

Amateur Extra – The Right Answers

Chapter Nine – Antennas and Feedlines

E9A01. What describes an isotropic antenna?

**A theoretical antenna used as a reference for antenna gain**

E9A02. What antenna has no gain in any direction?

**Isotropic antenna**

E9A04. Which of the following factors may affect the feed point impedance of an antenna?

**Antenna height, conductor length/diameter ratio and location of nearby conductive objects**

E9A05. What is included in the total resistance of an antenna system?

**Radiation resistance plus ohmic resistance**

E9A06. How does the beamwidth of an antenna vary as the gain is increased?

**It decreases**

E9A07. What is meant by antenna gain?

**The ratio of the radiated signal strength of an antenna in the direction of maximum radiation to that of a reference antenna**

E9A08. What is meant by antenna bandwidth?

**The frequency range over which an antenna satisfies a performance requirement**

E9A09. How is antenna efficiency calculated?

**(radiation resistance / total resistance) x 100 percent**

E9A10. Which of the following choices is a way to improve the efficiency of a ground-mounted quarter-wave vertical antenna?

**Install a good radial system**

E9A11. Which of the following factors determines ground losses for a ground-mounted vertical antenna operating in the 3 MHz to 30 MHz range?

**Soil conductivity**

E9A12. How much gain does an antenna have compared to a 1/2-wavelength dipole when it has 6 dB gain over an isotropic antenna?

**3.85 dB**

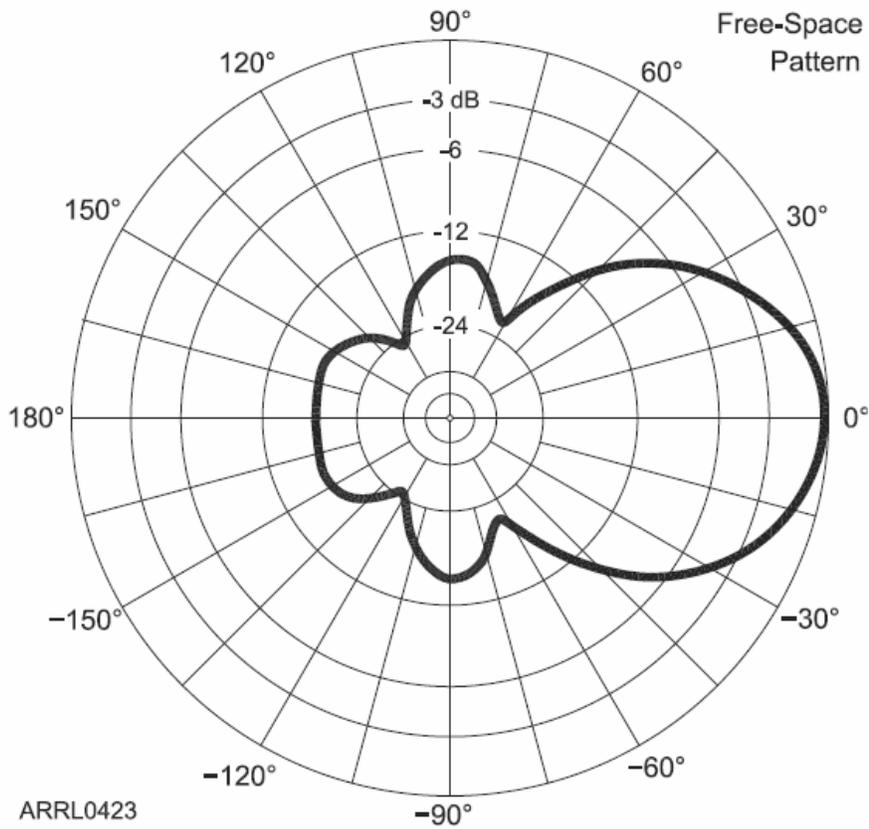
E9A13. How much gain does an antenna have compared to a 1/2-wavelength dipole when it has 12 dB gain over an isotropic antenna?

**9.85 dB**

E9A14. What is meant by the radiation resistance of an antenna?

**The value of a resistance that would dissipate the same amount of power as that radiated from an antenna**

Figure E9-1



E9B01. In the antenna radiation pattern shown in Figure E9-1, what is the 3 dB beamwidth?

**50 degrees**

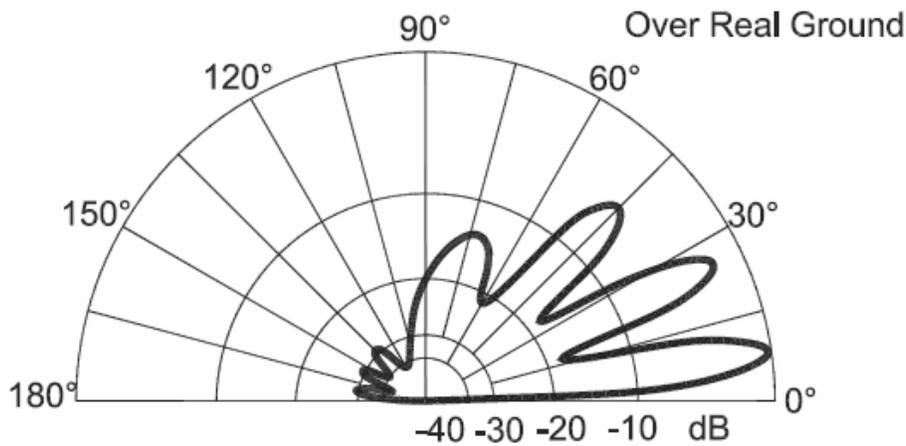
E9B02. In the antenna radiation pattern shown in Figure E9-1, what is the front-to-back ratio?

**18 dB**

E9B03. In the antenna radiation pattern shown in Figure E9-1, what is the front-to-side ratio?

**14 dB**

Figure E9-2



E9B05. What type of antenna pattern over real ground is shown in Figure E9-2?

**Elevation**

E9B06. What is the elevation angle of peak response in the antenna radiation pattern shown in Figure E9-2?

**7.5 degrees**

E9B07. How does the total amount of radiation emitted by a directional gain antenna compare with the total amount of radiation emitted from an isotropic antenna, assuming each is driven by the same amount of power?

**They are the same**

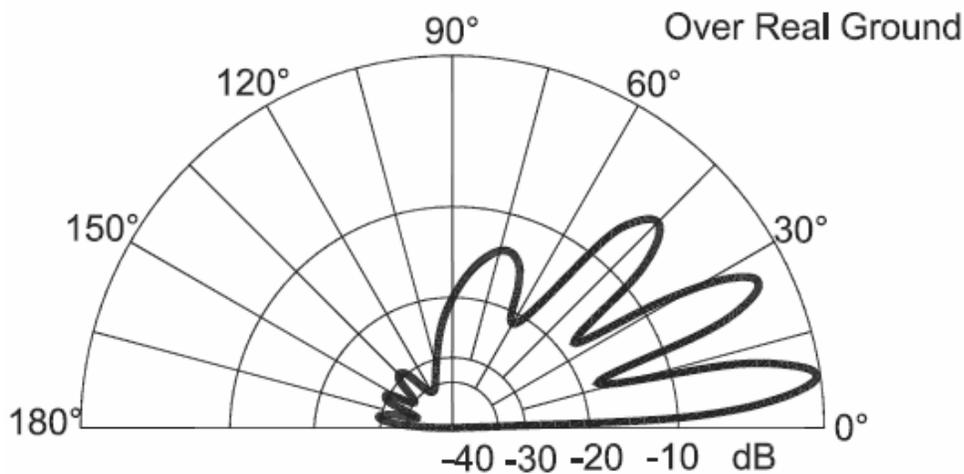
E9B08. How can the approximate beamwidth in a given plane of a directional antenna be determined?

**Note the two points where the signal strength of the antenna is 3 dB less than maximum and compute the angular difference**

E9B12. What is the far field of an antenna?

**The region where the shape of the antenna pattern is independent of distance**

Figure E9-2



E9B15. What is the front-to-back ratio of the radiation pattern shown in Figure E9-2?

**28 dB**

E9B16. How many elevation lobes appear in the forward direction of the antenna radiation pattern shown in Figure E9-2?

**4**

E9C11. How is the far-field elevation pattern of a vertically polarized antenna affected by being mounted over seawater versus rocky ground?

**The low-angle radiation increases**

E9C13. What is the main effect of placing a vertical antenna over an imperfect ground?

**It reduces low-angle radiation**

E9C14. How does the performance of a horizontally polarized antenna mounted on the side of a hill compare with the same antenna mounted on flat ground?

**The main lobe takeoff angle decreases in the downhill direction**

E9C15. How does the radiation pattern of a horizontally polarized 3-element beam antenna vary with its height above ground?

**The main lobe takeoff angle decreases with increasing height**

E9D08. What happens as the Q of an antenna increases?

**SWR bandwidth decreases**

E9D11. Which of the following types of conductor would be best for minimizing losses in a station's RF ground system?

**A wide flat copper strap**

E9D12. Which of the following would provide the best RF ground for your station?

**An electrically short connection to 3 or 4 interconnected ground rods driven into the Earth**

E9C01. What is the radiation pattern of two  $1/4$  wavelength vertical antennas spaced  $1/2$  wavelength apart and fed  $180$  degrees out of phase?

**A figure-8 oriented along the axis of the array**

E9C02. What is the radiation pattern of two  $1/4$  wavelength vertical antennas spaced  $1/4$  wavelength apart and fed  $90$  degrees out of phase?

**Cardioid**

E9C03. What is the radiation pattern of two  $1/4$  wavelength vertical antennas spaced  $1/2$  wavelength apart and fed in phase?

**A Figure-8 broadside to the axis of the array**

E9C04. What happens to the radiation pattern of an unterminated long wire antenna as the wire length is increased?

**The lobes align more in the direction of the wire**

E9C05. What is an OCFD antenna?

**A dipole fed approximately 1/3 the way from one end with a 4:1 balun to provide multiband operation**

E9C06. What is the effect of a terminating resistor on a rhombic antenna?

**It changes the radiation pattern from bidirectional to unidirectional**

E9C07. What is the approximate feed point impedance at the center of a two-wire folded dipole antenna?

**300 ohms**

E9C08. What is a folded dipole antenna?

**A dipole constructed from one wavelength of wire forming a very thin loop**

E9C09. What is a G5RV antenna?

**A multi-band dipole antenna fed with coax and a balun through a selected length of open wire transmission line**

E9C10. Which of the following describes a Zepp antenna?

**An end fed dipole antenna**

E9C12. Which of the following describes an extended double Zepp antenna?

**A center fed 1.25 wavelength antenna (two 5/8 wave elements in phase)**

E9D01. How does the gain of an ideal parabolic dish antenna change when the operating frequency is doubled?

**Gain increases by 6 dB**

E9D02. How can linearly polarized Yagi antennas be used to produce circular polarization?

**Arrange two Yagis perpendicular to each other with the driven elements at the same point on the boom fed 90 degrees out of phase**

E9D03. Where should a high-Q loading coil be placed to minimize losses in a shortened vertical antenna?

**Near the center of the vertical radiator**

E9D04. Why should an HF mobile antenna loading coil have a high ratio of reactance to resistance?

**To minimize losses**

E9D05. What is a disadvantage of using a multiband trapped antenna?

**It might radiate harmonics**

E9D06. What happens to the bandwidth of an antenna as it is shortened through the use of loading coils?

**It is decreased**

E9D07. What is an advantage of using top loading in a shortened HF vertical antenna?

**Improved radiation efficiency**

E9D09. What is the function of a loading coil used as part of an HF mobile antenna?

**To cancel capacitive reactance**

E9D10. What happens to feed point impedance at the base of a fixed length HF mobile antenna as the frequency of operation is lowered?

**The radiation resistance decreases and the capacitive reactance increases**

E9E12. What is the primary purpose of a phasing line when used with an antenna having multiple driven elements?

**It ensures that each driven element operates in concert with the others to create the desired antenna pattern**

E9E13. What is a use for a Wilkinson divider?

**It is used to divide power equally between two 50 ohm loads while maintaining 50 ohm input impedance**

E9H01. When constructing a Beverage antenna, which of the following factors should be included in the design to achieve good performance at the desired frequency?

**It should be one or more wavelengths long**

E9H02. Which is generally true for low band (160 meter and 80 meter) receiving antennas?

**Atmospheric noise is so high that gain over a dipole is not important**

E9H04. What is an advantage of using a shielded loop antenna for direction finding?

**It is electrostatically balanced against ground, giving better nulls**

E9H05. What is the main drawback of a wire-loop antenna for direction finding?

**It has a bidirectional pattern**

E9H06. What is the triangulation method of direction finding?

**Antenna headings from several different receiving locations are used to locate the signal source**

E9H07. Why is it advisable to use an RF attenuator on a receiver being used for direction finding?

**It prevents receiver overload which could make it difficult to determine peaks or nulls**

E9H08. What is the function of a sense antenna?

**It modifies the pattern of a DF antenna array to provide a null in one direction**

E9H09. Which of the following describes the construction of a receiving loop antenna?

**One or more turns of wire wound in the shape of a large open coil**

E9H10. How can the output voltage of a multiple turn receiving loop antenna be increased?

**By increasing either the number of wire turns in the loop or the area of the loop structure or both**

E9H11. What characteristic of a cardioid pattern antenna is useful for direction finding?

**A very sharp single null**

E9A03. Why would one need to know the feed point impedance of an antenna?

**To match impedances in order to minimize standing wave ratio on the transmission line**

E9A15. What is the effective radiated power relative to a dipole of a repeater station with 150 watts transmitter power output, 2 dB feed line loss, 2.2 dB duplexer loss, and 7 dBd antenna gain?

**286 watts**

E9A16. What is the effective radiated power relative to a dipole of a repeater station with 200 watts transmitter power output, 4 dB feed line loss, 3.2 dB duplexer loss, 0.8 dB circulator loss, and 10 dBd antenna gain?

**317 watts**

E9A17. What is the effective isotropic radiated power of a repeater station with 200 watts transmitter power output, 2 dB feed line loss, 2.8 dB duplexer loss, 1.2 dB circulator loss and 7 dBi antenna gain?

**252 watts**

E9A18. What term describes station output, taking into account all gains and losses?

**Effective radiated power**

E9E01. What system matches a higher impedance transmission line to a lower impedance antenna by connecting the line to the driven element in two places spaced a fraction of a wavelength each side of element center?

**The delta matching system**

E9E02. What is the name of an antenna matching system that matches an unbalanced feed line to an antenna by feeding the driven element both at the center of the element and at a fraction of a wavelength to one side of center?

**The gamma match**

E9E03. What is the name of the matching system that uses a section of transmission line connected in parallel with the feed line at or near the feed point?

**The stub match**

E9E04. What is the purpose of the series capacitor in a gamma-type antenna matching network?

**To cancel the inductive reactance of the matching network**

E9E05. How must the driven element in a 3-element Yagi be tuned to use a hairpin matching system?

**The driven element reactance must be capacitive**

E9E06. What is the equivalent lumped-constant network for a hairpin matching system of a 3-element Yagi?

**A shunt inductor**

E9E09. Which of these matching systems is an effective method of connecting a 50 ohm coaxial cable feed line to a grounded tower so it can be used as a vertical antenna?

**Gamma match**

E9E11. What is an effective way of matching a feed line to a VHF or UHF antenna when the impedances of both the antenna and feed line are unknown?

**Use the universal stub matching technique**

E4A07. Which of the following is an advantage of using an antenna analyzer compared to an SWR bridge to measure antenna SWR?

**Antenna analyzers do not need an external RF source**

E4A08. Which of the following instruments would be best for measuring the SWR of a beam antenna?

**An antenna analyzer**

E4B06. How much power is being absorbed by the load when a directional power meter connected between a transmitter and a terminating load reads 100 watts forward power and 25 watts reflected power?

**75 watts**

E4B07. What do the subscripts of S parameters represent?

**The port or ports at which measurements are made**

E4B09. What is indicated if the current reading on an RF ammeter placed in series with the antenna feed line of a transmitter increases as the transmitter is tuned to resonance?

**There is more power going into the antenna**

E4B11. How should an antenna analyzer be connected when measuring antenna resonance and feed point impedance?

**Connect the antenna feed line directly to the analyzer's connector**

E4B13. Which S parameter is equivalent to forward gain?

**S<sub>21</sub>**

E4B16. Which S parameter represents return loss or SWR?

**S<sub>11</sub>**

E4B17. What three test loads are used to calibrate a standard RF vector network analyzer?

**Short circuit, open circuit, and 50 ohms**

E9E07. What term best describes the interactions at the load end of a mismatched transmission line?

**Reflection coefficient**

E9E08. Which of the following measurements is characteristic of a mismatched transmission line?

**An SWR greater than 1:1**

E9E10. Which of these choices is an effective way to match an antenna with a 100 ohm feed point impedance to a 50 ohm coaxial cable feed line?

**Insert a 1/4 wavelength piece of 75 ohm coaxial cable transmission line in series between the antenna terminals and the 50 ohm feed cable**

E9F01. What is the velocity factor of a transmission line?

**The velocity of the wave in the transmission line divided by the velocity of light in a vacuum**

E9F02. Which of the following determines the velocity factor of a transmission line?

**Dielectric materials used in the line**

E9F03. Why is the physical length of a coaxial cable transmission line shorter than its electrical length?

**Electrical signals move more slowly in a coaxial cable than in air**

E9F04. What is the typical velocity factor for a coaxial cable with solid polyethylene dielectric?

**0.66**

E9F05. What is the approximate physical length of a solid polyethylene dielectric coaxial transmission line that is electrically one-quarter wavelength long at 14.1 MHz?

**3.5 meters**

E9F06. What is the approximate physical length of an air-insulated, parallel conductor transmission line that is electrically one-half wavelength long at 14.10 MHz?

**10 meters**

E9F07. How does ladder line compare to small-diameter coaxial cable such as RG-58 at 50 MHz?

**Lower loss**

E9F08. What is the term for the ratio of the actual speed at which a signal travels through a transmission line to the speed of light in a vacuum?

**Velocity factor**

E9F09. What is the approximate physical length of a solid polyethylene dielectric coaxial transmission line that is electrically one-quarter wavelength long at 7.2 MHz?

**6.9 meters**

E9F10. What impedance does a  $1/8$  wavelength transmission line present to a generator when the line is shorted at the far end?

**An inductive reactance**

E9F11. What impedance does a  $1/8$  wavelength transmission line present to a generator when the line is open at the far end?

**A capacitive reactance**

E9F12. What impedance does a  $1/4$  wavelength transmission line present to a generator when the line is open at the far end?

**Very low impedance**

E9F13. What impedance does a  $1/4$  wavelength transmission line present to a generator when the line is shorted at the far end?

**Very high impedance**

E9F14. What impedance does a  $1/2$  wavelength transmission line present to a generator when the line is shorted at the far end?

**Very low impedance**

E9F15. What impedance does a  $1/2$  wavelength transmission line present to a generator when the line is open at the far end?

**Very high impedance**

E9F16. Which of the following is a significant difference between foam dielectric coaxial cable and solid dielectric cable, assuming all other parameters are the same?

**Foam dielectric has lower safe operating voltage limits**

**Foam dielectric has lower loss per unit of length**

**Foam dielectric has higher velocity factor**

E9G01. Which of the following can be calculated using a Smith chart?

**Impedance along transmission lines**

E9G02. What type of coordinate system is used in a Smith chart?

**Resistance circles and reactance arcs**

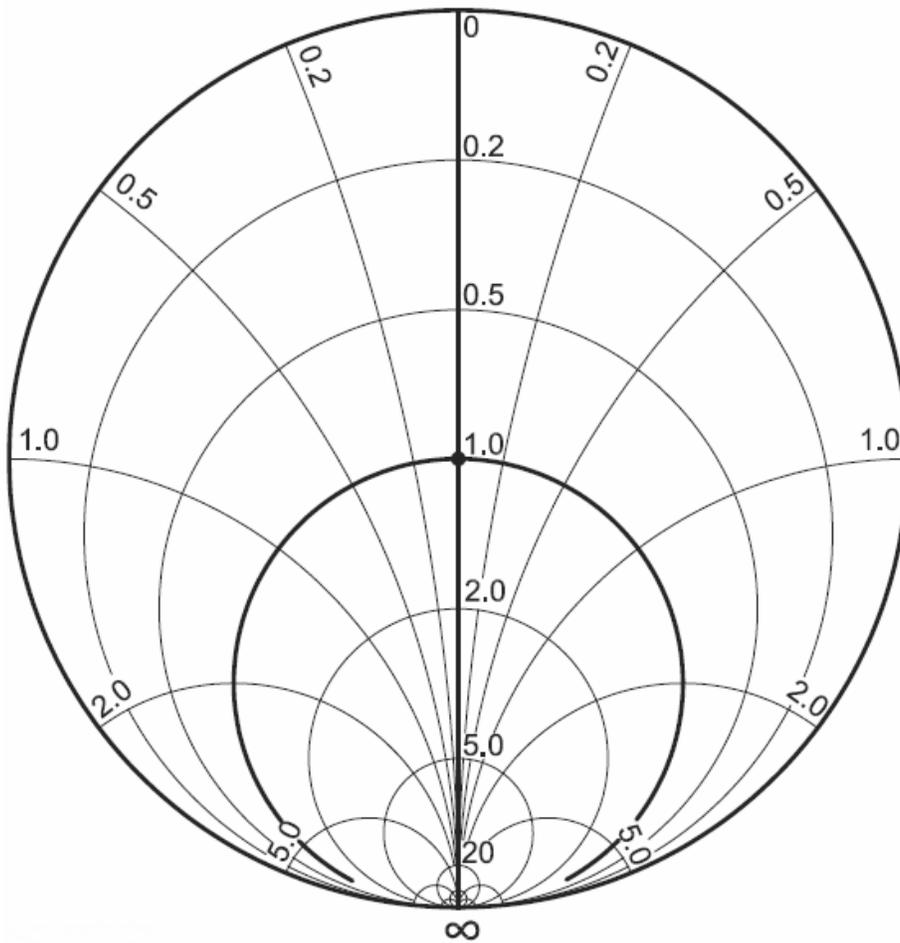
E9G03. Which of the following is often determined using a Smith chart?

**Impedance and SWR values in transmission lines**

E9G04. What are the two families of circles and arcs that make up a Smith chart?

**Resistance and reactance**

Figure E9-3



E9G05. What type of chart is shown in Figure E9-3?

**Smith chart**

E9G06. On the Smith chart shown in Figure E9-3, what is the name for the large outer circle on which the reactance arcs terminate?

**Reactance axis**

E9G07. On the Smith chart shown in Figure E9-3, what is the only straight line shown?

**The resistance axis**

E9G08. What is the process of normalization with regard to a Smith chart?

**Reassigning impedance values with regard to the prime center**

E9G09. What third family of circles is often added to a Smith chart during the process of solving problems?

**Standing wave ratio circles**

E9G10. What do the arcs on a Smith chart represent?

**Points with constant reactance**

E9G11. How are the wavelength scales on a Smith chart calibrated?

**In fractions of transmission line electrical wavelength**

E9B04. What may occur when a directional antenna is operated at different frequencies within the band for which it was designed?

**The gain may change depending on frequency**

E9B09. What type of computer program technique is commonly used for modeling antennas?

**Method of Moments**

E9B10. What is the principle of a Method of Moments analysis?

**A wire is modeled as a series of segments, each having a uniform value of current**

E9B11. What is a disadvantage of decreasing the number of wire segments in an antenna model below the guideline of 10 segments per half-wavelength?

**The computed feed point impedance may be incorrect**

E9B13. What does the abbreviation NEC stand for when applied to antenna modeling programs?

**Numerical Electromagnetics Code**

E9B14. What type of information can be obtained by submitting the details of a proposed new antenna to a modeling program?

**SWR vs. frequency charts**

**Polar plots of the far-field elevation and azimuth patterns**

**Antenna gain**

E9D13. What usually occurs if a Yagi antenna is designed solely for maximum forward gain?

**The front-to-back ratio decreases**