

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

**SUBELEMENT G3 – RADIO WAVE PROPAGATION [3 Exam Questions – 3 Groups]**

G3A – Sunspots and solar radiation; ionospheric disturbances; propagation forecasting and indices

G3A01

**What is the significance of the sunspot number with regard to HF propagation?**

- A. Higher sunspot numbers generally indicate a greater probability of good propagation at higher frequencies
- B. Lower sunspot numbers generally indicate greater probability of sporadic E propagation
- C. A zero sunspot number indicates that radio propagation is not possible on any band
- D. A zero sunspot number indicates undisturbed conditions

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G3A02

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

- A. It enhances propagation on all HF frequencies
- B. It disrupts signals on lower frequencies more than those on higher frequencies
- C. It disrupts communications via satellite more than direct communications
- D. None, because only areas on the night side of the Earth are affected

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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?**

- A. 28 days
- B. 1 to 2 hours
- C. 8 minutes
- D. 20 to 40 hours

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G3A04

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

- A. 80 meters and 160 meters
- B. 60 meters and 40 meters
- C. 30 meters and 20 meters
- D. 15 meters, 12 meters, and 10 meters

G3A05

**What is the solar flux index?**

- A. A measure of the highest frequency that is useful for ionospheric propagation between two points on Earth
- B. A count of sunspots that is adjusted for solar emissions
- C. Another name for the American sunspot number
- D. A measure of solar radiation at 10.7 centimeters wavelength

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G3A06

**What is a geomagnetic storm?**

- A. A sudden drop in the solar flux index
- B. A thunderstorm that affects radio propagation
- C. Ripples in the ionosphere
- D. A temporary disturbance in Earth's magnetosphere

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G3A07

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

- A. At the summer solstice
- B. Only at the maximum point of the solar cycle
- C. Only at the minimum point of the solar cycle
- D. At any point in the solar cycle

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G3A08

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

- A. Improved high-latitude HF propagation
- B. Degraded high-latitude HF propagation
- C. Improved ground wave propagation
- D. Degraded ground wave propagation

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G3A09

**What benefit can high geomagnetic activity have on radio communications?**

- A. Auroras that can reflect VHF signals
- B. Higher signal strength for HF signals passing through the polar regions
- C. Improved HF long path propagation
- D. Reduced long delayed echoes

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G3A10

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

- A. Long term oscillations in the upper atmosphere
- B. Cyclic variation in Earth's radiation belts
- C. The sun's rotation on its axis
- D. The position of the moon in its orbit

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G3A11

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

- A. 28 days
- B. 14 days
- C. 4 to 8 minutes
- D. 20 to 40 hours

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G3A12

**What does the K-index indicate?**

- A. The relative position of sunspots on the surface of the sun
- B. The short-term stability of Earth's magnetic field
- C. The stability of the sun's magnetic field
- D. The solar radio flux at Boulder, Colorado

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G3A13

**What does the A-index indicate?**

- A. The relative position of sunspots on the surface of the sun
- B. The amount of polarization of the sun's electric field
- C. The long-term stability of Earth's geomagnetic field
- D. The solar radio flux at Boulder, Colorado

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G3A14

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

- A. HF communications are improved
- B. HF communications are disturbed
- C. VHF/UHF ducting is improved
- D. VHF/UHF ducting is disturbed

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G3B – Maximum Usable Frequency; Lowest Usable Frequency; propagation

G3B01

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

- A. Periodic fading approximately every 10 seconds
- B. Signal strength increased by 3 dB
- C. The signal might be cancelled causing severe attenuation
- D. A slightly delayed echo might be heard

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G3B02

**What factors affect the MUF?**

- A. Path distance and location
- B. Time of day and season
- C. Solar radiation and ionospheric disturbances
- D. All these choices are correct

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G3B03

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

- A. Select a frequency just below the MUF
- B. Select a frequency just above the LUF
- C. Select a frequency just below the critical frequency
- D. Select a frequency just above the critical frequency

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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?**

- A. Listen for signals from an international beacon in the frequency range you plan to use
- B. Send a series of dots on the band and listen for echoes from your signal
- C. Check the strength of TV signals from western Europe
- D. Check the strength of signals in the MF AM broadcast band

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G3B05 (A)

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

- A. They are bent back to Earth
- B. They pass through the ionosphere
- C. They are amplified by interaction with the ionosphere
- D. They are bent and trapped in the ionosphere to circle Earth

G3B06

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

- A. They are bent back to Earth
- B. They pass through the ionosphere
- C. They are completely absorbed by the ionosphere
- D. They are bent and trapped in the ionosphere to circle Earth

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G3B07

**What does LUF stand for?**

- A. The Lowest Usable Frequency for communications between two points
- B. The Longest Universal Function for communications between two points
- C. The Lowest Usable Frequency during a 24-hour period
- D. The Longest Universal Function during a 24-hour period

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G3B08

**What does MUF stand for?**

- A. The Minimum Usable Frequency for communications between two points
- B. The Maximum Usable Frequency for communications between two points
- C. The Minimum Usable Frequency during a 24-hour period
- D. The Maximum Usable Frequency during a 24-hour period

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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?**

- A. 180 miles
- B. 1,200 miles
- C. 2,500 miles
- D. 12,000 miles

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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?**

- A. 180 miles
- B. 1,200 miles
- C. 2,500 miles
- D. 12,000 miles

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G3B11

**What happens to HF propagation when the LUF exceeds the MUF?**

- A. No HF radio frequency will support ordinary skywave communications over the path
- B. HF communications over the path are enhanced
- C. Double hop propagation along the path is more common
- D. Propagation over the path on all HF frequencies is enhanced

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G3C – Ionospheric layers; critical angle and frequency; HF scatter; Near Vertical Incidence Skywave

G3C01

**Which ionospheric layer is closest to the surface of Earth?**

- A. The D layer
- B. The E layer
- C. The F1 layer
- D. The F2 layer

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G3C02

**Where on Earth do ionospheric layers reach their maximum height?**

- A. Where the sun is overhead
- B. Where the sun is on the opposite side of Earth
- C. Where the sun is rising
- D. Where the sun has just set

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G3C03

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

- A. Because it is the densest ionospheric layer
- B. Because of the Doppler effect
- C. Because it is the highest ionospheric region
- D. Because of meteor trails at that level

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G3C04

**What does the term “critical angle” mean, as used in radio wave propagation?**

- A. The long path azimuth of a distant station
- B. The short path azimuth of a distant station
- C. The lowest takeoff angle that will return a radio wave to Earth under specific ionospheric conditions
- D. The highest takeoff angle that will return a radio wave to Earth under specific ionospheric conditions

G3C05

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

- A. The F layer absorbs signals at these frequencies during daylight hours
- B. The F layer is unstable during daylight hours
- C. The D layer absorbs signals at these frequencies during daylight hours
- D. The E layer is unstable during daylight hours

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G3C06

**What is a characteristic of HF scatter?**

- A. Phone signals have high intelligibility
- B. Signals have a fluttering sound
- C. There are very large, sudden swings in signal strength
- D. Scatter propagation occurs only at night

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G3C07

**What makes HF scatter signals often sound distorted?**

- A. The ionospheric layer involved is unstable
- B. Ground waves are absorbing much of the signal
- C. The E-region is not present
- D. Energy is scattered into the skip zone through several different radio wave paths

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G3C08

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

- A. Only a small part of the signal energy is scattered into the skip zone
- B. Signals are scattered from the magnetosphere, which is not a good reflector
- C. Propagation is through ground waves, which absorb most of the signal energy
- D. Propagation is through ducts in the F region, which absorb most of the energy

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G3C09

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

- A. Faraday rotation
- B. Scatter
- C. Chordal hop
- D. Short-path

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G3C10

**What is Near Vertical Incidence Skywave (NVIS) propagation?**

- A. Propagation near the MUF
- B. Short distance MF or HF propagation using high elevation angles
- C. Long path HF propagation at sunrise and sunset
- D. Double hop propagation near the LUF

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G3C11

**Which ionospheric layer is the most absorbent of long skip signals during daylight hours on frequencies below 10 MHz?**

- A. The F2 layer
- B. The F1 layer
- C. The E layer
- D. The D layer

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