

# Antennas and Propagation

## Chapters T4, G7, G8

### Antenna Fundamentals, More Antenna Types, Feed lines and Measurements, Propagation

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#### Antenna Fundamentals

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(T3A04) What can happen if the antennas at opposite ends of a VHF or UHF line of sight radio link are not using the same polarization?

ANSWER:

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(T3A07) What type of wave carries radio signals between transmitting and receiving stations?

ANSWER:

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(T3A09) Which of the following results from the fact that skip signals refracted from the ionosphere are elliptically polarized?

ANSWER:

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(T3B03) What are the two components of a radio wave?

ANSWER:

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(T5C07) A radio wave is made up of what type of energy?

ANSWER:

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(T9A11) What is the gain of an antenna?

ANSWER:

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

ANSWER:

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G9C15 -- What is meant by the terms dBi and dBd when referring to antenna gain?

ANSWER:

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(T9A03) Which of the following describes a simple dipole oriented parallel to the Earth's surface?

ANSWER:

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(T9A04) What is a disadvantage of the "rubber duck" antenna supplied with most handheld radio transceivers when compared to a full-sized quarter-wave antenna?

ANSWER:

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(T9A05) How would you change a dipole to make it resonant on a higher frequency?

ANSWER:

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(T9A06) What type of antennas are the quad, Yagi, and dish?

ANSWER:

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(T9A07) What is a disadvantage of using a handheld VHF transceiver, with its integral antenna, inside a vehicle?

ANSWER:

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(T9A08) What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?

ANSWER:

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(T9A09) What is the approximate length, in inches, of a half-wavelength 6 meter dipole antenna?

ANSWER:

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(T9A10) In which direction does a half-wave dipole antenna radiate the strongest signal?

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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T9A12 -- What is an advantage of using a properly mounted 5/8 wavelength antenna for VHF or UHF mobile service?

ANSWER:

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(T9A02) -- Which of the following describes a type of antenna loading?

ANSWER:

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G9B01 -- What is one disadvantage of a directly fed random-wire HF antenna?

ANSWER:

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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?

ANSWER:

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

ANSWER:

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

ANSWER:

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G9B05 -- How does antenna height affect the horizontal (azimuthal) radiation pattern of a horizontal dipole HF antenna?

ANSWER:

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

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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# More Antenna Types

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

ANSWER:

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G2D11 -- Which of the following is typical of the lower HF frequencies during the summer?

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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G9C05 -- How does increasing boom length and adding directors affect a Yagi antenna?

ANSWER:

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G9C16 -- What is a beta or hairpin match?

ANSWER:

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

ANSWER:

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

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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G9C11 -- Which HF antenna would be the best to use for minimizing interference?

ANSWER:

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

ANSWER:

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G9C13 -- Approximately how long is each side of of the driven element of a quad antenna?

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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

ANSWER:

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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?

ANSWER:

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G9D13 -- What is the combined vertical and horizontal polarization pattern of a multi-wavelength, horizontal loop antenna?

ANSWER:

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G3C10 -- What is Near Vertical Incidence Skywave (NVIS) propagation?

ANSWER:

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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?

ANSWER:

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G9D04 -- What is the primary purpose of antenna traps?

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

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# Feed lines and Measurements

(T6D11) Which of the following is a resonant or tuned circuit?

ANSWER:

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(T4A05) What is the proper location for an external SWR meter?

ANSWER:

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(T7C03) What, in general terms, is standing wave ratio (SWR)?

ANSWER:

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(T7C04) What reading on an SWR meter indicates a perfect impedance match between the antenna and the feedline?

ANSWER:

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(T7C06) What does an SWR reading of 4:1 indicate?

ANSWER:

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(T7C07) What happens to power lost in a feed line?

ANSWER:

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(T6D12) Which of the following is a common reason to use shielded wire?

ANSWER:

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(T9B01) Why is it important to have low SWR when using coaxial cable feed line?

ANSWER:

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(T9B02) What is the impedance of most coaxial cables used in amateur radio installations?

ANSWER:

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(T9B03) Why is coaxial cable the most common feed line selected for amateur radio antenna systems?

ANSWER:

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(T9B05) In general, what happens as the frequency of a signal passing through coaxial cable is increased?

ANSWER:

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(T9B09) What can cause erratic changes in SWR readings?

ANSWER:

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(T9B11) Which of the following types of feed line has the lowest loss at VHF and UHF?

ANSWER:

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(T7C02) Which of the following instruments can be used to determine if an antenna is resonant at the desired operating frequency?

ANSWER:

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(T7C08) What instrument other than an SWR meter could you use to determine if a feed line and antenna are properly matched?

ANSWER:

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(T7C09) Which of the following is the most common cause for failure of coaxial cables?

ANSWER:

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(T7C10) Why should the outer jacket of coaxial cable be resistant to ultraviolet light?

ANSWER:

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(T7C11) What is a disadvantage of “air core” coaxial cable when compared to foam or solid dielectric types?

ANSWER:

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(T7D08) Which of the following types of solder is best for radio and electronic use?

ANSWER:

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(T7D09) What is the characteristic appearance of a “cold” solder joint?

ANSWER:

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(T9B04) What is the major function of an antenna tuner (antenna coupler)?

ANSWER:

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(T9B06) Which of the following connectors is most suitable for frequencies above 400 MHz?

ANSWER:

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(T9B07) Which of the following is true of PL-259 type coax connectors?

ANSWER:

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(T9B08) Why should coax connectors exposed to the weather be sealed against water intrusion?

ANSWER:

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(T9B10) What is the electrical difference between RG-58 and RG-8 coaxial cable?

ANSWER:

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G4A06 -- What type of device is often used to match transmitter output impedance to an impedance not equal to 50 ohms?

ANSWER:

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G9A01 -- Which of the following factors determine the characteristic impedance of a parallel conductor antenna feed line?

ANSWER:

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G9A02 -- What are the typical characteristic impedances of coaxial cables used for antenna feed lines at amateur stations?

ANSWER:

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G9A03 -- What is the typical characteristic impedance of "window line" parallel transmission line?

ANSWER:

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G9A04 -- What might cause reflected power at the point where a feed line connects to an antenna?

ANSWER:

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G9A05 -- How does the attenuation of coaxial cable change as the frequency of the signal it is carrying increases?

ANSWER:

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G9A06 -- In what units is RF feed line loss usually expressed?

ANSWER:

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G9A07 -- What must be done to prevent standing waves on an antenna feed line?

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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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?

ANSWER:

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G9A12 -- What is the interaction between high standing wave ratio (SWR) and transmission line loss?

ANSWER:

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G9A13 -- What is the effect of transmission line loss on SWR measured at the input to the line?

ANSWER:

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# Propagation

(T3A01) What should you do if another operator reports that your station's 2 meter signals were strong just a moment ago, but now they are weak or distorted?

ANSWER:

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(T3A12) How might fog and light rain affect radio range on the 10 meter and 6 meter bands?

ANSWER:

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(T3A13) What weather condition would decrease range at microwave frequencies?

ANSWER:

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(T3A02) Why might the range of VHF and UHF signals be greater in the winter?

ANSWER:

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(T3A03) What antenna polarization is normally used for long-distance weak-signal CW and SSB contacts using the VHF and UHF bands?

ANSWER:

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(T3A05) When using a directional antenna, how might your station be able to access a distant repeater if buildings or obstructions are blocking the direct line of sight path?

ANSWER:

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(T3C11) Why do VHF and UHF radio signals usually travel somewhat farther than the visual line of sight distance between two stations?

ANSWER:

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(T3A06) What term is commonly used to describe the rapid fluttering sound sometimes heard from mobile stations that are moving while transmitting?

ANSWER:

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(T3A08) Which of the following is a likely cause of irregular fading of signals received by ionospheric reflection?

ANSWER:

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(T3A10) What may occur if data signals arrive via multiple paths?

ANSWER:

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(T3A11) Which part of the atmosphere enables the propagation of radio signals around the world?

ANSWER:

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(T1A06) What is the FCC Part 97 definition of a beacon?

ANSWER:

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(T3C01) Why are direct (not via a repeater) UHF signals rarely heard from stations outside your local coverage area?

ANSWER:

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(T3C02) Which of the following is an advantage of HF vs VHF and higher frequencies?

ANSWER:

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(T3C03) What is a characteristic of VHF signals received via auroral reflection

ANSWER:

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(T3C04) Which of the following propagation types is most commonly associated with occasional strong over-the-horizon signals on the 10, 6, and 2 meter bands?

ANSWER:

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(T3C05) Which of the following effects might cause radio signals to be heard despite obstructions between the transmitting and receiving stations?

ANSWER:

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(T3C06) What mode is responsible for allowing over-the-horizon VHF and UHF communications to ranges of approximately 300 miles on a regular basis?

ANSWER:

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(T3C07) What band is best suited for communicating via meteor scatter?

ANSWER:

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(T3C08) What causes tropospheric ducting?

ANSWER:

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(T3C09) What is generally the best time for long-distance 10 meter band propagation via the F layer?

ANSWER:

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(T3C10) Which of the following bands may provide long distance communications during the peak of the sunspot cycle?

ANSWER:

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G1E10 -- Why should an amateur operator normally avoid transmitting on 14.100, 18.110, 21.150, 24.930 and 28.200 MHz?

ANSWER:

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G2D06 -- How is a directional antenna pointed when making a "long-path" contact with another station?

ANSWER:

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G3B01 -- What is a characteristic of skywave signals arriving at your location by both short-path and long-path propagation?

ANSWER:

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G3B02 -- What factors affect the MUF?

ANSWER:

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G3B05 -- What usually happens to radio waves with frequencies below the MUF and above the LUF when they are sent into the ionosphere?

ANSWER:

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G3B09 -- What is the approximate maximum distance along the Earth's surface that is normally covered in one hop using the F2 region?

ANSWER:

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G3B10 -- What is the approximate maximum distance along the Earth's surface that is normally covered in one hop using the E region?

ANSWER:

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G3C01 -- Which ionospheric layer is closest to the surface of Earth?

ANSWER:

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G3C02 -- Where on Earth do ionospheric layers reach their maximum height?

ANSWER:

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G3C03 -- Why is the F2 region mainly responsible for the longest distance radio wave propagation?

ANSWER:

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G3C04 -- What does the term "critical angle" mean, as used in radio wave propagation?

ANSWER:

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G3C05 -- Why is long-distance communication on the 40-meter, 60-meter, 80-meter, and 160-meter bands more difficult during the day?

ANSWER:

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G3C11 -- Which ionospheric layer is the most absorptive of long skip signals during daylight hours on frequencies below 10 MHz?

ANSWER:

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G3A01 -- What is the significance of the sunspot number about HF propagation?

ANSWER:

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G3A02 -- What effect does a Sudden Ionospheric Disturbance have on the daytime ionospheric propagation of HF radio waves?

ANSWER:

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G3A03 -- Approximately how long does it take the increased ultraviolet and X-ray radiation from solar flares to affect radio propagation on Earth?

ANSWER:

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G3A04 -- Which of the following are least reliable for long-distance communications during periods of low solar activity?

ANSWER:

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G3A05 -- What is the solar flux index?

ANSWER:

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G3A06 -- What is a geomagnetic storm?

ANSWER:

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G3A07 -- At what point in the solar cycle does the 20-meter band usually support worldwide propagation during daylight hours?

ANSWER:

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G3A08 -- Which of the following effects can a geomagnetic storm have on radio propagation?

ANSWER:

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G3A09 -- What benefit can high geomagnetic activity have on radio communications?

ANSWER:

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G3A10 -- What causes HF propagation conditions to vary periodically in a roughly 28-day cycle?

ANSWER:

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G3A11 -- How long does it take charged particles from coronal mass ejections to affect radio propagation on Earth?

ANSWER:

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G3A12 -- What does the K-index indicate?

ANSWER:

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G3A13 -- What does the A-index indicate?

ANSWER:

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G3A14 -- How are radio communications usually affected by the charged particles that reach Earth from solar coronal holes?

ANSWER:

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G3B03 -- Which of the following applies when selecting a frequency for lowest attenuation when transmitting on HF?

ANSWER:

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G3B04 -- What is a reliable way to determine if the MUF is high enough to support skip propagation between your station and a distant location on frequencies between 14 and 30 MHz?

ANSWER:

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G3B06 -- What usually happens to radio waves with frequencies below the LUF?

ANSWER:

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G3B07 -- What does LUF stand for?

ANSWER:

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G3B08 -- What does MUF stand for?

ANSWER:

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G3B11 -- What happens to HF propagation when the LUF exceeds the MUF?

ANSWER:

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G3C06 -- What is a characteristic of HF scatter?

ANSWER:

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G3C07 -- What makes HF scatter signals often sound distorted?

ANSWER:

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G3C08 -- Why are HF scatter signals in the skip zone usually weak?

ANSWER:

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G3C09 -- What type of propagation allows signals to be heard in the transmitting station's skip zone?

ANSWER:

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