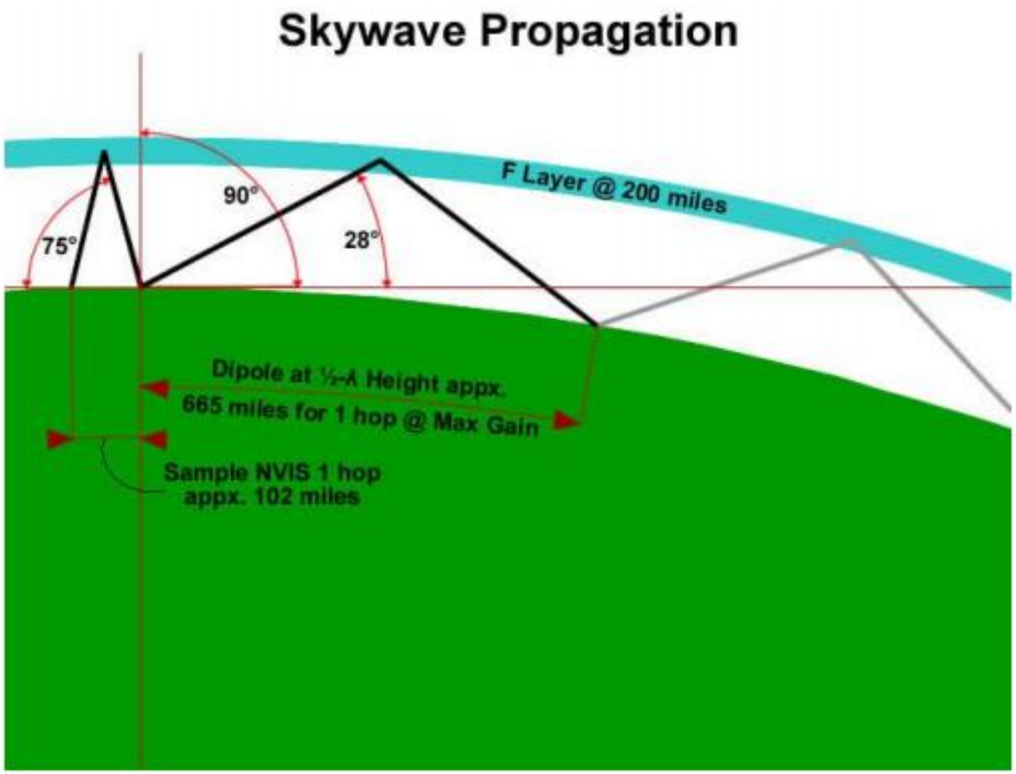
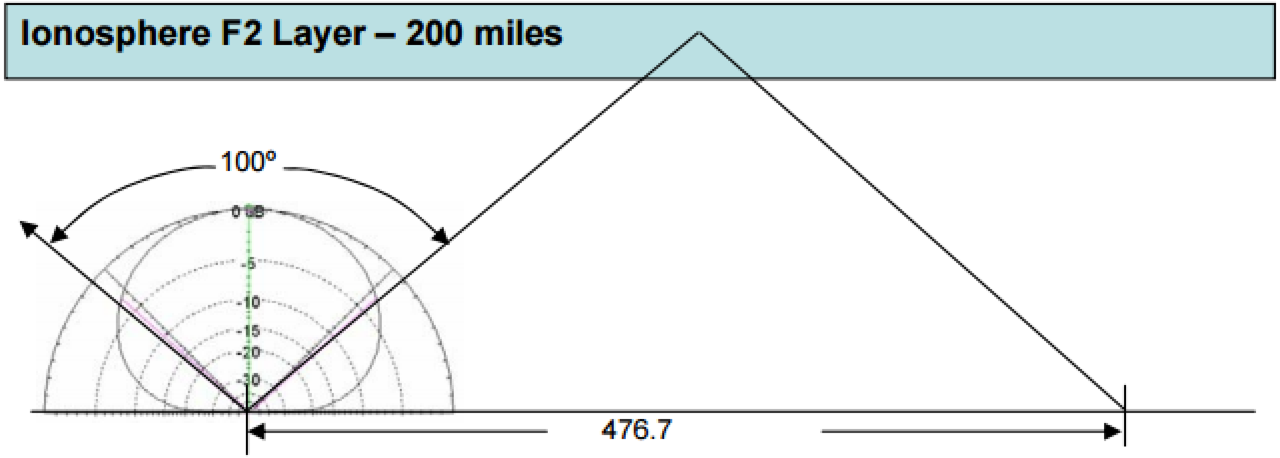


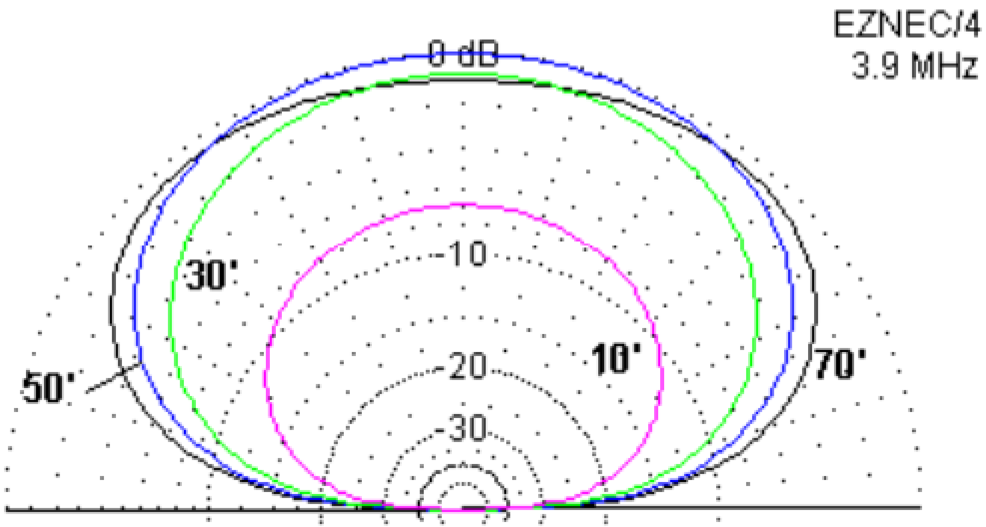
Fig 7-68—Gain and elevation angle for a 2-meter high Beverage antenna for 160 and 80 meters, as a function of the antenna length. Three curves are shows: over Very Poor Ground (VPG), over Average Ground (AVG), and over Very Good Ground (VGG). The radiation angle is computed for Average Ground. This angle only changes marginally between Very Poor and Very Good ground.

NVIS

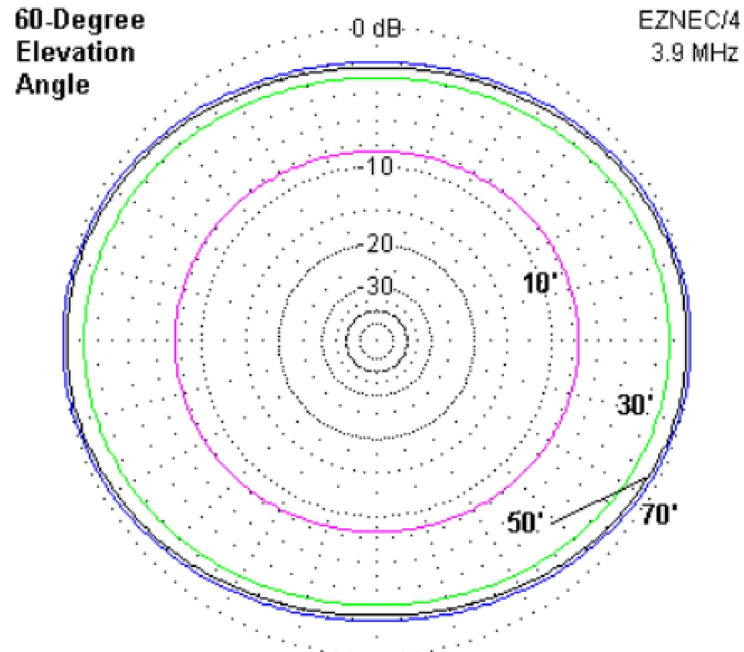


Slide found at http://www.w5jck.com/nvis/W5JCK-NVIS-Antenna-Presentation.pdf





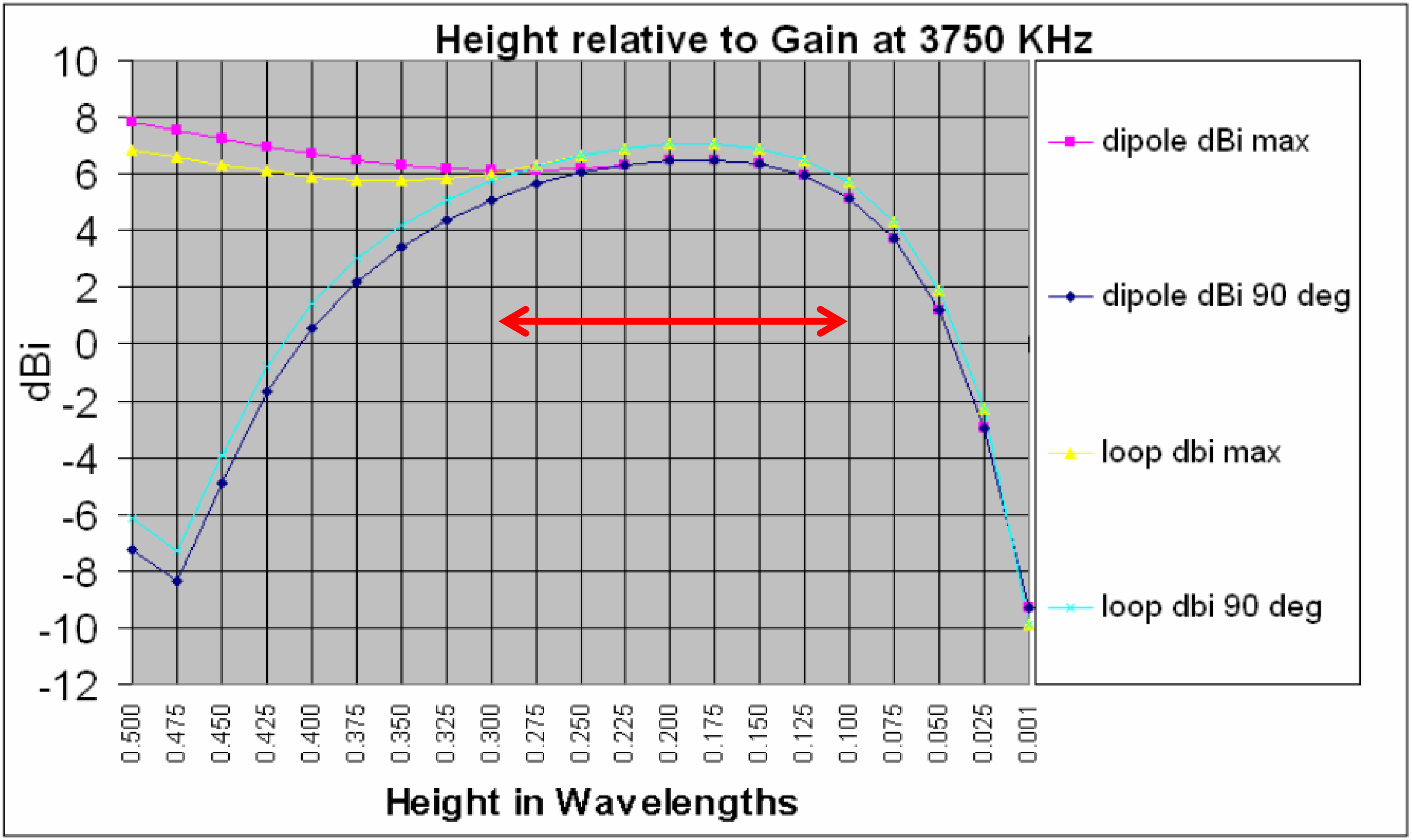
Elevation Patterns of a 75-Meter Dipole for NVIS Service at 10, 30, 50, and 70 Feet Above Average Soil



Azimuth Patterns of a 75-Meter Dipole for NVIS Service at 10, 30, 50, and 70 Feet Above Average Soil

Effekt av opphengs høyde

- As can be seen, heights from 0.1 to 0.3 wavelengths have the highest gain. This fact will be very important when optimizing a NVIS antenna to work over a wide range of frequencies.



An antenna mounted auto-tuner used for temporary portable operation does not need sun shielding as shown in Figures 33 and 34.

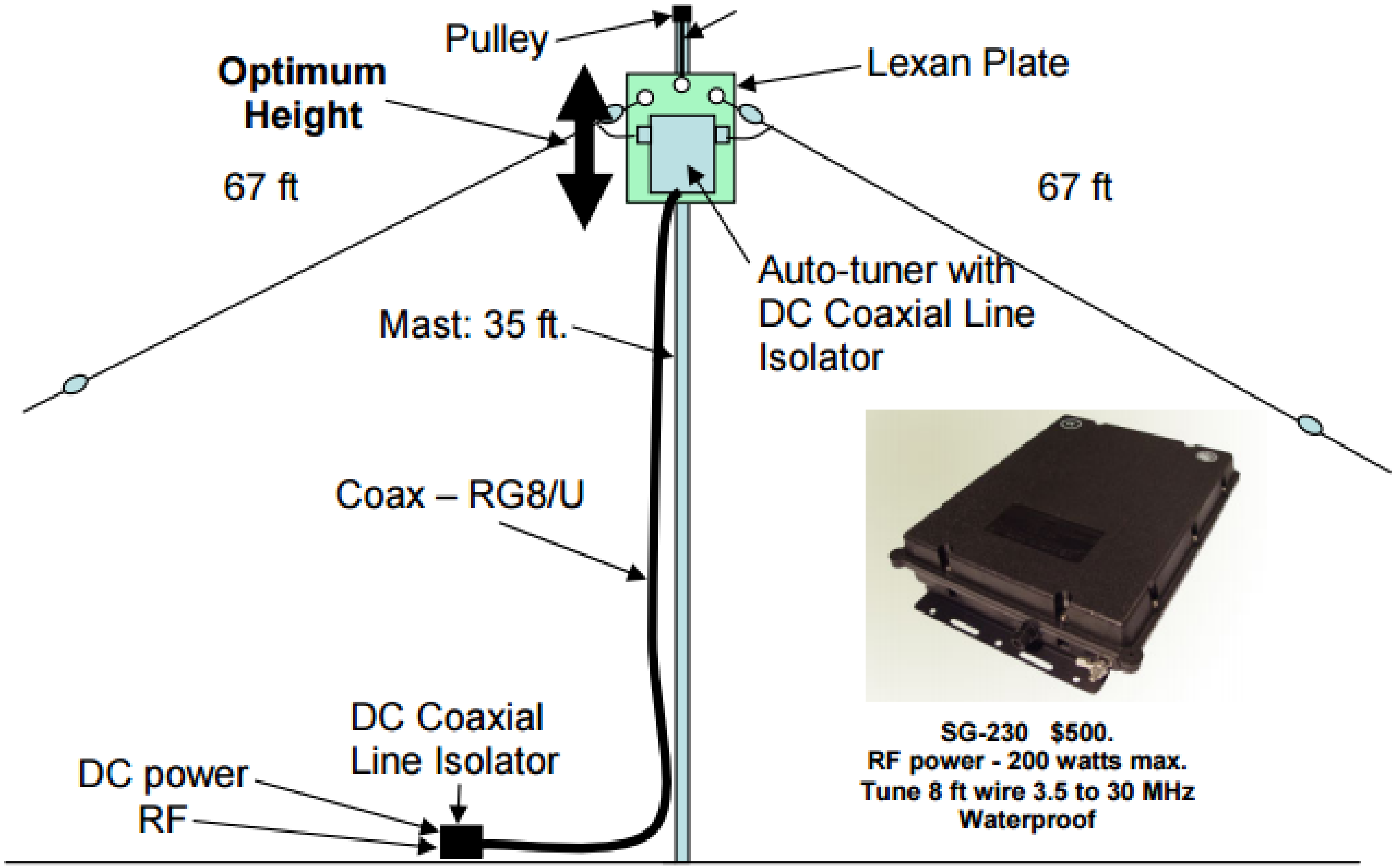
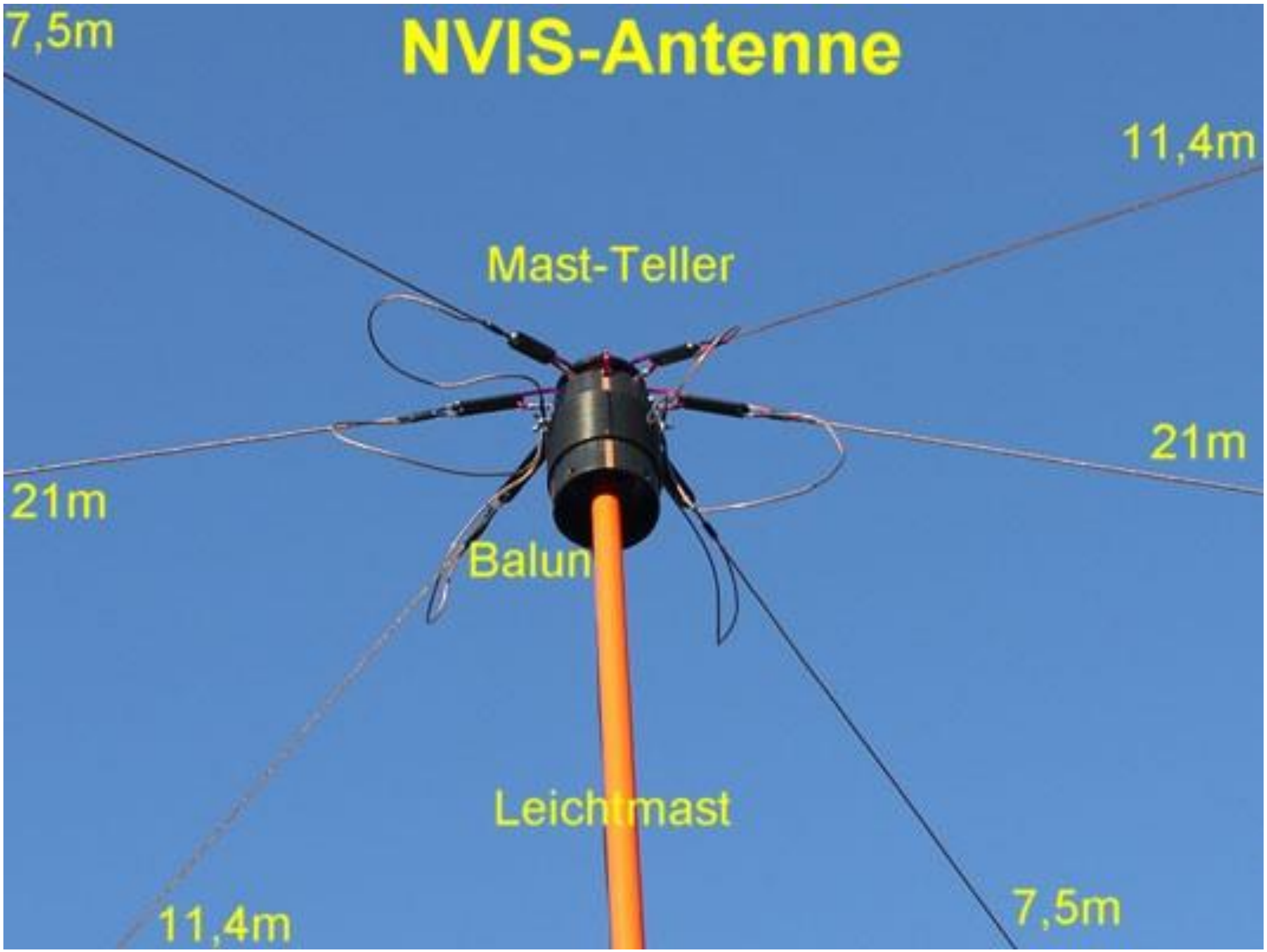


Figure 33: Auto-Tuner for Portable Operation

NVIS antenne for 80m, 40m og 30m



Og det ble nordlys

am92VLv_460sv.mp4


Takk for i kveld!