FCC Exam Element 3 Question Pool for General Class
Effective 7/1/2019 – 6/30/2023

SUBELEMENT G9 – ANTENNAS AND FEED LINES [4 Exam Questions – 4 Groups]

G9A – Antenna feed lines: characteristic impedance and attenuation; SWR calculation, measurement, and effects; matching networks

G9A01
Which of the following factors determine the characteristic impedance of a parallel conductor antenna feed line?
A. The distance between the centers of the conductors and the radius of the conductors
B. The distance between the centers of the conductors and the length of the line
C. The radius of the conductors and the frequency of the signal
D. The frequency of the signal and the length of the line
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G9A02
What are the typical characteristic impedances of coaxial cables used for antenna feed lines at amateur stations?
A. 25 and 30 ohms
B. 50 and 75 ohms
C. 80 and 100 ohms
D. 500 and 750 ohms
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G9A03
What is the typical characteristic impedance of "window line" parallel transmission line?
A. 50 ohms
B. 75 ohms
C. 100 ohms
D. 450 ohms
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G9A04
What might cause reflected power at the point where a feed line connects to an antenna?
A. Operating an antenna at its resonant frequency
B. Using more transmitter power than the antenna can handle
C. A difference between feed-line impedance and antenna feed-point impedance
D. Feeding the antenna with unbalanced feed line
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G9A05

How does the attenuation of coaxial cable change as the frequency of the signal it is carrying increases?

A. Attenuation is independent of frequency
B. Attenuation increases
C. Attenuation decreases
D. Attenuation reaches a maximum at approximately 18 MHz

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G9A06

In what units is RF feed line loss usually expressed?

A. Ohms per 1000 feet
B. Decibels per 1000 feet
C. Ohms per 100 feet
D. Decibels per 100 feet

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G9A07

What must be done to prevent standing waves on an antenna feed line?

A. The antenna feed point must be at DC ground potential
B. The feed line must be cut to a length equal to an odd number of electrical quarter wavelengths
C. The feed line must be cut to a length equal to an even number of physical half wavelengths
D. The antenna feed point impedance must be matched to the characteristic impedance of the feed line

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G9A08

If the SWR on an antenna feed line is 5 to 1, and a matching network at the transmitter end of the feed line is adjusted to 1 to 1 SWR, what is the resulting SWR on the feed line?

A. 1 to 1
B. 5 to 1
C. Between 1 to 1 and 5 to 1 depending on the characteristic impedance of the line
D. Between 1 to 1 and 5 to 1 depending on the reflected power at the transmitter

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G9A09

What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 200 ohm impedance?

A. 4:1
B. 1:4
C. 2:1
D. 1:2

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G9A10

What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 10 ohm impedance?

A. 2:1
B. 50:1
C. 1:5
D. 5:1
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G9A11

What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 50 ohm impedance?

A. 2:1
B. 1:1
C. 50:50
D. 0:0
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G9A12

What is the interaction between high standing wave ratio (SWR) and transmission line loss?

A. There is no interaction between transmission line loss and SWR
B. If a transmission line is lossy, high SWR will increase the loss
C. High SWR makes it difficult to measure transmission line loss
D. High SWR reduces the relative effect of transmission line loss
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G9A13

What is the effect of transmission line loss on SWR measured at the input to the line?

A. The higher the transmission line loss, the more the SWR will read artificially low
B. The higher the transmission line loss, the more the SWR will read artificially high
C. The higher the transmission line loss, the more accurate the SWR measurement will be
D. Transmission line loss does not affect the SWR measurement
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G9B – Basic antennas

G9B01

What is one disadvantage of a directly fed random-wire HF antenna?

A. It must be longer than 1 wavelength
B. You may experience RF burns when touching metal objects in your station
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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G9B02

Which of the following is a common way to adjust the feed-point impedance of a 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

D. Shorten the radials

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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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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

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G9B05

How does antenna height affect the horizontal (azimuthal) radiation pattern of a horizontal dipole HF antenna?

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

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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 of the Earth or buried a few inches below the ground

D. At the center of the antenna

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G9B07

How does the feed-point impedance of a 1/2 wave dipole antenna change as the antenna is lowered below 1/4 wave 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

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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

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G9B09

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

A. Lower ground reflection losses
B. Lower feed-point impedance
C. Shorter radials
D. Lower radiation resistance

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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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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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G9B12

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

A. 8 feet
B. 11 feet
C. 16 feet
D. 21 feet
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G9C – Directional antennas

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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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
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G9C04

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

A. dBi gain figures are 2.15 dB lower than dBd gain figures
B. dBi gain figures are 2.15 dB higher than dBd gain figures
C. dBi gain figures are the same as the square root of dBd gain figures multiplied by 2.15
D. dBi gain figures are the reciprocal of dBd gain figures + 2.15 dB
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G9C05

How does increasing boom length and adding directors affect a Yagi antenna?

A. Gain increases
B. Beamwidth increases
C. Front-to-back ratio decreases
D. Front-to-side ratio decreases

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G9C06

What configuration of the loops of a two-element quad antenna must be used for the antenna to operate as a beam antenna, assuming one of the elements is used as a reflector?

A. The driven element must be fed with a balun transformer
B. There must be an open circuit in the driven element at the point opposite the feed point
C. The reflector element must be approximately 5 percent shorter than the driven element
D. The reflector element must be approximately 5 percent longer than the driven element

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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 radiation lobe compared to that in the opposite direction
D. The ratio of forward gain to dipole gain

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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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G9C09

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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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

Which HF antenna would be the best to use for minimizing interference?

A. A quarter-wave vertical antenna
B. An isotropic antenna
C. A directional antenna
D. An omnidirectional antenna

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G9C12

Which of the following is an advantage of using a gamma match with a Yagi antenna?

A. It does not require that the driven element be insulated from the boom
B. It does not require any inductors or capacitors
C. It is useful for matching multiband antennas
D. All these choices are correct

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G9C13

Approximately how long is each side of the driven element of a quad antenna?

A. 1/4 wavelength
B. 1/2 wavelength
C. 3/4 wavelength
D. 1 wavelength

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G9C14

How does the forward gain of a two-element quad antenna compare to the forward gain of a three-element Yagi antenna?

A. About the same
B. About 2/3 as much
C. About 1.5 times as much
D. About twice as much

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G9C15

What is meant by the terms dBi and dBd when referring to antenna gain?

A. dBi refers to an isotropic antenna, dBd refers to a dipole antenna
B. dBi refers to an ionospheric reflecting antenna, dBd refers to a dissipative antenna
C. dBi refers to an inverted-vee antenna, dBd refers to a downward reflecting antenna
D. dBi refers to an isometric antenna, dBd refers to a discone antenna
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G9C16

What is a beta or hairpin match?

A. It is a shorted transmission line stub placed at the feed point of a Yagi antenna to provide impedance matching
B. It is a ¼ wavelength section of 75 ohm coax in series with the feed point of a Yagi to provide impedance matching
C. It is a series capacitor selected to cancel the inductive reactance of a folded dipole antenna
D. It is a section of 300 ohm twinlead used to match a folded dipole antenna
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G9D – Specialized antennas

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 left-hand circularly polarized antenna
D. A right-hand circularly polarized antenna
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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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G9D03

In which direction is the maximum radiation from a portable 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. Toward the halo's supporting mast
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G9D04

What is the primary purpose of antenna traps?

A. To permit 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 vertical stacking of horizontally polarized Yagi antennas?

A. It allows quick selection of vertical or horizontal polarization
B. It allows simultaneous vertical and horizontal polarization
C. It narrows the main lobe in azimuth
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

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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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G9D09

What is the primary use of a Beverage antenna?

A. Directional receiving for low HF bands
B. Directional transmitting for low HF bands
C. Portable direction finding at higher HF frequencies
D. Portable direction finding at lower HF frequencies

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G9D10

In which direction or directions does an electrically small loop (less than 1/3 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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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
C. They must be fed with open wire line
D. They have poor harmonic rejection

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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

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G9D13

What is the combined vertical and horizontal polarization pattern of a multi-wavelength, horizontal loop antenna?

A. A figure-eight, similar to a dipole
B. Four major loops with deep nulls
C. Virtually omnidirectional with a lower peak vertical radiation angle than a dipole
D. Radiation maximum is straight up

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