

Extra Class License Things to Know #9

1. An isotropic Antenna is a theoretical antenna used as a reference for antenna gain.
2. A 1/2-wavelength dipole antenna has 2.15 dB gain when compared to an isotropic antenna.
3. An Isotropic antenna has no gain in any direction.
4. One would need to know the feed point impedance of an antenna to be able to match impedances for maximum power transfer from a feed line.
5. Antenna height and conductor length/diameter ratio, and location of nearby conductive objects determine the radiation resistance of an antenna.
6. The term for the ratio of the radiation resistance of an antenna to the total resistance of the system is efficiency.
7. Radiation resistance plus ohmic resistance is included in the total resistance of an antenna system.
8. A folded dipole antenna is an antenna constructed from one wavelength of wire forming a very thin loop.
9. Antenna gain is the numerical ratio relating the radiated signal strength of an antenna in the direction of maximum radiation to that of a reference antenna.
10. Antenna bandwidth is the frequency range over which an antenna satisfies a performance requirement.
11. Antenna efficiency calculated by multiplying (radiation resistance / total resistance) x 100%.
12. The efficiency of an HF quarter-wave grounded vertical antenna can be improved by installing a good radial system.
13. The most important factor that determines ground losses for a ground-mounted vertical antenna operating in the 3-30 MHz range is soil conductivity.
14. An antenna has 3.85 dB gain over a 1/2-wavelength dipole when it has 6 dB gain over an isotropic antenna.
15. An antenna has 9.85 dB gain over a 1/2-wavelength dipole when it has 12 dB gain over an isotropic antenna.
16. The radiation resistance of an antenna is the value of a resistance that would dissipate the same amount of power as that radiated from an antenna.
17. The free-space polarization of an antenna is the orientation of its electric field (E Field).

18. In the antenna radiation pattern shown in Figure E9-1, the 3-dB beamwidth is 50 degrees.

19. In the antenna radiation pattern shown in Figure E9-1, the front-to-back ratio is 18 dB.

20. In the antenna radiation pattern shown in Figure E9-1, the front-to-side ratio is 14 dB.

21. The gain may exhibit significant variations when a directional antenna is operated at different frequencies within the band for which it was designed.

22. The front-to-back ratio decreases when a Yagi antenna is designed solely for maximum forward gain.

23. If the boom of a Yagi antenna is lengthened and the elements are properly retuned, the gain increases.

24. There is no difference between the two antennas when 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.

25. The approximate beamwidth of a directional antenna can be determined by noting the two points where the signal strength of the antenna is 3 dB less than maximum and compute the angular difference.

26. Method of Moments is the type of computer program technique is commonly used for modeling antennas.

27. The principle of a Method of Moments analysis is when a wire is modeled as a series of segments, each having a distinct value of current.

28. A disadvantage of decreasing the number of wire segments in an antenna model below the guideline of 10 segments per half-wavelength is that the computed feed-point impedance may be incorrect.

29. A disadvantage of NEC-based antenna modeling programs is that the computing time increases as the number of wire segments is increased.

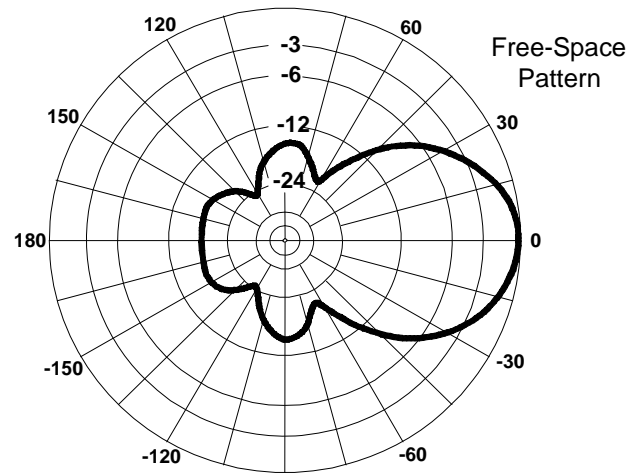
30. The abbreviation NEC stands Numerical Electromagnetics Code when applied to antenna modeling programs.

31. The type of information that can be obtained by submitting the details of a proposed new antenna to a modeling program is its SWR vs. frequency charts, polar plots of the far-field elevation and azimuth patterns and antenna gain.

32. The radiation pattern of two $1/4$ -wavelength vertical antennas spaced $1/2$ -wavelength apart and fed 180 degrees out of phase is a figure-8 oriented along the axis of the array.

33. The radiation pattern of two $1/4$ -wavelength vertical antennas spaced $1/4$ -wavelength apart and fed 90 degrees out of phase is a cardioids.

Figure E9-1



34. The radiation pattern of two 1/4-wavelength vertical antennas spaced 1/2-wavelength apart and fed in phase is a Figure-8 broadside to the axis of the array.

35. A basic rhombic antenna can be described as a bidirectional; four-sided, each side one or more wavelengths long; open at the end opposite the transmission line connection.

36. The main advantage of a terminated rhombic antenna is its wide frequency range, high gain and high front-to-back ratio.

37. The disadvantage of a terminated rhombic antenna for the HF bands is that the antenna requires a large physical area and 4 separate supports.

38. The effect of a terminating resistor on a rhombic antenna is that it changes the radiation pattern from bidirectional to unidirectional.

39. Elevation is the antenna pattern over real ground shown in Figure E9-2.

40. The elevation angle of peak response in the antenna radiation pattern shown in Figure E9-2 is 7.5 degrees.

41. The front-to-back ratio of the radiation pattern shown in Figure E9-2 is 28 dB.

42. 4 elevation lobes appear in the forward direction of the antenna radiation pattern shown in Figure E9-2.

43. The far-field elevation pattern of a vertically polarized antenna is affected by being mounted over seawater versus rocky ground because the low-angle radiation increases.

44. When constructing a Beverage antenna, It should be one or more wavelengths long to achieve good performance at the desired frequency.

45. The electric field would be oriented horizontally for a Yagi with three elements mounted parallel to the ground.

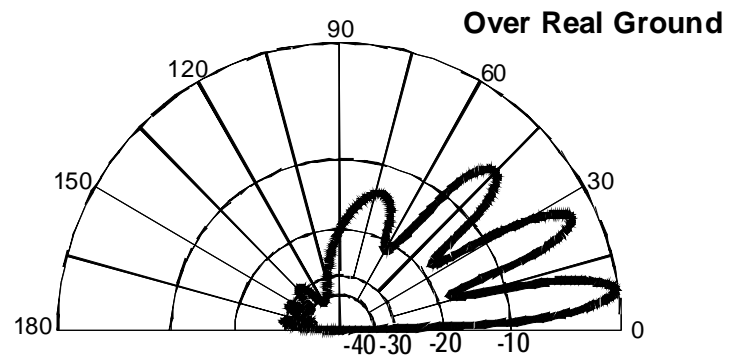
46. The conductivity and dielectric constant of the soil in the area of the antenna strongly affects the shape of the far-field, low-angle elevation pattern of a vertically polarized antenna.

47. An advantage of using an elevated-radial counterpoise with a vertical antenna is that it reduces near-field ground losses, compared to on-ground systems using more radials.

48. The main effect of placing a vertical antenna over an imperfect ground is that it reduces low-angle radiation.

49. The gain of a parabolic dish antenna changes when the operating frequency is doubled by a gain increase of 6 dB.

Figure E9-2



50. One way to produce circular polarization when using linearly polarized antennas is to arrange two Yagis perpendicular to each other with the driven elements at the same point on the boom and fed 90 degrees out of phase.
51. The beamwidth of an antenna decreases as the gain is increased.
52. It is desirable for a ground-mounted satellite communications antenna system to be able to move in both azimuth and elevation in order to track the satellite as it orbits the earth.
53. For a shortened vertical antenna a loading coil should be placed near the center of the vertical radiator to minimize losses and produce the most effective performance.
54. For a shortened vertical antenna, a loading coil should be placed near the center of the vertical radiator to minimize losses and produce the most effective performance.
55. An HF mobile antenna loading coil should have a high ratio of reactance to resistance to minimize losses.
56. A disadvantage of using a multiband trapped antenna is that it might radiate harmonics.
57. The bandwidth of an antenna decreases as it is shortened through the use of loading coils.
58. An advantage of using top loading in a shortened HF vertical antenna is that improves radiation efficiency.
59. The approximate feed-point impedance at the center of a folded dipole antenna is 300 ohms.
60. A loading coil is often used with an HF mobile antenna to cancel capacitive reactance.
61. An advantage of using a trapped antenna is that it may be used for multi-band operation.
62. The resistance decreases and the capacitive reactance increases at the base feed-point of a fixed-length HF mobile antenna as the frequency of operation is lowered.
63. A thin, flat copper strap several inches wide is the type of conductor that would be best for minimizing losses in a station's RF ground system.
64. A connection to 3 or 4 interconnected ground rods driven into the Earth would provide the best RF ground for your station.
65. The delta matching system matches a high-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.
66. Gamma match 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.
67. The name of the matching system that uses a short perpendicular section of transmission line connected to the feed line near the antenna is the stub match.

68. The purpose of the series capacitor in a gamma-type antenna matching network is to compensate for the inductive reactance of the matching network.
69. The driven element in a 3-element Yagi be tuned to use a hairpin matching system is the driven element reactance must be capacitive.
70. The equivalent lumped-constant network for a hairpin matching system on a 3-element Yagi is an L network.
71. Reflection coefficient is the parameter that best describes the interactions at the load end of a mismatched transmission line.
72. An SWR greater than 1:1 measurement describes a mismatched transmission line.
73. Gamma match 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.
74. 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 is an effective way to match an antenna with a 100-ohm terminal impedance to a 50-ohm coaxial cable feed-line.
75. 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 is using the "universal stub" matching technique.
76. The primary purpose of a "phasing line" when used with an antenna having multiple driven elements is that it ensures that each driven element operates in concert with the others to create the desired antenna pattern.
77. The purpose of a "Wilkinson divider" is that it divides power equally among multiple loads while preventing changes in one load from disturbing power flow to the others.
78. The velocity factor of a transmission line is the velocity of the wave in the transmission line divided by the velocity of light in a vacuum.
79. The velocity factor in a transmission line determines the dielectric materials used in the line.
80. The reason the physical length of a coaxial cable transmission line is shorter than its electrical length is because the electrical signals move more slowly in a coaxial cable than in air.
81. The typical velocity factor for a coaxial cable with solid polyethylene dielectric is 0.66.
82. The physical length of a coaxial transmission line that is electrically one-quarter wavelength long at 14.1 MHz? (Assume a velocity factor of 0.66.) is 3.5 meters.
83. The physical length of a parallel conductor feed line that is electrically one-half wavelength long at 14.10 MHz (Assume a velocity factor of 0.95.) is 10 meters.
84. A 450-ohm ladder line, at 50 MHz, will have the characteristic of lower loss as compared to 0.195-inch-diameter coaxial cable (such as RG-58).

85. 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 is the velocity factor.

86. The physical length of a typical coaxial transmission line that is electrically one-quarter wavelength long at 7.2 MHz (Assume a velocity factor of 0.66) would be 6.9 meters.

87. An inductive reactance is the kind of impedance that a $1/8$ -wavelength transmission line present to a generator when the line is shorted at the far end.

88. A capacitive reactance is the kind of impedance that a $1/8$ -wavelength transmission line present to a generator when the line is open at the far end.

89. A very low impedance is the kind of impedance that a $1/4$ -wavelength transmission line present to a generator when the line is open at the far end.

90. A very high impedance is the kind of impedance that a $1/4$ -wavelength transmission line present to a generator when the line is shorted at the far end.

91. A very low impedance is the kind of impedance that a $1/2$ -wavelength transmission line present to a generator when the line is shorted at the far end.

92. A very high impedance is the kind of impedance that a $1/2$ -wavelength transmission line present to a generator when the line is open at the far end.

93. The primary difference between foam-dielectric coaxial cable as opposed to solid-dielectric cable, assuming all other parameters are the same is that it reduced safe operating voltage limits, it reduced losses per unit of length and it has a higher velocity factor.

94. The impedance along a transmission lines can be calculated using a Smith chart.

95. Resistance circles and reactance arcs are the type of coordinate system that is used in a Smith chart.

96. Impedance and SWR values in transmission lines are often determined using a Smith chart.

97. The two families of circles and arcs that make up a Smith chart are resistance and reactance.

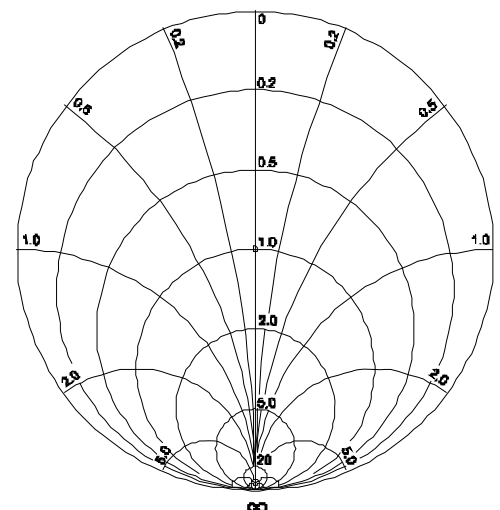
98. A Smith chart is shown in Figure E9-3.

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

100. On the Smith chart shown in Figure E9-3, the resistance axis is the only straight line shown.

101. The process of normalization with regard to a Smith chart is the reassigning of impedance values with regard to the prime center.

Figure E9-3



102. The third family of circles often added to a Smith chart during the process of solving problems is the standing-wave ratio circles.
103. The arcs on a Smith chart represent points with constant reactance.
104. The wavelength scales on a Smith chart are calibrated in fractions of the transmission line's electrical wavelength.
105. The effective radiated power 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 is 286 watts.
106. The effective radiated power 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 is 317 watts.
107. The effective 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-dBd antenna gain is 252 watts.
108. Effective radiated power is the term that describes the station's output (including the transmitter, antenna and everything in between), when considering transmitter power and system gains and losses.
109. The main drawback of a wire-loop antenna for direction finding is that it has a bidirectional pattern.
110. The triangulation method of direction finding is where the antenna headings from several different receiving stations are used to locate the signal source.
111. An RF attenuator desirable in a receiver used for direction finding because it prevents receiver overload from extremely strong signals.
112. The function of a sense antenna is that it modifies the pattern of a DF antenna array to provide a null in one direction.
113. A receiving loop antenna is one or more turns of wire wound in the shape of a large open coil.
114. The output voltage of a receiving loop antenna can be increased by increasing either the number of wire turns in the loop or the area of the loop structure.
115. An antenna with a cardioid pattern is desirable for a direction-finding system because the response characteristics of the cardioid pattern can assist in determining the direction of the desired station.
116. An advantage of using a shielded loop antenna for direction finding is that it is electro-statically balanced with against ground, giving better nulls.