General License Course

Chapter 7.1
Dipoles and Ground Planes

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Antenna Basics

- Definitions:
- *Elements* – the conducting portion of an antenna that radiates or receives a signal
- *Polarization* – refers to the orientation of the electric field radiated by the antenna (vertical, horizontal, circular)
- *Feed point impedance* – the ratio of RF voltage to RF current at an antenna's feed point (R = E ÷ I)
- *Resonant* – when an antenna's feed point impedance is completely resistive ($X_L = X_C$)
- *Radiation pattern* – a graph of an antenna's signal strength in every compass direction or vertical angle

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Antenna Basics

Definitions:

Azimuthal pattern – signal strength in horizontal (compass) directions

Elevation pattern – signal strength in a vertical direction (a side view of the major lobe)

Lobes – regions in the radiation pattern where the antenna is radiating a signal

Nulls – points at which radiation is at a minimum between lobes

Isotropic – antenna radiates equally in every possible direction (a point source, only a reference antenna)

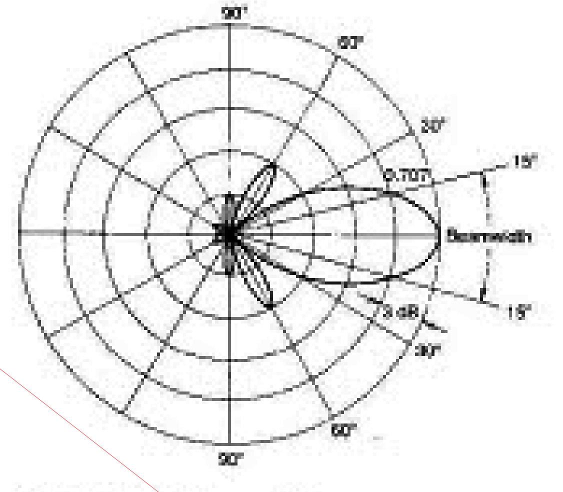
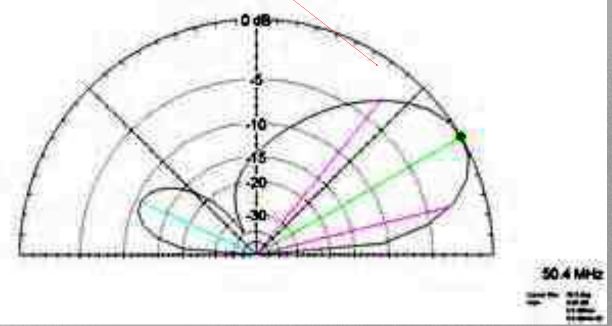


FIGURE 9-9 Beamwidth.



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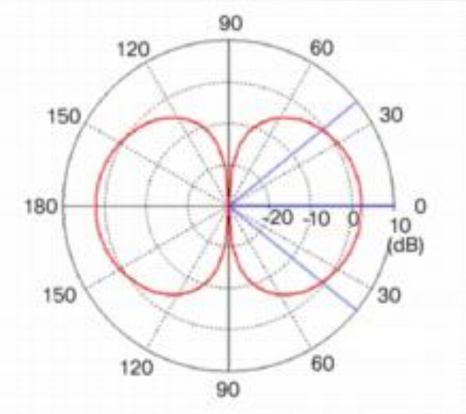
Antenna Basics

- *Omnidirectional* – antenna radiates a signal of equal strength in every horizontal (compass) direction
- *Directional* – antenna radiates preferentially in one or more directions
- *Gain* – concentration of signal transmitted toward or received from a specific direction. *Gain ratios* are measured in dB
- *Front-to-back ratio* – ratio of gain in a forward direction to the opposite direction
- *Front-to-side ratio* – ratio of gain in a forward direction to directions at right angles
- *Standing wave ratio* (SWR) equals the ratio of the antenna's input impedance to the impedance of the feed line

Dipoles

The dipole antenna is a straight conductor, usually ½ wavelength (λ) long with a feed point in the middle

A dipole radiates best broadside to its axis and weaker off the ends (see next slide)



The shape of the azimuthal pattern for a dipole in free space (far above ground) "in a plane containing the conductor" is a Figure-8 at right angles to the dipole

The feed point impedance of a center-fed dipole is approximately 72 Ω but varies depending on height

The feed point impedance of a dipole <u>increases</u> as it is moved away from the center of the dipole – an end-fed ½ λ dipole would have a VERY high feed point impedance

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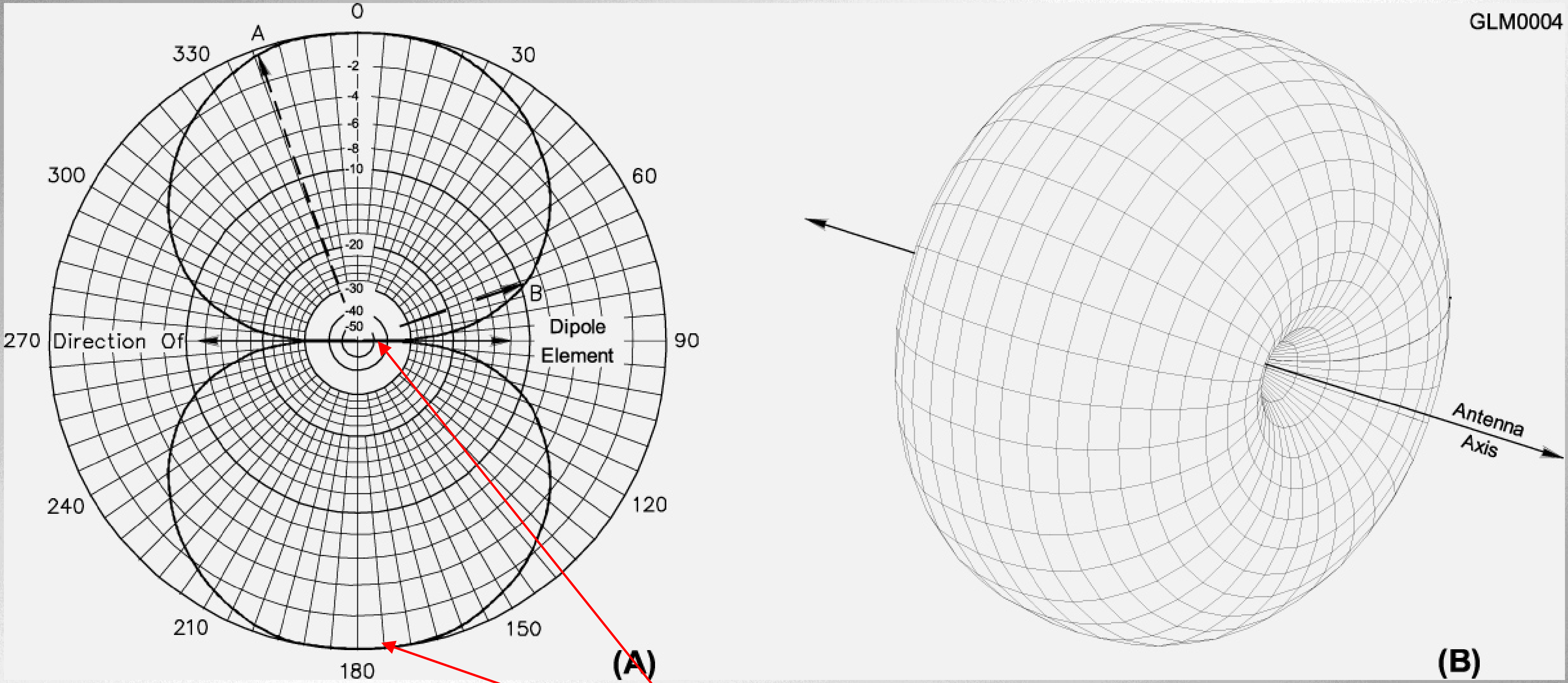
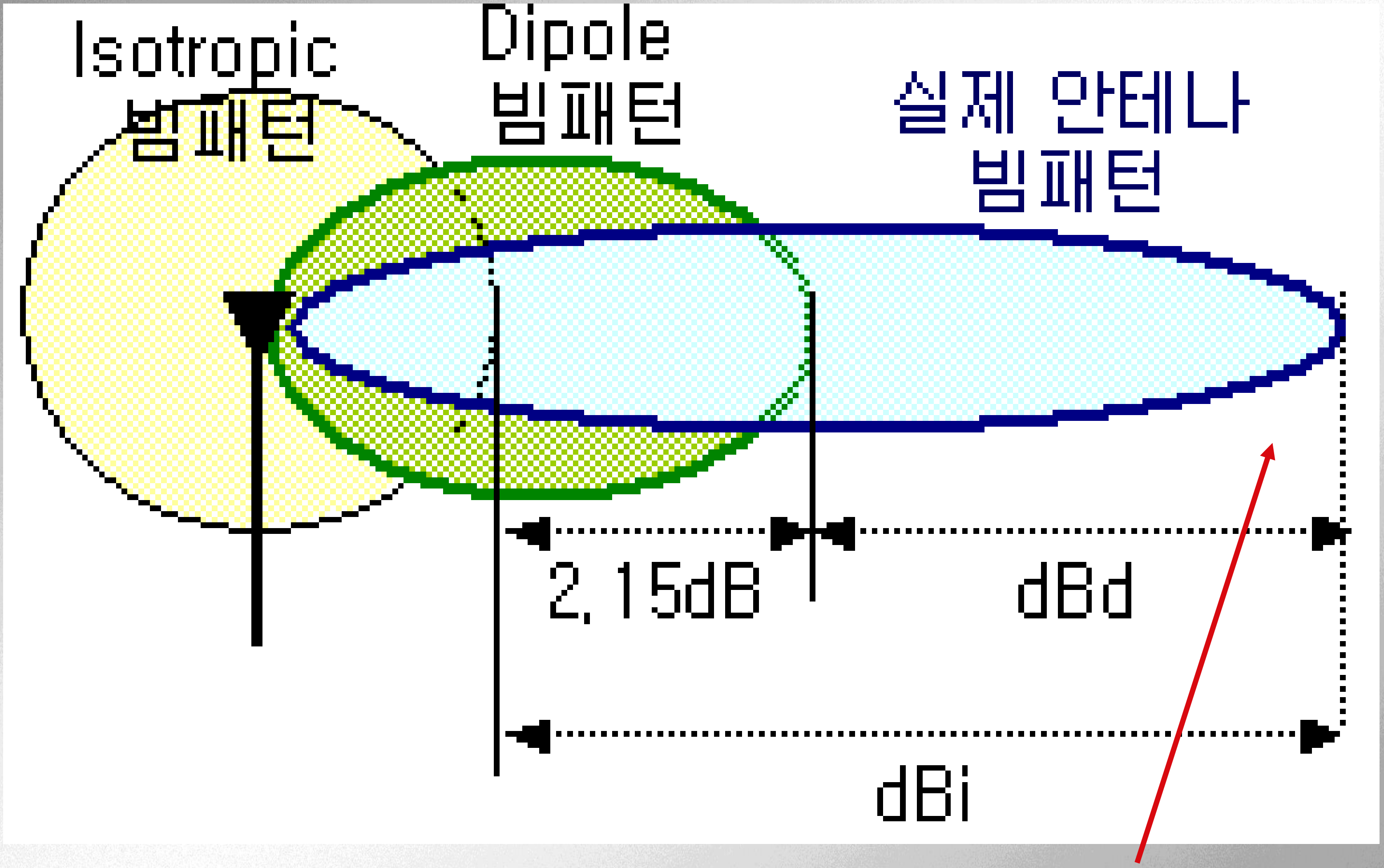
Dipoles



"Gain" = 2.15dBi (see next slide)

dBd vs dBi

- Antenna gain is specified in decibels (dB) with respect to an identified reference antenna
  - Gain compared to an isotropic antenna is called dBi
  - Gain compared to a dipole antenna's maximum radiation is called dBd
  - A dipole in free space has a gain of 2.15 dBi in its main lobes - the dBi gain figure of an antenna is therefore 2.15 dB greater than dBd gain figure for that antenna
  - Convert dBd to dBi by adding 2.15 dB and from dBi to dBd by subtracting 2.15 dB - *dBi is always the bigger number*
    - *2.15 dBi = 0 dBd*



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If the gain represented by the blue lobe equals 5 dBd, it can also be expressed as 7.15 dBi

Dipole

- Center-fed dipoles are generally a good match for 50 to 75 Ω coax at common heights
- In free space, ½ wavelength (λ) in feet equals 492 divided by frequency in MHz
- Practical ½-wave dipoles are shorter than 492/f because of velocity factor - signals move ~5% more slowly in wire than in free space - Dipole approx. length = ~468/freq in MHz

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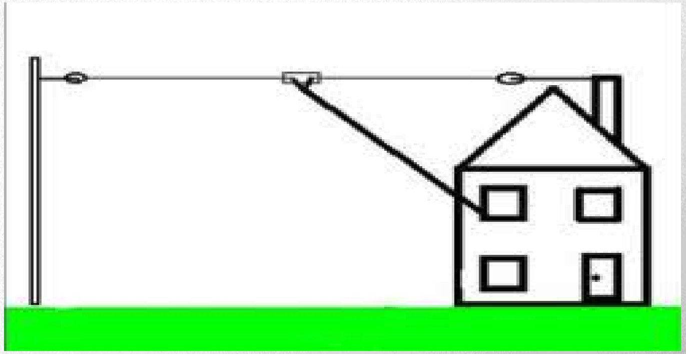
Dipoles

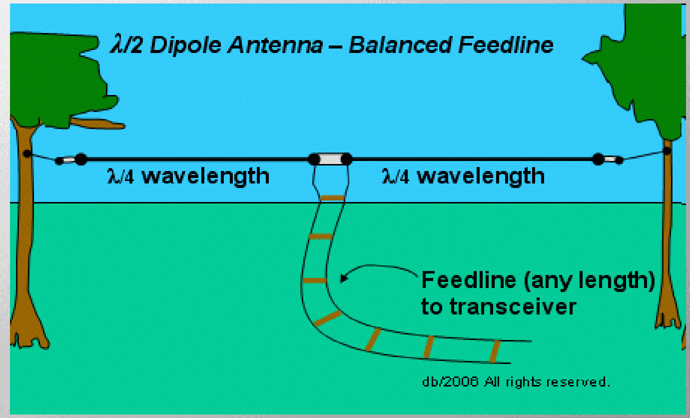
33 feet is the approximate length for a 1/2-wave dipole antenna cut for 14.250 MHz (20 meters)

Calculate ½ wavelength in feet by dividing 468 by the frequency in MHz. 468 / 14.250 = 32.8 Feet **(~33 feet)**



The approximate length for a 1/2-wave dipole antenna cut for 3.550 MHz (80 meters) is **132 feet**.

Calculate ½ wavelength in feet by dividing 468 by the frequency in Mhz. 468 / 3.550 = 131.8 Feet (**~132 feet**)



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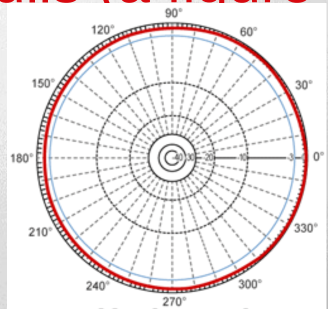
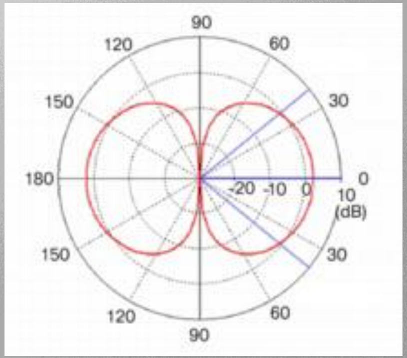
Effects Of Height Above Ground

- Below 1/4 wavelength in height, the antenna's feed point impedance steadily decreases until it is close to zero at ground level
- Above 1/4 wavelength in height the impedance varies, eventually reaching a stable value at a height of several wavelengths
- Height also affects the radiation pattern - Below ½ wavelength, the dipole pattern is almost omnidirectional. Greater heights cause the pattern to develop lobes and nulls (a figure-8 pattern)





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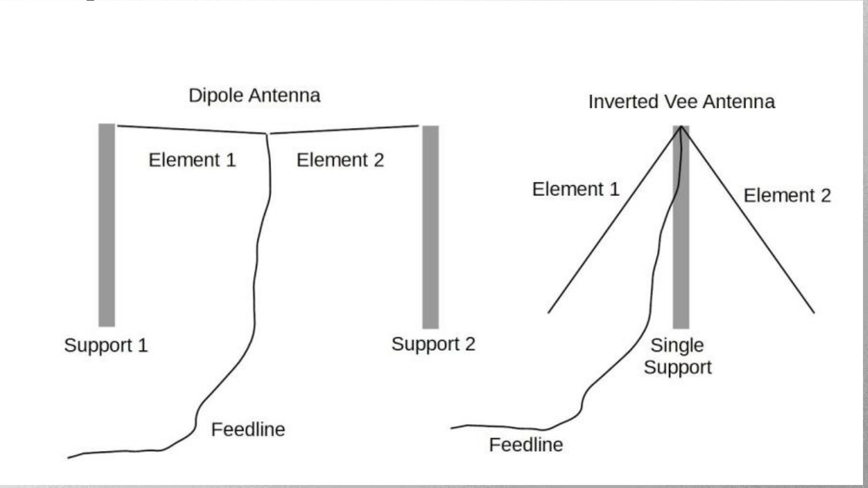
Inverted V Antenna

- A dipole with a single central support is commonly referred to as an Inverted V
- The downward slope of the legs cause the feed point impedance to drop to ~50 ohms

Inverted Vs are largely omnidirectional



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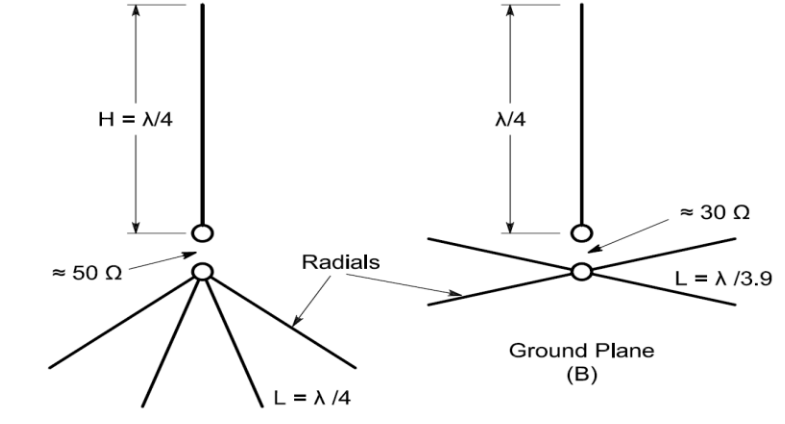
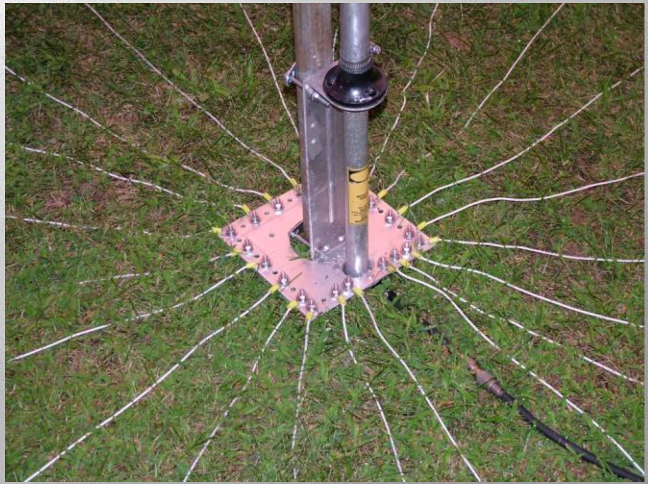
Ground Planes (Verticals)

- The basic ground plane antenna is ¼ λ vertical element over a ground plane. It radiates omnidirectionally in azimuth
- A ¼ λ vertical for 28.5 MHz is ~8 feet tall
  - Ground plane antenna length is 234/frequency in MHz (OR 1/2 the equivalent Dipole length [= 468/F]) 234 / 28.5 MHz = 8.2 feet (round to 8)
- Currents in the ground plane create the effect of an electrical image of the missing half, providing a low resistance return path for antenna current
- The ground plane can be made from sheet metal, a wire grid, or individual radial wires

Ground Plane Vertical

- Ground-mounted ground plane antennas have radial wires laid on the surface or buried within a few inches of the surface
- Feed point impedance of a ground plane antenna (with a good ground return system) is approximately 35Ω (half a dipole)
- Sloping elevated radials downward by 30 to 45 degrees will raise the feed point impedance to approximately 50Ω





Mobile HF Antennas

- Mobile antennas for HF are often some form of a ground plane (vertical whip)
- *Electrical loading* is a technique for *electrically lengthening* a short mobile vertical to present a reasonable SWR - a capacitance hat is most efficient (end loading)
- A shortened antenna will have very limited (narrower) operating bandwidth without retuning, a disadvantage
- *Screwdriver antennas* with an adjustable coil (***base-loading inductance***) are a good compromise between performance and convenience

The purpose of a "corona ball" on a HF mobile antenna is to <u>reduce RF voltage discharge</u> from the tip of the antenna.

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Effects of Polarization

- Radio waves reflecting from the ground have lower losses when the polarization of the wave is parallel to the ground
- Horizontally polarized antennas have lower ground reflection losses than vertically polarized antennas
- Ground-mounted vertical antennas are able to generate stronger signals at lower angles of radiation than horizontal antennas at low heights - Vertical antennas are often preferred for DX contacts where it's impossible to erect tall towers and beams

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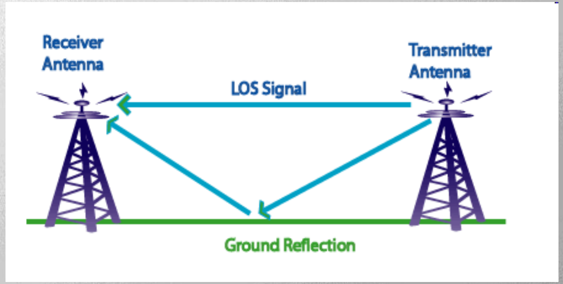
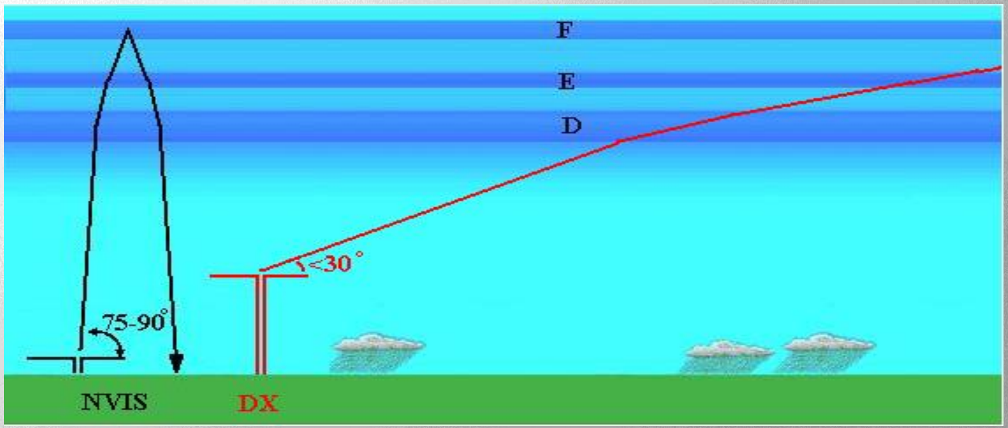


NVIS Antenna

- *NVIS* (Near-Vertical Incidence Sky-wave) – antenna radiates mostly straight up to the ionosphere where it's reflected back down to Earth over a wide area
  - Pattern covers an area of only a few hundred kilometers across
  - Used for disaster communications
  - The best height is between **1⁄10** and ¼ wavelength above ground
  - Typically a simple λ/2 dipole



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Take Quiz 1

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G4E01 - What is the purpose of a capacitance hat on a mobile antenna?

A. To increase the power handling capacity of a whip antenna

B. To reduce radiation resistance

C. To electrically lengthen a physically short antenna

D. To lower the radiation angle

G4E01 - What is the purpose of a capacitance hat on a mobile antenna?

A. To increase the power handling capacity of a whip antenna

B. To reduce radiation resistance

C. To electrically lengthen a physically short antenna

D. To lower the radiation angle

G4E02 - What is the purpose of a corona ball on an HF mobile antenna?

A. To narrow the operating bandwidth of the antenna

B. To increase the "Q" of the antenna

C. To reduce the chance of damage if the antenna should strike an object

D. To reduce RF voltage discharge from the tip of the antenna while transmitting

G4E02 - What is the purpose of a corona ball on an HF mobile antenna?

A. To narrow the operating bandwidth of the antenna

B. To increase the "Q" of the antenna

C. To reduce the chance of damage if the antenna should strike an object

D. To reduce RF voltage discharge from the tip of the antenna while transmitting

G4E06 - What is one disadvantage of using a shortened mobile antenna as opposed to a full-size antenna?

A. Short antennas are more likely to cause distortion of transmitted signals

B. Q of the antenna will be very low

C. Operating bandwidth may be very limited

D. Harmonic radiation may increase

G4E06 - What is one disadvantage of using a shortened mobile antenna as opposed to a full-size antenna?

A. Short antennas are more likely to cause distortion of transmitted signals

B. Q of the antenna will be very low

C. Operating bandwidth may be very limited

D. Harmonic radiation may increase

G9B02 - Which of the following is a common way to adjust the feed point impedance of an elevated quarter-wave ground-plane vertical antenna to be approximately 50 ohms?

A. Slope the radials upward

B. Slope the radials downward

C. Lengthen the radials beyond one wavelength

D. Coil the radials

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A. Slope the radials upward

B. Slope the radials downward

C. Lengthen the radials beyond one wavelength

D. Coil the radials

G9B03 - Which of the following best describes the radiation pattern of a quarter-wave ground-plane vertical antenna?

A. Bi-directional in azimuth

B. Isotropic

C. Hemispherical

D. Omnidirectional in azimuth

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D. Omnidirectional in azimuth

G9B04 - What is the radiation pattern of a dipole antenna in free space in a plane containing the conductor?

A. It is a figure-eight at right angles to the antenna

B. It is a figure-eight off both ends of the antenna

C. It is a circle (equal radiation in all directions)

D. It has a pair of lobes on one side of the antenna and a single lobe on the other side

G9B04 - What is the radiation pattern of a dipole antenna in free space in a plane containing the conductor?

A. It is a figure-eight at right angles to the antenna

B. It is a figure-eight off both ends of the antenna

C. It is a circle (equal radiation in all directions)

D. It has a pair of lobes on one side of the antenna and a single lobe on the other side

G9B05 - How does antenna height affect the azimuthal radiation pattern of a horizontal dipole HF antenna at elevation angles higher than about 45 degrees?

A. If the antenna is too high, the pattern becomes unpredictable

B. Antenna height has no effect on the pattern

C. If the antenna is less than 1/2 wavelength high, the azimuthal pattern is almost omnidirectional

D. If the antenna is less than 1/2 wavelength high, radiation off the ends of the wire is eliminated

G9B05 - How does antenna height affect the azimuthal radiation pattern of a horizontal dipole HF antenna at elevation angles higher than about 45 degrees?

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G9B06 - Where should the radial wires of a ground-mounted vertical antenna system be placed?

A. As high as possible above the ground

B. Parallel to the antenna element

C. On the surface or buried a few inches below the ground

D. At the center of the antenna

G9B06 - Where should the radial wires of a ground-mounted vertical antenna system be placed?

A. As high as possible above the ground

B. Parallel to the antenna element

C. On the surface or buried a few inches below the ground

D. At the center of the antenna

G9B07 - How does the feed point impedance of a horizontal 1/2 wave dipole antenna change as the antenna height is reduced to 1/10 wavelength above ground?

A. It steadily increases

B. It steadily decreases

C. It peaks at about 1/8 wavelength above ground

D. It is unaffected by the height above ground

G9B07 - How does the feed point impedance of a horizontal 1/2 wave dipole antenna change as the antenna height is reduced to 1/10 wavelength above ground?

A. It steadily increases

B. It steadily decreases

C. It peaks at about 1/8 wavelength above ground

D. It is unaffected by the height above ground

G9B08 - How does the feed point impedance of a 1/2 wave dipole change as the feed point is moved from the center toward the ends?

A. It steadily increases

B. It steadily decreases

C. It peaks at about 1/8 wavelength from the end

D. It is unaffected by the location of the feed point

G9B08 - How does the feed point impedance of a 1/2 wave dipole change as the feed point is moved from the center toward the ends?

A. It steadily increases

B. It steadily decreases

C. It peaks at about 1/8 wavelength from the end

D. It is unaffected by the location of the feed point

G9B09 - Which of the following is an advantage of using a horizontally polarized as compared to a vertically polarized HF antenna?

A. Lower ground losses

B. Lower feed point impedance

C. Shorter radials

D. Lower radiation resistance

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A. Lower ground losses

B. Lower feed point impedance

C. Shorter radials

D. Lower radiation resistance

G9B10 - What is the approximate length for a 1/2 wave dipole antenna cut for 14.250 MHz?

A. 8 feet

B. 16 feet

C. 24 feet

D. 33 feet

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A. 8 feet

B. 16 feet

C. 24 feet

D. 33 feet

G9B11 - What is the approximate length for a 1/2 wave dipole antenna cut for 3.550 MHz?

A. 42 feet

B. 84 feet

C. 132 feet

D. 263 feet

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A. 42 feet

B. 84 feet

C. 132 feet

D. 263 feet

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G9B12 - What is the approximate length for a 1/4 wave monopole antenna cut for 28.5 MHz?

A. 8 feet

B. 11 feet

C. 16 feet

D. 21 feet

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A. 8 feet

B. 11 feet

C. 16 feet

D. 21 feet

G9C04 - How does antenna gain in dBi compare to gain stated in dBd for the same antenna?

A. Gain in dBi is 2.15 dB lower

B. Gain in dBi is 2.15 dB higher

C. Gain in dBd is 1.25 dBd lower

D. Gain in dBd is 1.25 dBd higher

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G9D01 - Which of the following antenna types will be most effective as a near vertical incidence skywave (NVIS) antenna for short-skip communications on 40 meters during the day?

A. A horizontal dipole placed between 1/10 and 1/4 wavelength above the ground

B. A vertical antenna placed between 1/4 and 1/2 wavelength above the ground

C. A horizontal dipole placed at approximately 1/2 wavelength above the ground

D. A vertical dipole placed at approximately 1/2 wavelength above the ground

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C. A horizontal dipole placed at approximately 1/2 wavelength above the ground

D. A vertical dipole placed at approximately 1/2 wavelength above the ground

G9D02 - What is the feed point impedance of an end-fed half-wave antenna?

A. Very low

B. Approximately 50 ohms

C. Approximately 300 ohms

D. Very high

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G9D08 - How does a "screwdriver" mobile antenna adjust its feed point impedance?

A. By varying its body capacitance

B. By varying the base loading inductance

C. By extending and retracting the whip

D. By deploying a capacitance hat

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A. By varying its body capacitance

B. By varying the base loading inductance

C. By extending and retracting the whip

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G9D12 - What is the common name of a dipole with a single central support?

A. Inverted V

B. Inverted L

C. Sloper

D. Lazy H

G9D12 - What is the common name of a dipole with a single central support?

A. Inverted V

B. Inverted L

C. Sloper

D. Lazy H

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Chapter 7.2 and 7.3
Yagi Antennas and
Loop Antennas

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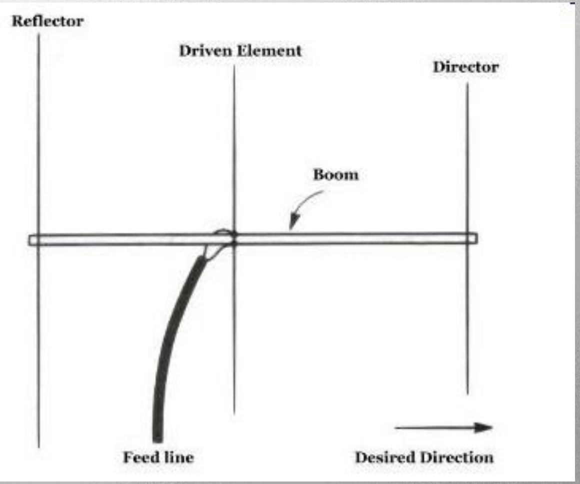
How Yagis Work

- Yagi elements:
- Driven element - connected to the feed line
- Parasitic element(s) – one or more elements not connected to the feed line that influence the antenna’s radiation and receiving pattern

Parasitic arrays – energy from the driven element induces a current to flow in the parasitic elements which is re-radiated as part of the antenna’s total signal



Remember *<u>mutual inductance</u>*?

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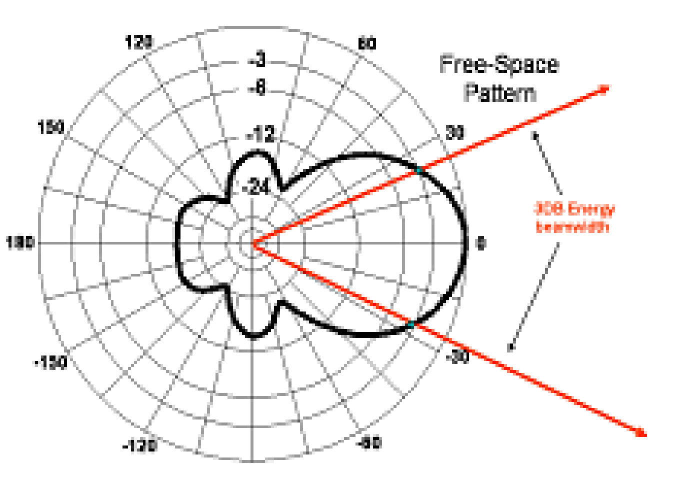
How Yagis Work

- Yagi – the most popular <u>directional</u> antenna
- Yagi antennas can be used to *reduce interference*, signals, and noise from unwanted directions
- Directional antennas create a ***maximum field strength in a specific direction*** (**<u>main lobe</u>**)
- *(that's where gain comes from)*



Yagi Structure & Function

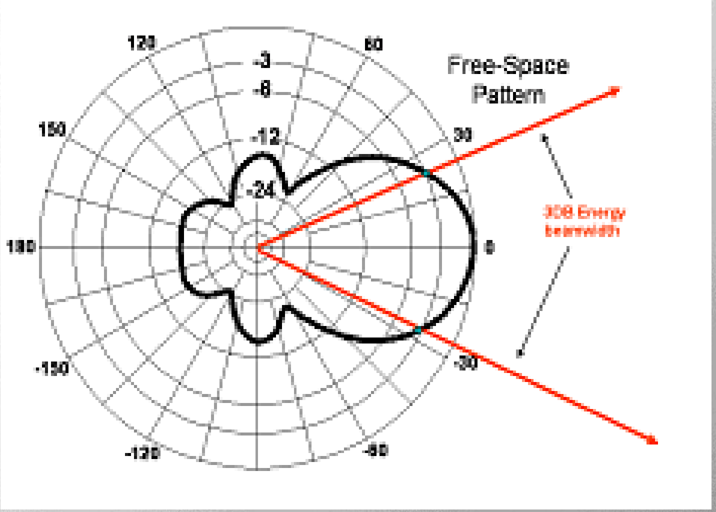
- A Yagi antenna has a driven element and at least one parasitic element

Driven element – about 1/2 λ (a dipole)

Director element(s) – reinforce signals in a single main lobe (~5% shorter than the driven element)

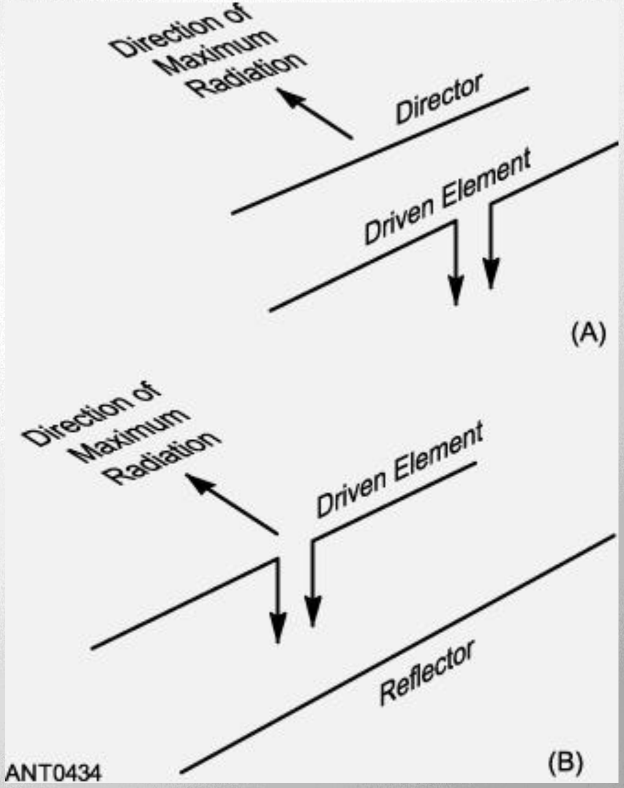
Reflector – cancel signals to the rear (~5% longer than the driven element)

Front-to-back ratio is the ratio of signal strength at the peak of the radiation pattern's major lobe to that in exactly the opposite direction



Yagi Structure

- The simplest Yagi is a two-element antenna with a driven element (DE) and either a reflector (usually) or a director.
- DE is a λ/2 dipole
- Reflector element is about 5% longer than the driven element and placed behind the DE by 0.1-0.2 λ
- Director element is about 5% shorter than the driven element and placed ahead of the DE by 0.15-0.2 λ



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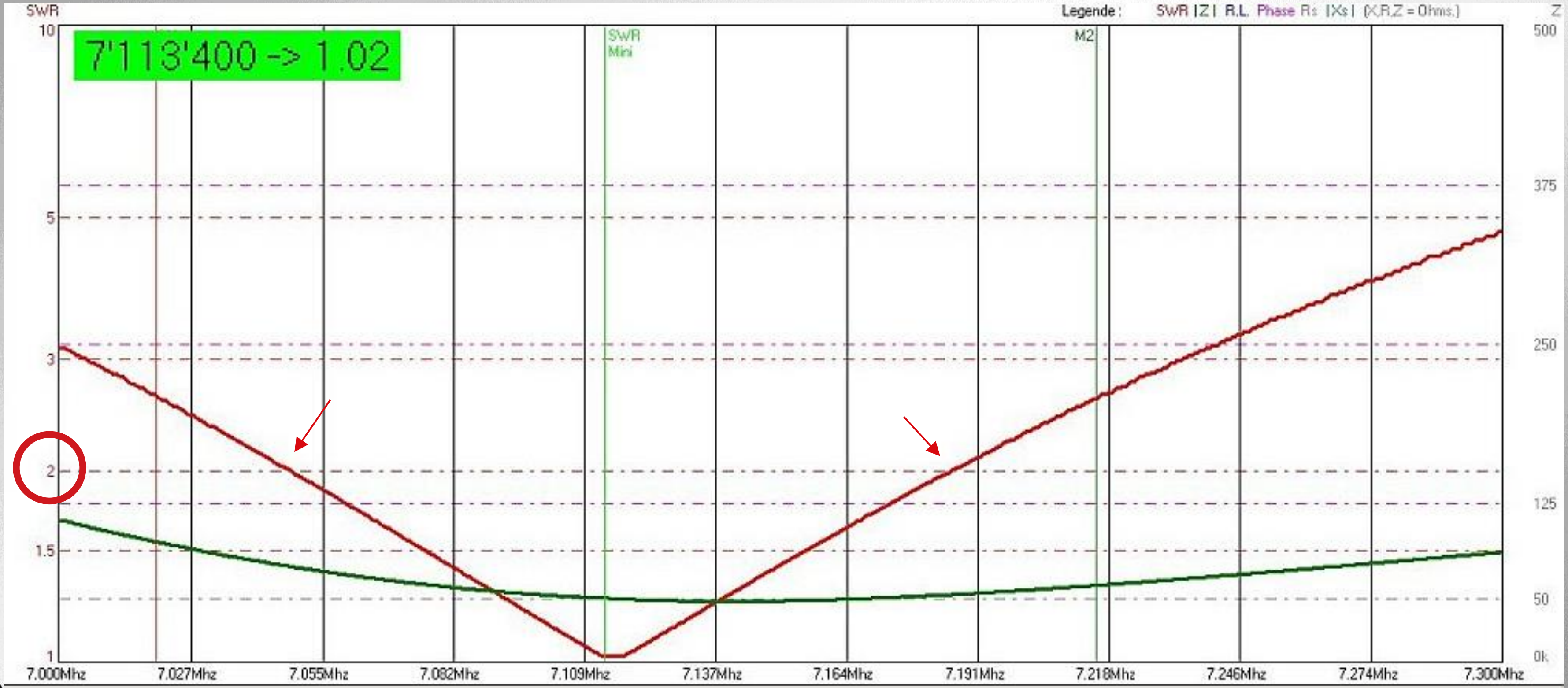
Design Tradeoffs

- Yagi design variables (gain, F-B ratio, SWR bandwidth) are boom length, number of elements, and element spacing *(all three)*
- Placement and length of the elements affects gain, resonance, bandwidth, SWR, and pattern
- Increasing boom length and adding directors increases gain
- Larger diameter elements increase SWR bandwidth
- Antenna modeling software can be used to optimize the antenna design

Preview of Feed Lines…

- *Forward power* – power traveling toward an antenna (load)
- *Reflected power* – power reflected from an impedance mismatch at the antenna
- *Standing waves* – interference wave pattern in a feed line from forward and reverse power
- *Standing wave ratio* (SWR) equals the ratio of the antenna's impedance to the impedance of the feed line (with the lower Z = 1: always X:1)
- Short or open circuit at the feedpoint: SWR = infinite and all power reflected

Bandwidth



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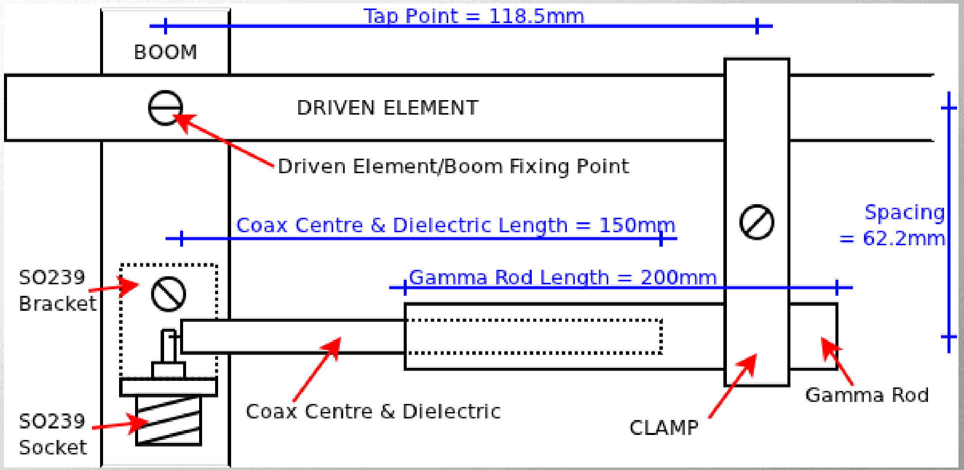
Impedance Matching – Gamma Match

- Most Yagi designs have a relatively low feed point impedance requiring a matching network to match 50 ohm feed lines.
- Gamma matching: the coax shield is connected to the center of the driven element, the center conductor is connected through a tubular capacitor to a tap point on the driven element
- Mechanical advantage - the driven element doesn't have to be insulated from the boom

Tune by adjusting the DE tap point and/or the capacitance



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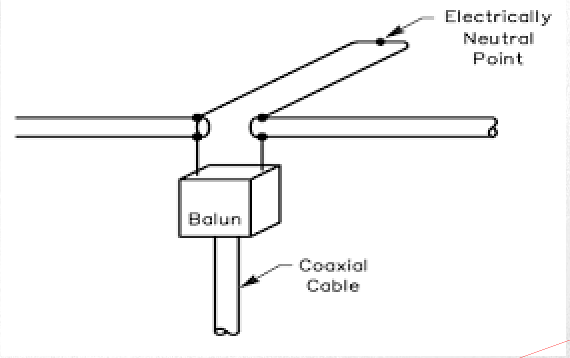
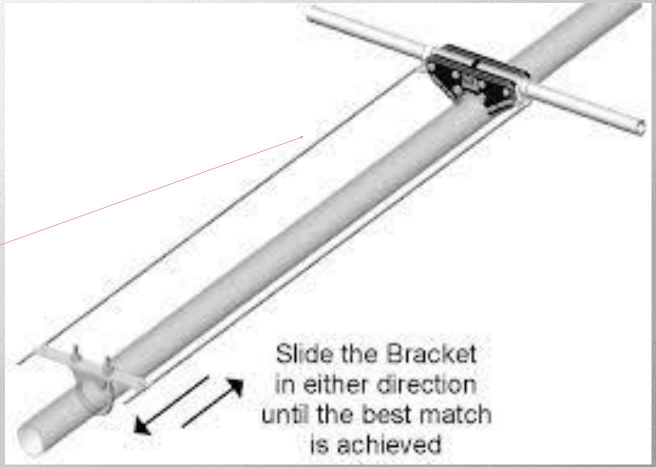
Impedance Matching – Beta Match

The Beta (or "hairpin") match is a short length of parallel conductor transmission line (shorted transmission line stub), shorted at one end, with the other end connected in parallel with the driven element feed point.

Its inductance compensates for the capacitive reactance at the feed point, bringing the impedance of the yagi up to 50 ohms.





D.E. insulated from the boom

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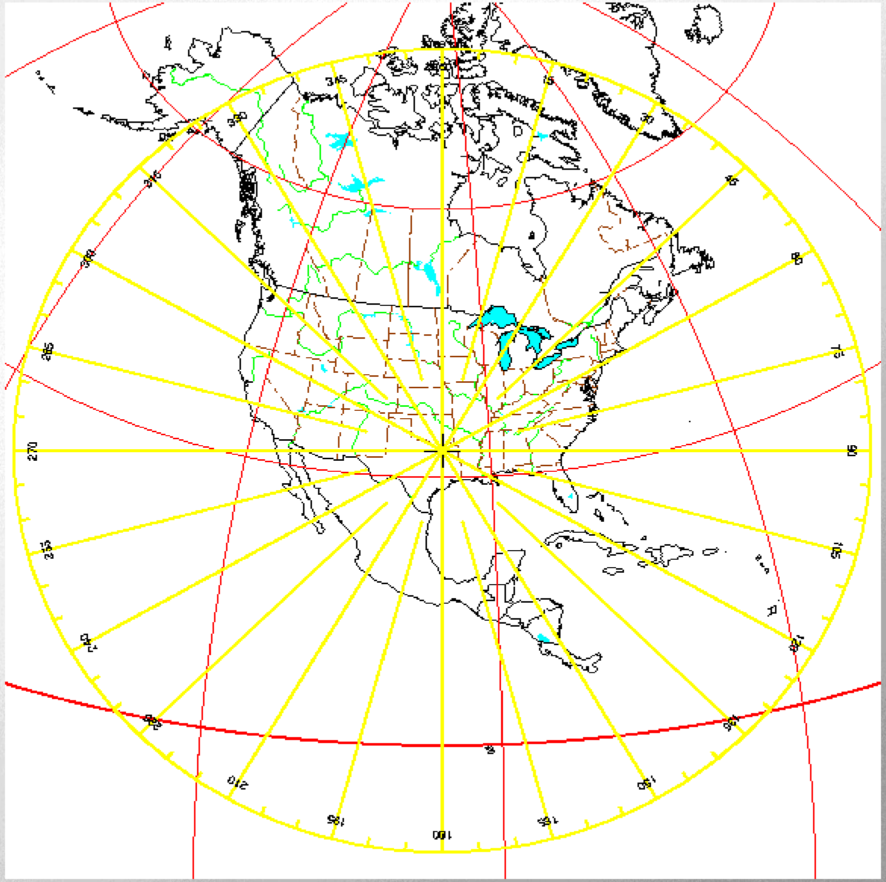
Operating Procedures

- To determine where to point a directional antenna use an azimuthal projection map
- An azimuthal projection map is a world map projection centered on a particular location, showing <u>true bearings and distances</u> from that location



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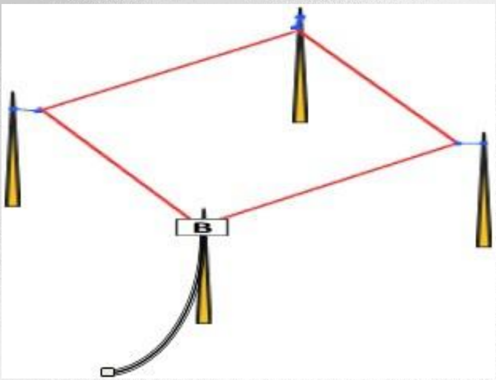
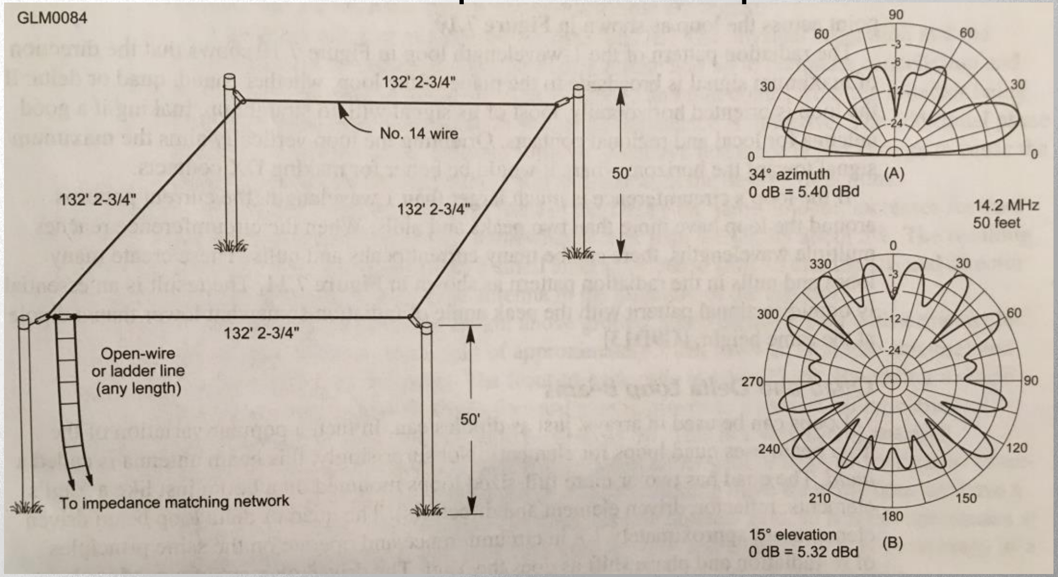
Large Horizontal Loops

If a loop's circumference is multiple wavelengths long many peaks and nulls appear in the radiation pattern, making the loop essentially omnidirectional with a lower peak vertical (elevation) angle than a dipole mounted at the same height.

160 meter loop – 20 meter pattern





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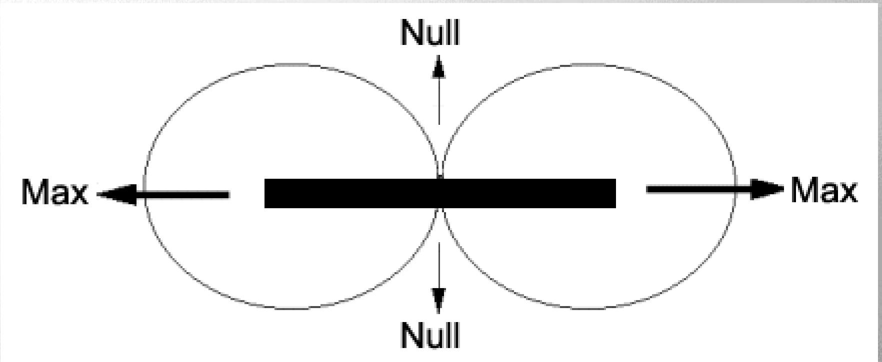
Small Loops

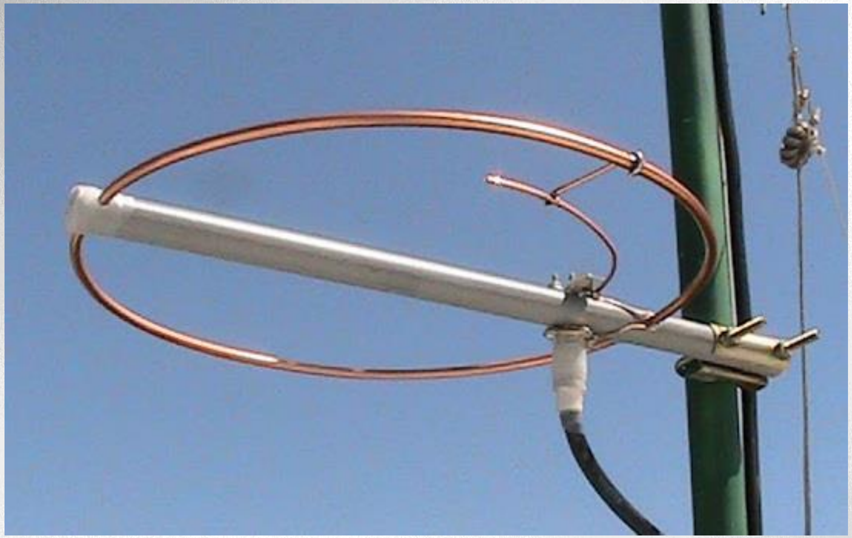
- In loops with circumferences of less than 1/3 λ, current in the loop becomes relatively uniform throughout the loop. The resulting radiation pattern features sharp nulls broadside to the plane of the loop (the opposite of 1 λ loops)

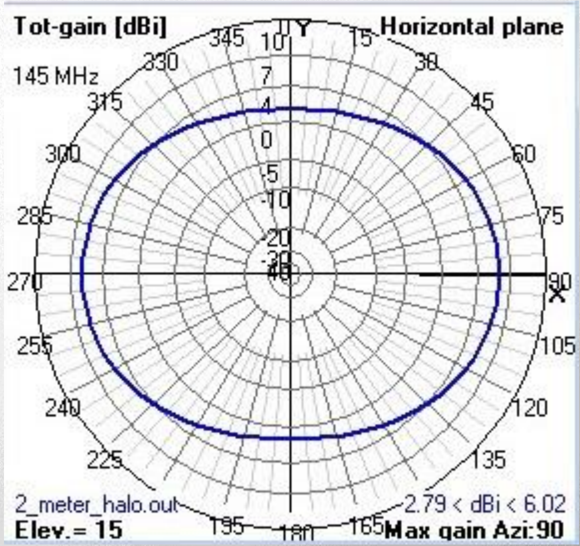
Loop viewed from above

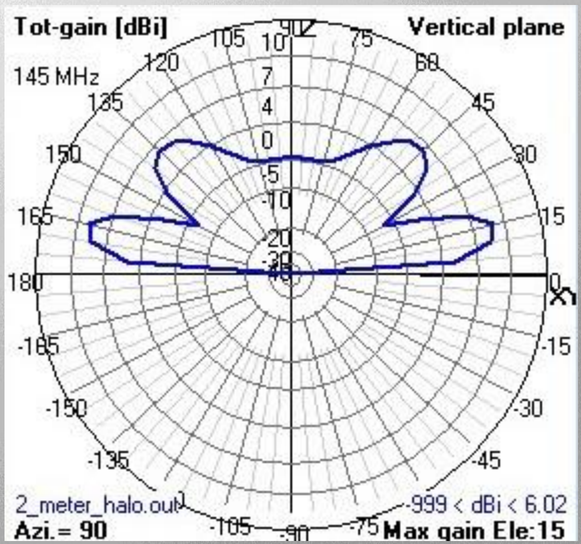


Halo Antenna

- A Halo isn't really a loop. It's a ½ λ dipole bent into a circle or square ("squalo"") with the ends separated by a small gap. Maximum radiation is in the plane of the antenna and its pattern is largely omnidirectional.







Take Quiz 2

G2D04 - Which of the following describes an azimuthal projection map?

A. A map that shows accurate land masses

B. A map that shows true bearings and distances from a specific location

C. A map that shows the angle at which an amateur satellite crosses the equator

D. A map that shows the number of degrees longitude that an amateur satellite appears to move westward at the equator with each orbit

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G9C01 - Which of the following would increase the bandwidth of a Yagi antenna?

A. Larger-diameter elements

B. Closer element spacing

C. Loading coils in series with the element

D. Tapered-diameter elements

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G9C02 - What is the approximate length of the driven element of a Yagi antenna?

A. 1/4 wavelength

B. 1/2 wavelength

C. 3/4 wavelength

D. 1 wavelength

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D. 1 wavelength

G9C03 - How do the lengths of a three-element Yagi reflector and director compare to that of the driven element?

A. The reflector is longer, and the director is shorter

B. The reflector is shorter, and the director is longer

C. They are all the same length

D. Relative length depends on the frequency of operation

G9C03 - How do the lengths of a three-element Yagi reflector and director compare to that of the driven element?

A. The reflector is longer, and the director is shorter

B. The reflector is shorter, and the director is longer

C. They are all the same length

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G9C05 - What is the primary effect of increasing boom length and adding directors to a Yagi antenna?

A. Gain increases

B. Beamwidth increases

C. Front-to-back ratio decreases

D. Resonant frequency is lower

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G9C07 - What does "front-to-back ratio" mean in reference to a Yagi antenna?

A. The number of directors versus the number of reflectors

B. The relative position of the driven element with respect to the reflectors and directors

C. The power radiated in the major lobe compared to that in the opposite direction

D. The ratio of forward gain to dipole gain

G9C07 - What does "front-to-back ratio" mean in reference to a Yagi antenna?

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G9C08 - What is meant by the "main lobe" of a directive antenna?

A. The magnitude of the maximum vertical angle of radiation

B. The point of maximum current in a radiating antenna element

C. The maximum voltage standing wave point on a radiating element

D. The direction of maximum radiated field strength from the antenna

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G9C10 - Which of the following can be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth of a Yagi antenna?

A. The physical length of the boom

B. The number of elements on the boom

C. The spacing of each element along the boom

D. All these choices are correct

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G9C11 - What is a beta or hairpin match?

A. A shorted transmission line stub placed at the feed point of a Yagi antenna to provide impedance matching

B. A 1/4 wavelength section of 75-ohm coax in series with the feed point of a Yagi to provide impedance matching

C. A series capacitor selected to cancel the inductive reactance of a folded dipole antenna

D. A section of 300-ohm twin-lead transmission line used to match a folded dipole antenna

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G9C12 - Which of the following is a characteristic of using a gamma match with a Yagi antenna?

A. It does not require the driven element to be insulated from the boom

B. It does not require any inductors or capacitors

C. It is useful for matching multiband antennas

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G9D03 - In which direction is the maximum radiation from a VHF/UHF "halo" antenna?

A. Broadside to the plane of the halo

B. Opposite the feed point

C. Omnidirectional in the plane of the halo

D. On the same side as the feed point

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G9D10 - In which direction or directions does an electrically small loop (less than 1/10 wavelength in circumference) have nulls in its radiation pattern?

A. In the plane of the loop

B. Broadside to the loop

C. Broadside and in the plane of the loop

D. Electrically small loops are omnidirectional

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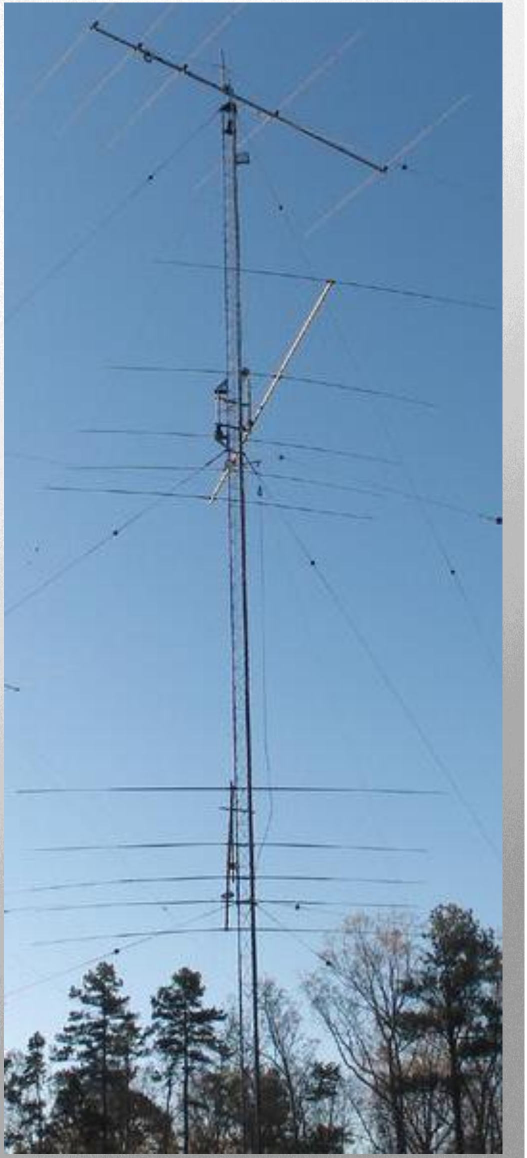
General License Course

Chapter 7.4
Specialized Antennas

Specialized Antennas

- *Stacked Antennas* – identical antennas stacked above or beside each other to increase gain
- *Vertical stacking* of horizontally polarized yagis increases gain and narrows the main lobe in <u>elevation</u>
- Antennas in a vertical stack are usually about ½ wavelength to 1 wavelength apart



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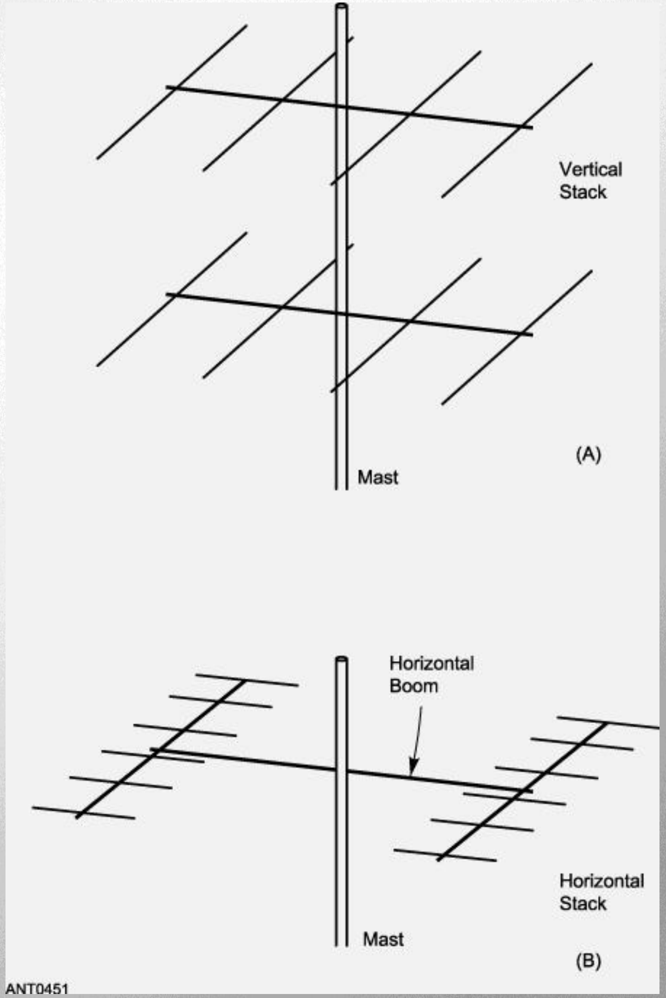
Specialized Antennas

- Stacking 2 identical beams ½ wavelength apart increases gain by 3 dB
- Gain another 3 dB by stacking 4 beam antennas
- Stacking horizontally narrows the *azmuthal* pattern beamwidth



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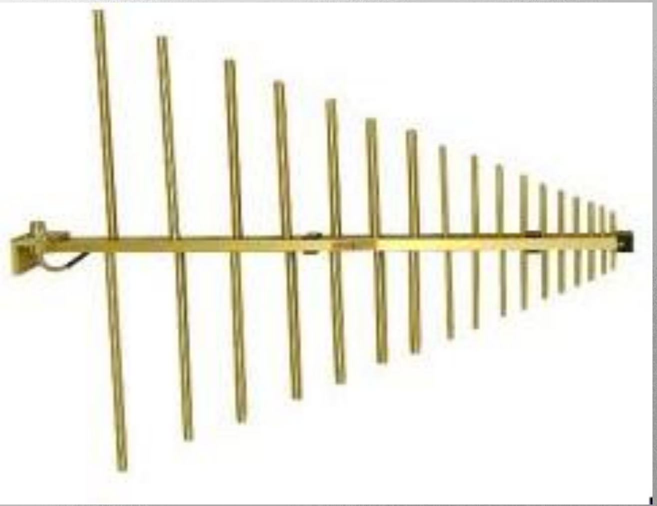
Specialized Antennas

- *Log Periodics* – are designed to have a consistent radiation pattern and SWR across a wide (up to 10:1) frequency range (wide bandwidth)
- Short elements are active at higher frequencies, longer elements are active at lower frequencies
- Log periodic antennas have less gain and lower front-to-back ratio than Yagi antennas

The length and spacing of the elements increases logarithmically from one end of the boom to the other



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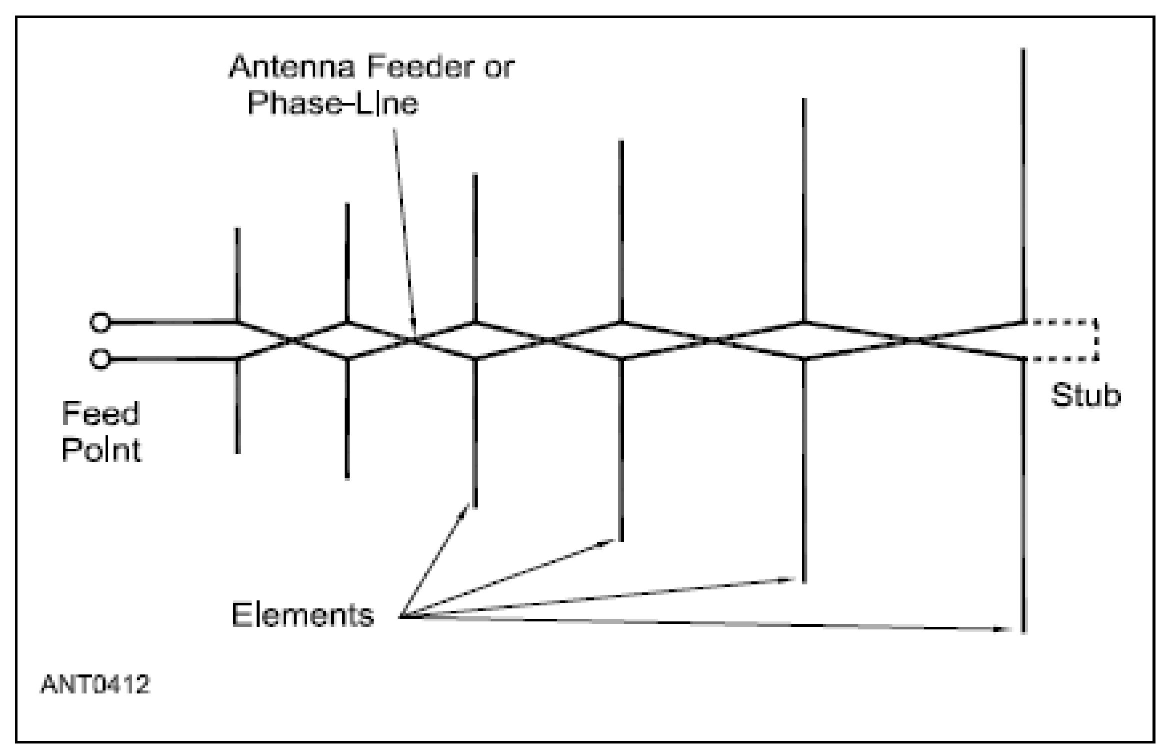
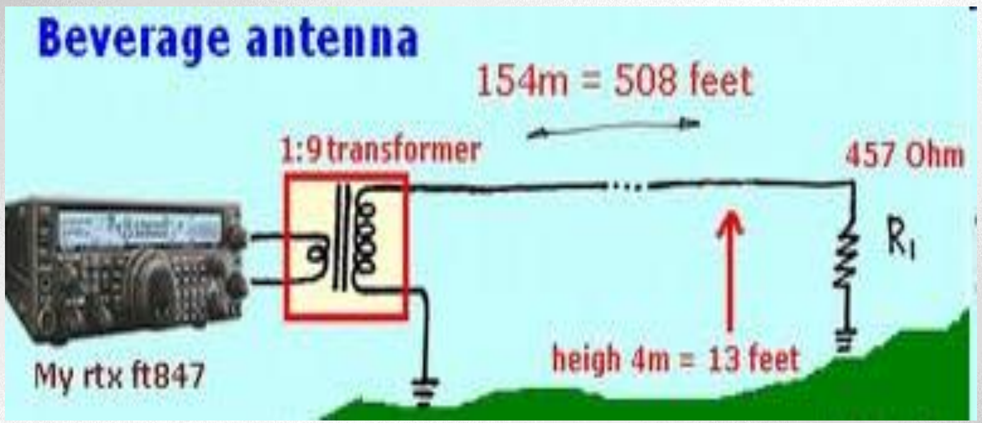
Log Periodic Antenna



Specialized Antennas

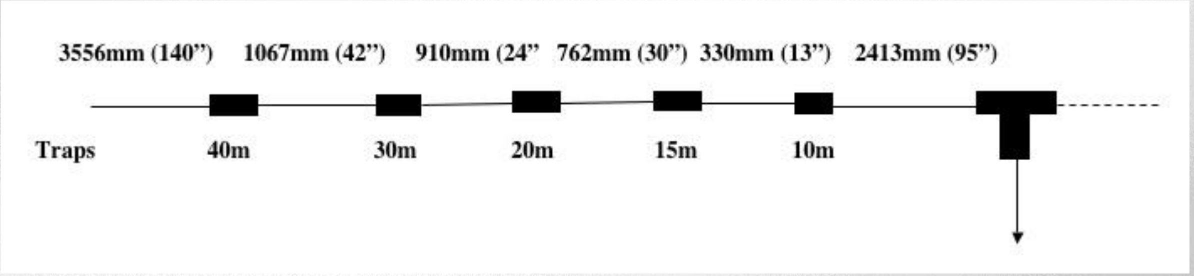
- *Beverage antenna* – directional low-band receive-only antenna
- Beverage antennas are *very inefficient (<u>high loss</u>)* but do a good job of rejecting noise coming from non-preferred directions. They are not suitable for transmitting
- A Beverage antenna is a long, low wire (less than 20 ft high) pointed in a preferred signal direction



Receive direction

Multiband Antennas

- A *Trapped dipole* is a common multiband antenna
- The traps act as electrical switches to isolate parts of the antenna to permit multiband operation
- *Triband Yagi* (10-15-20 meters) can be trapped or have separate elements for each frequency
- Disadvantage: multiband antennas have poor harmonic rejection



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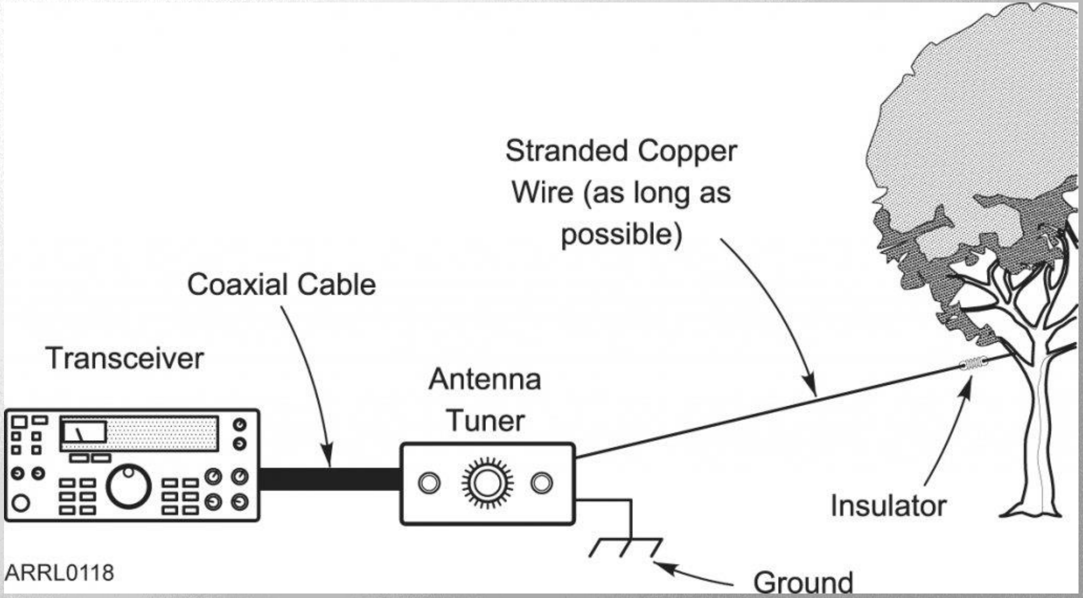
Random Wire Antenna

- End fed directly at the transmitter or antenna matching device – they can work very well
- Ground connections are part of the antenna

You may experience RF burns when touching metal station components when transmitting!



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Take Quiz 3

G9B01 - What is a characteristic of a random-wire HF antenna connected directly to the transmitter?

A. It must be longer than 1 wavelength

B. Station equipment may carry significant RF current

C. It produces only vertically polarized radiation

D. It is more effective on the lower HF bands than on the higher bands

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G9C09 - In free space, how does the gain of two three-element, horizontally polarized Yagi antennas spaced vertically 1/2 wavelength apart typically compare to the gain of a single three-element Yagi?

A. Approximately 1.5 dB higher

B. Approximately 3 dB higher

C. Approximately 6 dB higher

D. Approximately 9 dB higher

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A. To enable multiband operation

B. To notch spurious frequencies

C. To provide balanced feed point impedance

D. To prevent out-of-band operation

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G9D05 - What is an advantage of vertically stacking horizontally polarized Yagi antennas?

A. It allows quick selection of vertical or horizontal polarization

B. It allows simultaneous vertical and horizontal polarization

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D. It narrows the main lobe in elevation

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G9D06 - Which of the following is an advantage of a log-periodic antenna?

A. Wide bandwidth

B. Higher gain per element than a Yagi antenna

C. Harmonic suppression

D. Polarization diversity

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G9D07 - Which of the following describes a log-periodic antenna?

A. Element length and spacing vary logarithmically along the boom

B. Impedance varies periodically as a function of frequency

C. Gain varies logarithmically as a function of frequency

D. SWR varies periodically as a function of boom length

G9D07 - Which of the following describes a log-periodic antenna?

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C. Gain varies logarithmically as a function of frequency

D. SWR varies periodically as a function of boom length

G9D09 - What is the primary use of a Beverage antenna?

A. Directional receiving for MF and low HF bands

B. Directional transmitting for low HF bands

C. Portable direction finding at higher HF frequencies

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G9D11 - Which of the following is a disadvantage of multiband antennas?

A. They present low impedance on all design frequencies

B. They must be used with an antenna tuner

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Next Week
Chapters 7.5 and 9

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