

**2022-2026 Technician Class
FCC Element 2 Question Pool
Effective 7/01/2022 – 6/30/2026**

SUBELEMENT T3 – RADIO WAVE PROPAGATION – [3 Exam Questions - 3 Groups]

T3A - Radio wave characteristics: how a radio signal travels, fading, multipath, polarization, wavelength vs absorption; Antenna orientation

T3A01

Why do VHF signal strengths sometimes vary greatly when the antenna is moved only a few feet?

- A. The signal path encounters different concentrations of water vapor
- B. VHF ionospheric propagation is very sensitive to path length
- C. Multipath propagation cancels or reinforces signals**
- D. All these choices are correct

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T3A02

What is the effect of vegetation on UHF and microwave signals?

- A. Knife-edge diffraction
- B. Absorption**
- C. Amplification
- D. Polarization rotation

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T3A03

What antenna polarization is normally used for long-distance CW and SSB contacts on the VHF and UHF bands?

- A. Right-hand circular
- B. Left-hand circular
- C. Horizontal**
- D. Vertical

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T3A04

What happens when antennas at opposite ends of a VHF or UHF line of sight radio link are not using the same polarization?

- A. The modulation sidebands might become inverted
- B. Received signal strength is reduced**
- C. Signals have an echo effect
- D. Nothing significant will happen

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T3A05

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

- A. Change from vertical to horizontal polarization
- B. Try to find a path that reflects signals to the repeater
- C. Try the long path
- D. Increase the antenna SWR

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T3A06

What is the meaning of the term “picket fencing”?

- A. Alternating transmissions during a net operation
- B. Rapid flutter on mobile signals due to multipath propagation
- C. A type of ground system used with vertical antennas
- D. Local vs long-distance communications

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T3A07

What weather condition might decrease range at microwave frequencies?

- A. High winds
- B. Low barometric pressure
- C. Precipitation
- D. Colder temperatures

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T3A08

What is a likely cause of irregular fading of signals propagated by the ionosphere?

- A. Frequency shift due to Faraday rotation
- B. Interference from thunderstorms
- C. Intermodulation distortion
- D. Random combining of signals arriving via different paths

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T3A09

Which of the following results from the fact that signals propagated by the ionosphere are elliptically polarized?

- A. Digital modes are unusable
- B. Either vertically or horizontally polarized antennas may be used for transmission or reception
- C. FM voice is unusable
- D. Both the transmitting and receiving antennas must be of the same polarization

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T3A10

What effect does multi-path propagation have on data transmissions?

- A. Transmission rates must be increased by a factor equal to the number of separate paths observed
- B. Transmission rates must be decreased by a factor equal to the number of separate paths observed
- C. No significant changes will occur if the signals are transmitted using FM
- D. Error rates are likely to increase

T3A11

Which region of the atmosphere can refract or bend HF and VHF radio waves?

- A. The stratosphere
- B. The troposphere
- C. The ionosphere
- D. The mesosphere

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T3A12

What is the effect of fog and rain on signals in the 10 meter and 6 meter bands?

- A. Absorption
- B. There is little effect
- C. Deflection
- D. Range increase

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T3B - Electromagnetic wave properties: wavelength vs frequency, nature and velocity of electromagnetic waves, relationship of wavelength and frequency; Electromagnetic spectrum definitions: UHF, VHF, HF

T3B01

What is the relationship between the electric and magnetic fields of an electromagnetic wave?

- A. They travel at different speeds
- B. They are in parallel
- C. They revolve in opposite directions
- D. They are at right angles

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T3B02

What property of a radio wave defines its polarization?

- A. The orientation of the electric field
- B. The orientation of the magnetic field
- C. The ratio of the energy in the magnetic field to the energy in the electric field
- D. The ratio of the velocity to the wavelength

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T3B03

What are the two components of a radio wave?

- A. Impedance and reactance
- B. Voltage and current
- C. Electric and magnetic fields
- D. Ionizing and non-ionizing radiation

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T3B04

What is the velocity of a radio wave traveling through free space?

- A. Speed of light
- B. Speed of sound
- C. Speed inversely proportional to its wavelength
- D. Speed that increases as the frequency increases

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T3B05

What is the relationship between wavelength and frequency?

- A. Wavelength gets longer as frequency increases
- B. Wavelength gets shorter as frequency increases
- C. Wavelength and frequency are unrelated
- D. Wavelength and frequency increase as path length increases

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T3B06

What is the formula for converting frequency to approximate wavelength in meters?

- A. Wavelength in meters equals frequency in hertz multiplied by 300
- B. Wavelength in meters equals frequency in hertz divided by 300
- C. Wavelength in meters equals frequency in megahertz divided by 300
- D. Wavelength in meters equals 300 divided by frequency in megahertz

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T3B07

In addition to frequency, which of the following is used to identify amateur radio bands?

- A. The approximate wavelength in meters
- B. Traditional letter/number designators
- C. Channel numbers
- D. All these choices are correct

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T3B08

What frequency range is referred to as VHF?

- A. 30 kHz to 300 kHz
- B. 30 MHz to 300 MHz
- C. 300 kHz to 3000 kHz
- D. 300 MHz to 3000 MHz

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T3B09

What frequency range is referred to as UHF?

- A. 30 to 300 kHz
- B. 30 to 300 MHz
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz

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T3B10

What frequency range is referred to as HF?

- A. 300 to 3000 MHz
- B. 30 to 300 MHz
- C. 3 to 30 MHz
- D. 300 to 3000 kHz

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T3B11

What is the approximate velocity of a radio wave in free space?

- A. 150,000 meters per second
- B. 300,000,000 meters per second
- C. 300,000,000 miles per hour
- D. 150,000 miles per hour

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T3C - Propagation modes: sporadic E, meteor scatter, auroral propagation, tropospheric ducting; F region skip; Line of sight and radio horizon

T3C01

Why are simplex UHF signals rarely heard beyond their radio horizon?

- A. They are too weak to go very far
- B. FCC regulations prohibit them from going more than 50 miles
- C. UHF signals are usually not propagated by the ionosphere
- D. UHF signals are absorbed by the ionospheric D region

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T3C02

What is a characteristic of HF communication compared with communications on VHF and higher frequencies?

- A. HF antennas are generally smaller
- B. HF accommodates wider bandwidth signals
- C. Long-distance ionospheric propagation is far more common on HF
- D. There is less atmospheric interference (static) on HF

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T3C03

What is a characteristic of VHF signals received via auroral backscatter?

- A. They are often received from 10,000 miles or more
- B. They are distorted and signal strength varies considerably
- C. They occur only during winter nighttime hours
- D. They are generally strongest when your antenna is aimed west

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T3C04

Which of the following types of propagation is most commonly associated with occasional strong signals on the 10, 6, and 2 meter bands from beyond the radio horizon?

- A. Backscatter
- B. Sporadic E**
- C. D region absorption
- D. Gray-line propagation

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T3C05

Which of the following effects may allow radio signals to travel beyond obstructions between the transmitting and receiving stations?

- A. Knife-edge diffraction**
- B. Faraday rotation
- C. Quantum tunneling
- D. Doppler shift

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T3C06

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

- A. Tropospheric ducting**
- B. D region refraction
- C. F2 region refraction
- D. Faraday rotation

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T3C07

What band is best suited for communicating via meteor scatter?

- A. 33 centimeters
- B. 6 meters**
- C. 2 meters
- D. 70 centimeters

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T3C08

What causes tropospheric ducting?

- A. Discharges of lightning during electrical storms
- B. Sunspots and solar flares
- C. Updrafts from hurricanes and tornadoes
- D. Temperature inversions in the atmosphere**

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T3C09

What is generally the best time for long-distance 10 meter band propagation via the F region?

- A. From dawn to shortly after sunset during periods of high sunspot activity
- B. From shortly after sunset to dawn during periods of high sunspot activity
- C. From dawn to shortly after sunset during periods of low sunspot activity
- D. From shortly after sunset to dawn during periods of low sunspot activity

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T3C10

Which of the following bands may provide long-distance communications via the ionosphere's F region during the peak of the sunspot cycle?

- A. 6 and 10 meters
- B. 23 centimeters
- C. 70 centimeters and 1.25 meters
- D. All these choices are correct

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T3C11

Why is the radio horizon for VHF and UHF signals more distant than the visual horizon?

- A. Radio signals move somewhat faster than the speed of light
- B. Radio waves are not blocked by dust particles
- C. The atmosphere refracts radio waves slightly
- D. Radio waves are blocked by dust particles

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