

**2023-2027 General Class Question Pool 2nd Errata
Issued April 15, 2023**

**The following changes have been made to the posted
2023-2027 General Class Question Pool
Released on December 1, 2022**

In the pool itself, 3 questions modified, and 1 question deleted:

G1A05 – in the answers, change answer D to read “All these choices are correct”.

D. All these choices are correct

G1E10 – in the question remove the space in 24.930 to read:

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

G9D01 – in answer C add “A” to the beginning of the answer to read:

C. A horizontal dipole placed at approximately 1/2 wavelength above the ground

G6B09 – question **deleted**

Question G6B09 is withdrawn from the pool and marked as deleted.

The remaining questions in G6B were not renumbered, leaving 11 questions.

2023-2027 General Class Question Pool Errata
Issued February 1, 2023

The following changes have been made to the posted
2023-2027 General Class Question Pool
Released on December 1, 2022

In the syllabus at the top of the pool one change:

Change SUBELEMENT G9 question count from 48 to 46:

SUBELEMENT G9 – ANTENNAS AND FEED LINES [4 Exam Questions – 4 Groups] 46 Questions

In the pool itself, 9 questions modified, and 2 questions deleted:

G1B01 – in the question add “not” after structure to read:

What is the maximum height above ground for an antenna structure not near a public use airport without requiring notification to the FAA and registration with the FCC?

G1C01 – in the question change “transmitting” to “transmitter” to read:

What is the maximum transmitter power an amateur station may use on 10.140 MHz?

G1C02 – in the question change “transmitting” to “transmitter” to read:

What is the maximum transmitter power an amateur station may use on the 12-meter band?

G5C02 – in the question change “output” to “input” before signal to read:

What is the output voltage if an input signal is applied to the secondary winding of a 4:1 voltage step-down transformer instead of the primary winding?

G7C10 – in the answers, add a period after the “D”.

G9B05 – in the question add “at elevation angles higher than about 45 degrees” to the end of the question to read:

How does antenna height affect the azimuthal radiation pattern of a horizontal dipole HF antenna at elevation angles higher than about 45 degrees?

G9C09 – in the question add “In free space,” to the beginning of the question to read:

In free space, 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?

G9D09 – in answer A add “MF and” before low HF bands to read:

A. Directional receiving for MF and low HF bands

G9D10 – in the question change “1/3” to “1/10” to read:

In which direction or directions does an electrically small loop (less than 1/10 wavelength in circumference) have nulls in its radiation pattern?

G9C06 - question deleted

Question G9C06 is withdrawn from the pool and marked as deleted.
The remaining questions in G9C were not renumbered, leaving 11 questions.

G9D13 - question deleted

Question G9D13 is withdrawn from the pool and marked as deleted.
The remaining questions in G9D were not renumbered, leaving 12 questions.

**2023-2027 General Class
FCC Element 3 Question Pool Syllabus
Effective 7/01/2023 – 6/30/2027**

SUBELEMENT G1 – COMMISSION'S RULES [5 Exam Questions – 5 Groups] 57 Questions

G1A – General class control operator frequency privileges; primary and secondary allocations

G1B – Antenna structure limitations; good engineering and good amateur practice; beacon operation; prohibited transmissions; retransmitting radio signals

G1C – Transmitter power regulations; data emission standards; 60-meter operation requirements

G1D – Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification; element credit; remote operation

G1E – Control categories; repeater regulations; third-party rules; ITU regions; automatically controlled digital station

SUBELEMENT G2 – OPERATING PROCEDURES [5 Exam Questions – 5 Groups] 60 Questions

G2A – Phone operating procedures: USB/LSB conventions, breaking into a contact, transmitter setup for voice operation; answering DX stations

G2B – Operating effectively; band plans; drills and emergencies; RACES operation

G2C – CW operating procedures and procedural signals; Q signals; full break-in

G2D – Volunteer Monitor Program; HF operations

G2E – Digital mode operating procedures

SUBELEMENT G3 – RADIO WAVE PROPAGATION [3 Exam Questions – 3 Groups] 37 Questions

G3A – Sunspots and solar radiation; geomagnetic field and stability indices

G3B – Maximum Usable Frequency; Lowest Usable Frequency; short path and long path propagation; determining propagation conditions; ionospheric refraction

G3C – Ionospheric regions; critical angle and frequency; HF scatter; near vertical incidence skywave (NVIS)

SUBELEMENT G4 – AMATEUR RADIO PRACTICES [5 Exam Questions – 5 groups] 60 Questions

G4A – Station configuration and operation

G4B – Tests and test equipment

G4C – Interference to consumer electronics; grounding and bonding

G4D – Speech processors; S meters; sideband operation near band edges

G4E – Mobile and portable HF stations; alternative energy source operation

SUBELEMENT G5 – ELECTRICAL PRINCIPLES [3 Exam Questions – 3 Groups] 40 Questions

G5A – Reactance; inductance; capacitance; impedance; impedance transformation; resonance

G5B – The decibel; current and voltage dividers; electrical power calculations; sine wave root-mean-square (RMS) values; PEP calculations

G5C – Resistors, capacitors, and inductors in series and parallel; transformers

SUBELEMENT G6 – CIRCUIT COMPONENTS [2 Exam Questions – 2 Groups] 24 Questions

G6A – Resistors; capacitors; inductors; rectifiers; solid-state diodes and transistors; vacuum tubes; batteries

G6B – Analog and digital integrated circuits (ICs); microwave ICs (MMICs); display devices; RF connectors; ferrite cores

SUBELEMENT G7 – PRACTICAL CIRCUITS [3 Exam Questions – 3 Groups] 38 Questions

G7A – Power supplies; schematic symbols

G7B – Digital circuits; amplifiers and oscillators

G7C – Transceiver design; filters; oscillators; digital signal processing (DSP)

SUBELEMENT G8 – SIGNALS AND EMISSIONS [3 Exam Questions – 3 Groups] 43 Questions

G8A – Carriers and modulation: AM, FM, and single sideband; modulation envelope; digital modulation; overmodulation; link budgets and link margins

G8B – Frequency changing; bandwidths of various modes; deviation; intermodulation

G8C – Digital emission modes

SUBELEMENT G9 – ANTENNAS AND FEED LINES [4 Exam Questions – 4 Groups] 46 Questions

G9A – Feed lines: characteristic impedance and attenuation; standing wave ratio (SWR) calculation, measurement, and effects; antenna feed point matching

G9B – Basic dipole and monopole antennas

G9C – Directional antennas

G9D – Specialized antenna types and applications

SUBELEMENT G0 – ELECTRICAL AND RF SAFETY [2 Exam Questions – 2 Groups] 25 Questions

G0A – RF safety principles, rules, and guidelines; routine station evaluation

G0B – Station safety: electrical shock, grounding, fusing, interlocks, and wiring; antenna and tower safety

**2023-2027 General Class
FCC Element 3 Question Pool
Effective 7/01/2023 – 6/30/2027**

SUBELEMENT G1 – COMMISSION'S RULES [5 Exam Questions – 5 Groups]

G1A – General class control operator frequency privileges; primary and secondary allocations

G1A01 (C) [97.301(d)]

On which HF and/or MF amateur bands are there portions where General class licensees cannot transmit?

- A. 60 meters, 30 meters, 17 meters, and 12 meters
- B. 160 meters, 60 meters, 15 meters, and 12 meters
- C. 80 meters, 40 meters, 20 meters, and 15 meters
- D. 80 meters, 20 meters, 15 meters, and 10 meters

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G1A02 (B) [97.305]

On which of the following bands is phone operation prohibited?

- A. 160 meters
- B. 30 meters
- C. 17 meters
- D. 12 meters

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G1A03 (B) [97.305]

On which of the following bands is image transmission prohibited?

- A. 160 meters
- B. 30 meters
- C. 20 meters
- D. 12 meters

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G1A04 (D) [97.303(h)]

Which of the following amateur bands is restricted to communication only on specific channels, rather than frequency ranges?

- A. 11 meters
- B. 12 meters
- C. 30 meters
- D. 60 meters

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G1A05 (A) [97.301(d)]

On which of the following frequencies are General class licensees prohibited from operating as control operator?

- A. 7.125 MHz to 7.175 MHz
- B. 28.000 MHz to 28.025 MHz

- C. 21.275 MHz to 21.300 MHz
- D. All of the above

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G1A06 (C) [97.303]

Which of the following applies when the FCC rules designate the amateur service as a secondary user on a band?

- A. Amateur stations must record the call sign of the primary service station before operating on a frequency assigned to that station
- B. Amateur stations may use the band only during emergencies
- C. Amateur stations must not cause harmful interference to primary users and must accept interference from primary users
- D. Amateur stations may only operate during specific hours of the day, while primary users are permitted 24-hour use of the band

~~

G1A07 (D) [97.305(a)]

On which amateur frequencies in the 10-meter band may stations with a General class control operator transmit CW emissions?

- A. 28.000 MHz to 28.025 MHz only
- B. 28.000 MHz to 28.300 MHz only
- C. 28.025 MHz to 28.300 MHz only
- D. The entire band

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G1A08 (B) [97.301(b)]

Which HF bands have segments exclusively allocated to Amateur Extra licensees?

- A. All HF bands
- B. 80 meters, 40 meters, 20 meters, and 15 meters
- C. All HF bands except 160 meters and 10 meters
- D. 60 meters, 30 meters, 17 meters, and 12 meters

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G1A09 (C) [97.301(d)]

Which of the following frequencies is within the General class portion of the 15-meter band?

- A. 14250 kHz
- B. 18155 kHz
- C. 21300 kHz
- D. 24900 kHz

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G1A10 (D) [97.205(b)]

What portion of the 10-meter band is available for repeater use?

- A. The entire band
- B. The portion between 28.1 MHz and 28.2 MHz
- C. The portion between 28.3 MHz and 28.5 MHz
- D. The portion above 29.5 MHz

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G1A11 (B) [97.301]

When General class licensees are not permitted to use the entire voice portion of a band, which portion of the voice segment is available to them?

- A. The lower frequency portion
- B. The upper frequency portion
- C. The lower frequency portion on frequencies below 7.3 MHz, and the upper portion on frequencies above 14.150 MHz
- D. The upper frequency portion on frequencies below 7.3 MHz, and the lower portion on frequencies above 14.150 MHz

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G1B – Antenna structure limitations; good engineering and good amateur practice; beacon operation; prohibited transmissions; retransmitting radio signals

G1B01 (C) [97.15(a)]

What is the maximum height above ground for an antenna structure not near a public use airport without requiring notification to the FAA and registration with the FCC?

- A. 50 feet
- B. 100 feet
- C. 200 feet
- D. 250 feet

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G1B02 (A) [97.203(b)]

With which of the following conditions must beacon stations comply?

- A. No more than one beacon station may transmit in the same band from the same station location
- B. The frequency must be coordinated with the National Beacon Organization
- C. The frequency must be posted on the internet or published in a national periodical
- D. All these choices are correct

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G1B03 (A) [97.3(a)(9)]

Which of the following is a purpose of a beacon station as identified in the FCC rules?

- A. Observation of propagation and reception
- B. Automatic identification of repeaters
- C. Transmission of bulletins of general interest to amateur radio licensees
- D. All these choices are correct

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G1B04 (C) [97.113(c)]

Which of the following transmissions is permitted for all amateur stations?

- A. Unidentified transmissions of less than 10 seconds duration for test purposes only
- B. Automatic retransmission of other amateur signals by any amateur station
- C. Occasional retransmission of weather and propagation forecast information from US government stations
- D. Encrypted messages, if not intended to facilitate a criminal act

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G1B05 (B) [97.111((5)(b)]

Which of the following one-way transmissions are permitted?

- A. Unidentified test transmissions of less than 10 seconds in duration
- B. Transmissions to assist with learning the International Morse code
- C. Regular transmissions offering equipment for sale, if intended for amateur radio use
- D. All these choices are correct

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G1B06 (D) [97.15(b), PRB-1, 101 FCC 2d 952 (1985)]

Under what conditions are state and local governments permitted to regulate amateur radio antenna structures?

- A. Under no circumstances, FCC rules take priority
- B. At any time and to any extent necessary to accomplish a legitimate purpose of the state or local entity, provided that proper filings are made with the FCC
- C. Only when such structures exceed 50 feet in height and are clearly visible 1,000 feet from the structure
- D. Amateur Service communications must be reasonably accommodated, and regulations must constitute the minimum practical to accommodate a legitimate purpose of the state or local entity

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G1B07 (B) [97.113(a)(4)]

What are the restrictions on the use of abbreviations or procedural signals in the amateur service?

- A. Only "Q" signals are permitted
- B. They may be used if they do not obscure the meaning of a message
- C. They are not permitted
- D. They are limited to those expressly listed in Part 97 of the FCC rules

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G1B08 (B) [97.111(a)(1)]

When is it permissible to communicate with amateur stations in countries outside the areas administered by the Federal Communications Commission?

- A. Only when the foreign country has a formal third-party agreement filed with the FCC
- B. When the contact is with amateurs in any country except those whose administrations have notified the ITU that they object to such communications
- C. Only when the contact is with amateurs licensed by a country which is a member of the United Nations, or by a territory possessed by such a country
- D. Only when the contact is with amateurs licensed by a country which is a member of the International Amateur Radio Union, or by a territory possessed by such a country

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G1B09 (D) [97.203(d)]

On what HF frequencies are automatically controlled beacons permitted?

- A. On any frequency if power is less than 1 watt
- B. On any frequency if transmissions are in Morse code
- C. 21.08 MHz to 21.09 MHz
- D. 28.20 MHz to 28.30 MHz

~~

G1B10 (C) [97.203(c)]

What is the power limit for beacon stations?

- A. 10 watts PEP output
- B. 20 watts PEP output
- C. 100 watts PEP output
- D. 200 watts PEP output

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G1B11 (A) [97.101(a)]

Who or what determines “good engineering and good amateur practice,” as applied to the operation of an amateur station in all respects not covered by the Part 97 rules?

- A. The FCC
- B. The control operator
- C. The IEEE
- D. The ITU

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G1C – Transmitter power regulations; data emission standards; 60-meter operation requirements

G1C01 (A) [97.313(c)(1)]

What is the maximum transmitter power an amateur station may use on 10.140 MHz?

- A. 200 watts PEP output
- B. 1000 watts PEP output
- C. 1500 watts PEP output
- D. 2000 watts PEP output

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G1C02 (C) [97.313]

What is the maximum transmitter power an amateur station may use on the 12-meter band?

- A. 50 watts PEP output
- B. 200 watts PEP output
- C. 1500 watts PEP output
- D. An effective radiated power equivalent to 100 watts from a half-wave dipole

~~

G1C03 (A) [97.303(h)(1)]

What is the maximum bandwidth permitted by FCC rules for amateur radio stations transmitting on USB frequencies in the 60-meter band?

- A. 2.8 kHz
- B. 5.6 kHz
- C. 1.8 kHz
- D. 3 kHz

~~

G1C04 (A) [97.303(i)]

Which of the following is required by the FCC rules when operating in the 60-meter band?

- A. If you are using an antenna other than a dipole, you must keep a record of the gain of your antenna
- B. You must keep a record of the date, time, frequency, power level, and stations worked

- C. You must keep a record of all third-party traffic
- D. You must keep a record of the manufacturer of your equipment and the antenna used

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G1C05 (C) [97.313]

What is the limit for transmitter power on the 28 MHz band for a General Class control operator?

- A. 100 watts PEP output
- B. 1000 watts PEP output
- C. 1500 watts PEP output
- D. 2000 watts PEP output

~~

G1C06 (D) [97.313]

What is the limit for transmitter power on the 1.8 MHz band?

- A. 200 watts PEP output
- B. 1000 watts PEP output
- C. 1200 watts PEP output
- D. 1500 watts PEP output

~~

G1C07 (C) [97.309(a)(4)]

What must be done before using a new digital protocol on the air?

- A. Type-certify equipment to FCC standards
- B. Obtain an experimental license from the FCC
- C. Publicly document the technical characteristics of the protocol
- D. Submit a rule-making proposal to the FCC describing the codes and methods of the technique

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G1C08 (D) [97.307(f)(3)]

What is the maximum symbol rate permitted for RTTY or data emission transmitted at frequencies below 28 MHz?

- A. 56 kilobaud
- B. 19.6 kilobaud
- C. 1200 baud
- D. 300 baud

~~

G1C09 (C) [97.313(i)]

What is the maximum power limit on the 60-meter band?

- A. 1500 watts PEP
- B. 10 watts RMS
- C. ERP of 100 watts PEP with respect to a dipole
- D. ERP of 100 watts PEP with respect to an isotropic antenna

~~

G1C10 (C) [97.305(c) and 97.307(f)(4)]

What is the maximum symbol rate permitted for RTTY or data emission transmissions on the 10-meter band?

- A. 56 kilobaud

- B. 19.6 kilobaud
- C. 1200 baud
- D. 300 baud

~~

G1C11 (D) [97.313]

What measurement is specified by FCC rules that regulate maximum power?

- A. RMS output from the transmitter
- B. RMS input to the antenna
- C. PEP input to the antenna
- D. PEP output from the transmitter

~~

G1D – Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification; element credit; remote operation

G1D01 (A) [97.501, 97.505(a)]

Who may receive partial credit for the elements represented by an expired amateur radio license?

- A. Any person who can demonstrate that they once held an FCC-issued General, Advanced, or Amateur Extra class license that was not revoked by the FCC
- B. Anyone who held an FCC-issued amateur radio license that expired not less than 5 and not more than 15 years ago
- C. Any person who previously held an amateur license issued by another country, but only if that country has a current reciprocal licensing agreement with the FCC
- D. Only persons who once held an FCC issued Novice, Technician, or Technician Plus license

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G1D02 (C) [97.509(b)(3)(i)]

What license examinations may you administer as an accredited Volunteer Examiner holding a General class operator license?

- A. General and Technician
- B. None, only Amateur Extra class licensees may be accredited
- C. Technician only
- D. Amateur Extra, General, and Technician

~~

G1D03 (C) [97.9(b)]

On which of the following band segments may you operate if you are a Technician class operator and have an unexpired Certificate of Successful Completion of Examination (CSCE) for General class privileges?

- A. Only the Technician band segments until your upgrade is posted in the FCC database
- B. Only on the Technician band segments until you have a receipt for the FCC application fee payment
- C. On any General or Technician class band segment
- D. On any General or Technician class band segment except 30 meters and 60 meters

~~

G1D04 (A) [97.509(3)(i)(c)]

Who must observe the administration of a Technician class license examination?

- A. At least three Volunteer Examiners of General class or higher
- B. At least two Volunteer Examiners of General class or higher
- C. At least two Volunteer Examiners of Technician class or higher
- D. At least three Volunteer Examiners of Technician class

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G1D05 (A) [97.7]

When operating a US station by remote control from outside the country, what license is required of the control operator?

- A. A US operator/primary station license
- B. Only an appropriate US operator/primary license and a special remote station permit from the FCC
- C. Only a license from the foreign country, as long as the call sign includes identification of portable operation in the US
- D. A license from the foreign country and a special remote station permit from the FCC

~~

G1D06 (A) [97.119(f)(2)]

Until an upgrade to General class is shown in the FCC database, when must a Technician licensee identify with "AG" after their call sign?

- A. Whenever they operate using General class frequency privileges
- B. Whenever they operate on any amateur frequency
- C. Whenever they operate using Technician frequency privileges
- D. A special identifier is not required if their General class license application has been filed with the FCC

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G1D07 (C) [97.509(b)(1)]

Volunteer Examiners are accredited by what organization?

- A. The Federal Communications Commission
- B. The Universal Licensing System
- C. A Volunteer Examiner Coordinator
- D. The Wireless Telecommunications Bureau

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G1D08 (B) [97.509(b)(3)]

Which of the following criteria must be met for a non-US citizen to be an accredited Volunteer Examiner?

- A. The person must be a resident of the US for a minimum of 5 years
- B. The person must hold an FCC granted amateur radio license of General class or above
- C. The person's home citizenship must be in ITU region 2
- D. None of these choices is correct; a non-US citizen cannot be a Volunteer Examiner

~~

G1D09 (C) [97.9(b)]

How long is a Certificate of Successful Completion of Examination (CSCE) valid for exam element credit?

- A. 30 days
- B. 180 days
- C. 365 days
- D. For as long as your current license is valid

~~

G1D10 (B) [97.509(b)(2)]

What is the minimum age that one must be to qualify as an accredited Volunteer Examiner?

- A. 16 years
- B. 18 years
- C. 21 years
- D. There is no age limit

~~

G1D11 (D) [97.505]

What action is required to obtain a new General class license after a previously held license has expired and the two-year grace period has passed?

- A. They must have a letter from the FCC showing they once held an amateur or commercial license
- B. There are no requirements other than being able to show a copy of the expired license
- C. Contact the FCC to have the license reinstated
- D. The applicant must show proof of the appropriate expired license grant and pass the current Element 2 exam

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G1D12 (C) [97.507]

When operating a station in South America by remote control over the internet from the US, what regulations apply?

- A. Those of both the remote station's country and the FCC
- B. Those of the remote station's country and the FCC's third-party regulations
- C. Only those of the remote station's country
- D. Only those of the FCC

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G1E – Control categories; repeater regulations; third-party rules; ITU regions; automatically controlled digital station

G1E01 (A) [97.115(b)(2)]

Which of the following would disqualify a third party from participating in sending a message via an amateur station?

- A. The third party's amateur license has been revoked and not reinstated
- B. The third party is not a US citizen
- C. The third party is speaking in a language other than English
- D. All these choices are correct

~~

G1E02 (D) [97.205(b)]

When may a 10-meter repeater retransmit the 2-meter signal from a station that has a Technician class control operator?

- A. Under no circumstances
- B. Only if the station on 10-meters is operating under a Special Temporary Authorization allowing such retransmission
- C. Only during an FCC-declared general state of communications emergency
- D. Only if the 10-meter repeater control operator holds at least a General class license

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G1E03 (A) [97.221]

What is required to conduct communications with a digital station operating under automatic control outside the automatic control band segments?

- A. The station initiating the contact must be under local or remote control
- B. The interrogating transmission must be made by another automatically controlled station
- C. No third-party traffic may be transmitted
- D. The control operator of the interrogating station must hold an Amateur Extra class license

~~

G1E04 (D) [97.13(b), 97.303, 97.311(b)]

Which of the following conditions require a licensed amateur radio operator to take specific steps to avoid harmful interference to other users or facilities?

- A. When operating within one mile of an FCC Monitoring Station
- B. When using a band where the Amateur Service is secondary
- C. When a station is transmitting spread spectrum emissions
- D. All these choices are correct

~~

G1E05 (C) [97.115(a)(2), 97.117]

What are the restrictions on messages sent to a third party in a country with which there is a Third-Party Agreement?

- A. They must relate to emergencies or disaster relief
- B. They must be for other licensed amateurs
- C. They must relate to amateur radio, or remarks of a personal character, or messages relating to emergencies or disaster relief
- D. The message must be limited to no longer than 1 minute in duration and the name of the third party must be recorded in the station log

~~

G1E06 (C) [97.301, ITU Radio Regulations]

The frequency allocations of which ITU region apply to radio amateurs operating in North and South America?

- A. Region 4
- B. Region 3
- C. Region 2
- D. Region 1

~~

G1E07 (D) [97.111]

In what part of the 2.4 GHz band may an amateur station communicate with non-licensed Wi-Fi stations?

- A. Anywhere in the band
- B. Channels 1 through 4
- C. Channels 42 through 45
- D. No part

~~

G1E08 (B) [97.313(j)]

What is the maximum PEP output allowed for spread spectrum transmissions?

- A. 100 milliwatts
- B. 10 watts
- C. 100 watts
- D. 1500 watts

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G1E09 (A) [97.115]

Under what circumstances are messages that are sent via digital modes exempt from Part 97 third-party rules that apply to other modes of communication?

- A. Under no circumstances
- B. When messages are encrypted
- C. When messages are not encrypted
- D. When under automatic control

~~

G1E10 (A) [97.101]

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

- A. A system of propagation beacon stations operates on those frequencies
- B. A system of automatic digital stations operates on those frequencies
- C. These frequencies are set aside for emergency operations
- D. These frequencies are set aside for bulletins from the FCC

~~

G1E11 (D) [97.221, 97.305]

On what bands may automatically controlled stations transmitting RTTY or data emissions communicate with other automatically controlled digital stations?

- A. On any band segment where digital operation is permitted
- B. Anywhere in the non-phone segments of the 10-meter or shorter wavelength bands
- C. Only in the non-phone Extra Class segments of the bands
- D. Anywhere in the 6-meter or shorter wavelength bands, and in limited segments of some of the HF bands

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G1E12 (A) [97.115]

When may third-party messages be transmitted via remote control?

- A. Under any circumstances in which third party messages are permitted by FCC rules
- B. Under no circumstances except for emergencies
- C. Only when the message is intended for licensed radio amateurs
- D. Only when the message is intended for third parties in areas where licensing is controlled by the FCC

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SUBELEMENT G2 – OPERATING PROCEDURES [5 Exam Questions – 5 Groups]

G2A – Phone operating procedures: USB/LSB conventions, breaking into a contact, transmitter setup for voice operation; answering DX stations

G2A01 (A)

Which mode is most commonly used for voice communications on frequencies of 14 MHz or higher?

- A. Upper sideband
- B. Lower sideband
- C. Suppressed sideband
- D. Double sideband

~~

G2A02 (B)

Which mode is most commonly used for voice communications on the 160-, 75-, and 40-meter bands?

- A. Upper sideband
- B. Lower sideband
- C. Suppressed sideband
- D. Double sideband

~~

G2A03 (A)

Which mode is most commonly used for SSB voice communications in the VHF and UHF bands?

- A. Upper sideband
- B. Lower sideband
- C. Suppressed sideband
- D. Double sideband

~~

G2A04 (A)

Which mode is most commonly used for voice communications on the 17- and 12-meter bands?

- A. Upper sideband
- B. Lower sideband
- C. Suppressed sideband
- D. Double sideband

~~

G2A05 (C)

Which mode of voice communication is most commonly used on the HF amateur bands?

- A. Frequency modulation
- B. Double sideband
- C. Single sideband
- D. Single phase modulation

~~

G2A06 (D)

Which of the following is an advantage of using single sideband, as compared to other analog voice modes on the HF amateur bands?

- A. Very high-fidelity voice modulation
- B. Less subject to interference from atmospheric static crashes
- C. Ease of tuning on receive and immunity to impulse noise
- D. Less bandwidth used and greater power efficiency

~~

G2A07 (B)

Which of the following statements is true of single sideband (SSB)?

- A. Only one sideband and the carrier are transmitted; the other sideband is suppressed
- B. Only one sideband is transmitted; the other sideband and carrier are suppressed
- C. SSB is the only voice mode authorized on the 20-, 15-, and 10-meter amateur bands
- D. SSB is the only voice mode authorized on the 160-, 75-, and 40-meter amateur bands

~~

G2A08 (B)

What is the recommended way to break into a phone contact?

- A. Say "QRZ" several times, followed by your call sign
- B. Say your call sign once
- C. Say "Breaker Breaker"
- D. Say "CQ" followed by the call sign of either station

~~

G2A09 (D)

Why do most amateur stations use lower sideband on the 160-, 75-, and 40-meter bands?

- A. Lower sideband is more efficient than upper sideband at these frequencies
- B. Lower sideband is the only sideband legal on these frequency bands
- C. Because it is fully compatible with an AM detector
- D. It is commonly accepted amateur practice

~~

G2A10 (B)

Which of the following statements is true of VOX operation versus PTT operation?

- A. The received signal is more natural sounding
- B. It allows "hands free" operation
- C. It occupies less bandwidth
- D. It provides more power output

~~

G2A11 (C)

Generally, who should respond to a station in the contiguous 48 states calling "CQ DX"?

- A. Any caller is welcome to respond
- B. Only stations in Germany
- C. Any stations outside the lower 48 states
- D. Only contest stations

~~

G2A12 (B)

What control is typically adjusted for proper ALC setting on a single sideband transceiver?

- A. RF clipping level
- B. Transmit audio or microphone gain
- C. Antenna inductance or capacitance
- D. Attenuator level

~~

G2B – Operating effectively; band plans; drills and emergencies; RACES operation

G2B01 (C) [97.101(b), (c)]

Which of the following is true concerning access to frequencies?

- A. Nets have priority
- B. QSOs in progress have priority
- C. Except during emergencies, no amateur station has priority access to any frequency
- D. Contest operations should yield to non-contest use of frequencies

~~

G2B02 (B)

What is the first thing you should do if you are communicating with another amateur station and hear a station in distress break in?

- A. Inform your local emergency coordinator
- B. Acknowledge the station in distress and determine what assistance may be needed
- C. Immediately decrease power to avoid interfering with the station in distress
- D. Immediately cease all transmissions

~~

G2B03 (C)

What is good amateur practice if propagation changes during a contact creating interference from other stations using the frequency?

- A. Advise the interfering stations that you are on the frequency and that you have priority
- B. Decrease power and continue to transmit
- C. Attempt to resolve the interference problem with the other stations in a mutually acceptable manner
- D. Switch to the opposite sideband

~~

G2B04 (B)

When selecting a CW transmitting frequency, what minimum separation from other stations should be used to minimize interference to stations on adjacent frequencies?

- A. 5 Hz to 50 Hz
- B. 150 Hz to 500 Hz
- C. 1 kHz to 3 kHz
- D. 3 kHz to 6 kHz

~~

G2B05 (C)

When selecting an SSB transmitting frequency, what minimum separation should be used to minimize interference to stations on adjacent frequencies?

- A. 5 Hz to 50 Hz
- B. 150 Hz to 500 Hz
- C. 2 kHz to 3 kHz
- D. Approximately 6 kHz

~~

G2B06 (A)

How can you avoid harmful interference on an apparently clear frequency before calling CQ on CW or phone?

- A. Send "QRL?" on CW, followed by your call sign; or, if using phone, ask if the frequency is in use, followed by your call sign
- B. Listen for 2 minutes before calling CQ
- C. Send the letter "V" in Morse code several times and listen for a response, or say "test" several times and listen for a response
- D. Send "QSY" on CW or if using phone, announce "the frequency is in use," then give your call sign and listen for a response

~~

G2B07 (C)

Which of the following complies with commonly accepted amateur practice when choosing a frequency on which to initiate a call?

- A. Listen on the frequency for at least two minutes to be sure it is clear
- B. Identify your station by transmitting your call sign at least 3 times
- C. Follow the voluntary band plan
- D. All these choices are correct

~~

G2B08 (A)

What is the voluntary band plan restriction for US stations transmitting within the 48 contiguous states in the 50.1 MHz to 50.125 MHz band segment?

- A. Only contacts with stations not within the 48 contiguous states
- B. Only contacts with other stations within the 48 contiguous states
- C. Only digital contacts
- D. Only SSTV contacts

~~

G2B09 (A) [97.407(a)]

Who may be the control operator of an amateur station transmitting in RACES to assist relief operations during a disaster?

- A. Only a person holding an FCC-issued amateur operator license
- B. Only a RACES net control operator
- C. A person holding an FCC-issued amateur operator license or an appropriate government official
- D. Any control operator when normal communication systems are operational

~~

G2B10 (B)

Which of the following is good amateur practice for net management?

- A. Always use multiple sets of phonetics during check-in
- B. Have a backup frequency in case of interference or poor conditions
- C. Transmit the full net roster at the beginning of every session
- D. All these choices are correct

~~

G2B11 (C) [97.407(d)(4)]

How often may RACES training drills and tests be routinely conducted without special authorization?

- A. No more than 1 hour per month
- B. No more than 2 hours per month
- C. No more than 1 hour per week
- D. No more than 2 hours per week

~~

G2C – CW operating procedures and procedural signals; Q signals; full break-in

G2C01 (D)

Which of the following describes full break-in CW operation (QSK)?

- A. Breaking stations send the Morse code prosign “BK”
- B. Automatic keyers, instead of hand keys, are used to send Morse code
- C. An operator must activate a manual send/receive switch before and after every transmission
- D. Transmitting stations can receive between code characters and elements

~~

G2C02 (A)

What should you do if a CW station sends “QRS?”

- A. Send slower
- B. Change frequency
- C. Increase your power
- D. Repeat everything twice

~~

G2C03 (C)

What does it mean when a CW operator sends “KN” at the end of a transmission?

- A. No US stations should call
- B. Operating full break-in
- C. Listening only for a specific station or stations
- D. Closing station now

~~

G2C04 (D)

What does the Q signal “QRL?” mean?

- A. “Will you keep the frequency clear?”
- B. “Are you operating full break-in?” or “Can you operate full break-in?”
- C. “Are you listening only for a specific station?”
- D. “Are you busy?” or “Is this frequency in use?”

~~

G2C05 (B)

What is the best speed to use when answering a CQ in Morse code?

- A. The fastest speed at which you are comfortable copying, but no slower than the CQ
- B. The fastest speed at which you are comfortable copying, but no faster than the CQ
- C. At the standard calling speed of 10 wpm
- D. At the standard calling speed of 5 wpm

~~

G2C06 (D)

What does the term "zero beat" mean in CW operation?

- A. Matching the speed of the transmitting station
- B. Operating split to avoid interference on frequency
- C. Sending without error
- D. Matching the transmit frequency to the frequency of a received signal

~~

G2C07 (A)

When sending CW, what does a "C" mean when added to the RST report?

- A. Chirpy or unstable signal
- B. Report was read from an S meter rather than estimated
- C. 100 percent copy
- D. Key clicks

~~

G2C08 (C)

What prosign is sent to indicate the end of a formal message when using CW?

- A. SK
- B. BK
- C. AR
- D. KN

~~

G2C09 (C)

What does the Q signal "QSL" mean?

- A. Send slower
- B. We have already confirmed the contact
- C. I have received and understood
- D. We have worked before

~~

G2C10 (D)

What does the Q signal "QRN" mean?

- A. Send more slowly
- B. Stop sending
- C. Zero beat my signal
- D. I am troubled by static

~~

G2C11 (D)

What does the Q signal "QRV" mean?

- A. You are sending too fast
- B. There is interference on the frequency
- C. I am quitting for the day
- D. I am ready to receive

~~

G2D – Volunteer Monitor Program; HF operations

G2D01 (A)

What is the Volunteer Monitor Program?

- A. Amateur volunteers who are formally enlisted to monitor the airwaves for rules violations
- B. Amateur volunteers who conduct amateur licensing examinations
- C. Amateur volunteers who conduct frequency coordination for amateur VHF repeaters
- D. Amateur volunteers who use their station equipment to help civil defense organizations in times of emergency

~~

G2D02 (D)

Which of the following are objectives of the Volunteer Monitor Program?

- A. To conduct efficient and orderly amateur licensing examinations
- B. To provide emergency and public safety communications
- C. To coordinate repeaters for efficient and orderly spectrum usage
- D. To encourage amateur radio operators to self-regulate and comply with the rules

~~

G2D03 (B)

What procedure may be used by Volunteer Monitors to localize a station whose continuous carrier is holding a repeater on in their area?

- A. Compare vertical and horizontal signal strengths on the input frequency
- B. Compare beam headings on the repeater input from their home locations with that of other Volunteer Monitors
- C. Compare signal strengths between the input and output of the repeater
- D. All these choices are correct

~~

G2D04 (B)

Which of the following describes an azimuthal projection map?

- A. A map that shows accurate land masses
- B. A map that shows true bearings and distances from a specific location
- C. A map that shows the angle at which an amateur satellite crosses the equator
- D. A map that shows the number of degrees longitude that an amateur satellite appears to move westward at the equator with each orbit

~~

G2D05 (C)

Which of the following indicates that you are looking for an HF contact with any station?

- A. Sign your call sign once, followed by the words "listening for a call" -- if no answer, change frequency and repeat
- B. Say "QTC" followed by "this is" and your call sign -- if no answer, change frequency and repeat
- C. Repeat "CQ" a few times, followed by "this is," then your call sign a few times, then pause to listen, repeat as necessary

D. Transmit an unmodulated carrier for approximately 10 seconds, followed by “this is” and your call sign, and pause to listen -- repeat as necessary

~~

G2D06 (C)

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

- A. Toward the rising sun
- B. Along the gray line
- C. 180 degrees from the station’s short-path heading
- D. Toward the north

~~

G2D07 (D)

Which of the following are examples of the NATO Phonetic Alphabet?

- A. Able, Baker, Charlie, Dog
- B. Adam, Boy, Charles, David
- C. America, Boston, Canada, Denmark
- D. Alpha, Bravo, Charlie, Delta

~~

G2D08 (D)

Why do many amateurs keep a station log?

- A. The FCC requires a log of all international contacts
- B. The FCC requires a log of all international third-party traffic
- C. The log provides evidence of operation needed to renew a license without retest
- D. To help with a reply if the FCC requests information about your station

~~

G2D09 (C)

Which of the following is required when participating in a contest on HF frequencies?

- A. Submit a log to the contest sponsor
- B. Send a QSL card to the stations worked, or QSL via Logbook of The World
- C. Identify your station according to normal FCC regulations
- D. All these choices are correct

~~

G2D10 (B)

What is QRP operation?

- A. Remote piloted model control
- B. Low-power transmit operation
- C. Transmission using Quick Response Protocol
- D. Traffic relay procedure net operation

~~

G2D11 (A)

Why are signal reports typically exchanged at the beginning of an HF contact?

- A. To allow each station to operate according to conditions
- B. To be sure the contact will count for award programs

- C. To follow standard radiogram structure
- D. To allow each station to calibrate their frequency display

~~

G2E – Digital mode operating procedures

G2E01 (D)

Which mode is normally used when sending RTTY signals via AFSK with an SSB transmitter?

- A. USB
- B. DSB
- C. CW
- D. LSB

~~

G2E02 (B)

What is VARA?

- A. A low signal-to-noise digital mode used for EME (moonbounce)
- B. A digital protocol used with Winlink
- C. A radio direction finding system used on VHF and UHF
- D. A DX spotting system using a network of software defined radios

~~

G2E03 (D)

What symptoms may result from other signals interfering with a PACTOR or VARA transmission?

- A. Frequent retries or timeouts
- B. Long pauses in message transmission
- C. Failure to establish a connection between stations
- D. All these choices are correct

~~

G2E04 (D)

Which of the following is good practice when choosing a transmitting frequency to answer a station calling CQ using FT8?

- A. Always call on the station's frequency
- B. Call on any frequency in the waterfall except the station's frequency
- C. Find a clear frequency during the same time slot as the calling station
- D. Find a clear frequency during the alternate time slot to the calling station

~~

G2E05 (B)

What is the standard sideband for JT65, JT9, FT4, or FT8 digital signal when using AFSK?

- A. LSB
- B. USB
- C. DSB
- D. SSB

~~

G2E06 (B)

What is the most common frequency shift for RTTY emissions in the amateur HF bands?

- A. 85 Hz
- B. 170 Hz
- C. 425 Hz
- D. 850 Hz

~~

G2E07 (B)

Which of the following is required when using FT8?

- A. A special hardware modem
- B. Computer time accurate to within approximately 1 second
- C. Receiver attenuator set to -12 dB
- D. A vertically polarized antenna

~~

G2E08 (D)

In what segment of the 20-meter band are most digital mode operations commonly found?

- A. At the bottom of the slow-scan TV segment, near 14.230 MHz
- B. At the top of the SSB phone segment, near 14.325 MHz
- C. In the middle of the CW segment, near 14.100 MHz
- D. Between 14.070 MHz and 14.100 MHz

~~

G2E09 (C)

How do you join a contact between two stations using the PACTOR protocol?

- A. Send broadcast packets containing your call sign while in MONITOR mode
- B. Transmit a steady carrier until the PACTOR protocol times out and disconnects
- C. Joining an existing contact is not possible, PACTOR connections are limited to two stations
- D. Send a NAK code

~~

G2E10 (D)

Which of the following is a way to establish contact with a digital messaging system gateway station?

- A. Send an email to the system control operator
- B. Send QRL in Morse code
- C. Respond when the station broadcasts its SSID
- D. Transmit a connect message on the station's published frequency

~~

G2E11 (C)

What is the primary purpose of an Amateur Radio Emergency Data Network (AREDN) mesh network?

- A. To provide FM repeater coverage in remote areas
- B. To provide real time propagation data by monitoring amateur radio transmissions worldwide
- C. To provide high-speed data services during an emergency or community event
- D. To provide DX spotting reports to aid contesters and DXers

~~

G2E12 (D)

Which of the following describes Winlink?

- A. An amateur radio wireless network to send and receive email on the internet
- B. A form of Packet Radio
- C. A wireless network capable of both VHF and HF band operation
- D. All of the above

~~

G2E13 (B)

What is another name for a Winlink Remote Message Server?

- A. Terminal Node Controller
- B. Gateway
- C. RJ-45
- D. Printer/Server

~~

G2E14 (D)

What could be wrong if you cannot decode an RTTY or other FSK signal even though it is apparently tuned in properly?

- A. The mark and space frequencies may be reversed
- B. You may have selected the wrong baud rate
- C. You may be listening on the wrong sideband
- D. All these choices are correct

~~

G2E15 (C)

Which of the following is a common location for FT8?

- A. Anywhere in the voice portion of the band
- B. Anywhere in the CW portion of the band
- C. Approximately 14.074 MHz to 14.077 MHz
- D. Approximately 14.110 MHz to 14.113 MHz

~~

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

G3A – Sunspots and solar radiation; geomagnetic field and stability indices

G3A01 (A)

How does a higher sunspot number affect 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

~~

G3A02 (B)

What effect does a sudden ionospheric disturbance have on the daytime ionospheric propagation?

- 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

~~

G3A03 (C)

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

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

~~

G3A04 (D)

Which of the following are the least reliable bands 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 (D)

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 with a wavelength of 10.7 centimeters

~~

G3A06 (D)

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 geomagnetic force
- D. A temporary disturbance in Earth's geomagnetic field

~~

G3A07 (D)

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
- C. Only at the minimum point
- D. At any point

~~

G3A08 (D)

How can a geomagnetic storm affect HF propagation?

- A. Improve high-latitude HF propagation
- B. Degrade ground wave propagation
- C. Improve ground wave propagation
- D. Degrade high-latitude HF propagation

~~

G3A09 (A)

How can high geomagnetic activity benefit radio communications?

- A. Creates auroras that can reflect VHF signals
- B. Increases signal strength for HF signals passing through the polar regions
- C. Improve HF long path propagation
- D. Reduce long delayed echoes

~~

G3A10 (C)

What causes HF propagation conditions to vary periodically in a 26- to 28-day cycle?

- A. Long term oscillations in the upper atmosphere
- B. Cyclic variation in Earth's radiation belts
- C. Rotation of the Sun's surface layers around its axis
- D. The position of the Moon in its orbit

~~

G3A11 (D)

How long does it take a coronal mass ejection to affect radio propagation on Earth?

- A. 28 days
- B. 14 days
- C. 4 to 8 minutes
- D. 15 hours to several days

~~

G3A12 (B)

What does the K-index measure?

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

~~

G3A13 (C)

What does the A-index measure?

- 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

~~

G3A14 (B)

How is long distance radio communication usually affected by the charged particles that reach Earth from solar coronal holes?

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

~~

G3B – Maximum Usable Frequency; Lowest Usable Frequency; short path and long path propagation; determining propagation conditions; ionospheric refraction

G3B01 (D)

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

~~

G3B02 (D)

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

~~

G3B03 (A)

Which frequency will have the least attenuation for long-distance skip propagation?

- A. Just below the MUF
- B. Just above the LUF
- C. Just below the critical frequency
- D. Just above the critical frequency

~~

G3B04 (A)

Which of the following is a way to determine current propagation on a desired band from your station?

- A. Use a network of automated receiving stations on the internet to see where your transmissions are being received
- B. Check the A-index
- C. Send a series of dots and listen for echoes
- D. All these choices are correct

~~

G3B05 (A)

How does the ionosphere affect radio waves with frequencies below the MUF and above the LUF?

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

~~

G3B06 (C)

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

- A. They are refracted back to Earth
- B. They pass through the ionosphere
- C. They are attenuated before reaching the destination
- D. They are refracted and trapped in the ionosphere to circle Earth

~~

G3B07 (A)

What does LUF stand for?

- A. The Lowest Usable Frequency for communications between two specific points
- B. Lowest Usable Frequency for communications to any point outside a 100-mile radius
- C. The Lowest Usable Frequency during a 24-hour period
- D. Lowest Usable Frequency during the past 60 minutes

~~

G3B08 (B)

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

~~

G3B09 (C)

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

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

~~

G3B10 (B)

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

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

~~

G3B11 (A)

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

- A. Propagation via ordinary skywave communications is not possible over that 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

~~

G3B12 (D)

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

- A. Poor propagation at any time of day
- B. World-wide propagation during daylight hours
- C. Heavy distortion on signals due to photon absorption
- D. High levels of atmospheric noise or static

~~

G3C – Ionospheric regions; critical angle and frequency; HF scatter; near vertical incidence skywave (NVIS)

G3C01 (A)

Which ionospheric region is closest to the surface of Earth?

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

~~

G3C02 (A)

What is meant by the term “critical frequency” at a given incidence angle?

- A. The highest frequency which is refracted back to Earth
- B. The lowest frequency which is refracted back to Earth
- C. The frequency at which the signal-to-noise ratio approaches unity
- D. The frequency at which the signal-to-noise ratio is 6 dB

~~

G3C03 (C)

Why is skip propagation via the F2 region longer than that via the other ionospheric regions?

- A. Because it is the densest
- B. Because of the Doppler effect
- C. Because it is the highest
- D. Because of temperature inversions

~~

G3C04 (D)

What does the term “critical angle” mean, as applied to 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 (C)

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

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

~~

G3C06 (B)

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

~~

G3C07 (D)

What makes HF scatter signals often sound distorted?

- A. The ionospheric region 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 paths

~~

G3C08 (A)

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 via ground waves, which absorb most of the signal energy
- D. Propagation is via ducts in the F region, which absorb most of the energy

~~

G3C09 (B)

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

~~

G3C10 (B)

What is near vertical incidence skywave (NVIS) propagation?

- A. Propagation near the MUF

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

~~

G3C11 (D)

Which ionospheric region is the most absorbent of signals below 10 MHz during daylight hours?

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

~~

SUBELEMENT G4 – AMATEUR RADIO PRACTICES [5 Exam Questions – 5 groups]

G4A – Station configuration and operation

G4A01 (B)

What is the purpose of the notch filter found on many HF transceivers?

- A. To restrict the transmitter voice bandwidth
- B. To reduce interference from carriers in the receiver passband
- C. To eliminate receiver interference from impulse noise sources
- D. To remove interfering splatter generated by signals on adjacent frequencies

~~

G4A02 (C)

What is the benefit of using the opposite or “reverse” sideband when receiving CW?

- A. Interference from impulse noise will be eliminated
- B. More stations can be accommodated within a given signal passband
- C. It may be possible to reduce or eliminate interference from other signals
- D. Accidental out-of-band operation can be prevented

~~

G4A03 (C)

How does a noise blanker work?

- A. By temporarily increasing received bandwidth
- B. By redirecting noise pulses into a filter capacitor
- C. By reducing receiver gain during a noise pulse
- D. By clipping noise peaks

~~

G4A04 (B)

What is the effect on plate current of the correct setting of a vacuum-tube RF power amplifier’s TUNE control?

- A. A pronounced peak
- B. A pronounced dip
- C. No change will be observed
- D. A slow, rhythmic oscillation

~~

G4A05 (C)

Why is automatic level control (ALC) used with an RF power amplifier?

- A. To balance the transmitter audio frequency response
- B. To reduce harmonic radiation
- C. To prevent excessive drive
- D. To increase overall efficiency

~~

G4A06 (C)

What is the purpose of an antenna tuner?

- A. Reduce the SWR in the feed line to the antenna
- B. Reduce the power dissipation in the feedline to the antenna
- C. Increase power transfer from the transmitter to the feed line
- D. All these choices are correct

~~

G4A07 (A)

What happens as a receiver's noise reduction control level is increased?

- A. Received signals may become distorted
- B. Received frequency may become unstable
- C. CW signals may become severely attenuated
- D. Received frequency may shift several kHz

~~

G4A08 (D)

What is the correct adjustment for the LOAD or COUPLING control of a vacuum tube RF power amplifier?

- A. Minimum SWR on the antenna
- B. Minimum plate current without exceeding maximum allowable grid current
- C. Highest plate voltage while minimizing grid current
- D. Desired power output without exceeding maximum allowable plate current

~~

G4A09 (C)

What is the purpose of delaying RF output after activating a transmitter's keying line to an external amplifier?

- A. To prevent key clicks on CW
- B. To prevent transient overmodulation
- C. To allow time for the amplifier to switch the antenna between the transceiver and the amplifier output
- D. To allow time for the amplifier power supply to reach operating level

~~

G4A10 (B)

What is the function of an electronic keyer?

- A. Automatic transmit/receive switching
- B. Automatic generation of dots and dashes for CW operation
- C. To allow time for switching the antenna from the receiver to the transmitter
- D. Computer interface for PSK and RTTY operation

~~

G4A11 (B)

Why should the ALC system be inactive when transmitting AFSK data signals?

- A. ALC will invert the modulation of the AFSK mode
- B. The ALC action distorts the signal
- C. When using digital modes, too much ALC activity can cause the transmitter to overheat
- D. All these choices are correct

~~

G4A12 (C)

Which of the following is a common use of the dual-VFO feature on a transceiver?

- A. To allow transmitting on two frequencies at once
- B. To permit full duplex operation -- that is, transmitting and receiving at the same time
- C. To transmit on one frequency and listen on another
- D. To improve frequency accuracy by allowing variable frequency output (VFO) operation

~~

G4A13 (A)

What is the purpose of using a receive attenuator?

- A. To prevent receiver overload from strong incoming signals
- B. To reduce the transmitter power when driving a linear amplifier
- C. To reduce power consumption when operating from batteries
- D. To reduce excessive audio level on strong signals

~~

G4B – Tests and test equipment

G4B01 (D)

What item of test equipment contains horizontal and vertical channel amplifiers?

- A. An ohmmeter
- B. A signal generator
- C. An ammeter
- D. An oscilloscope

~~

G4B02 (D)

Which of the following is an advantage of an oscilloscope versus a digital voltmeter?

- A. An oscilloscope uses less power
- B. Complex impedances can be easily measured
- C. Greater precision
- D. Complex waveforms can be measured

~~

G4B03 (A)

Which of the following is the best instrument to use for checking the keying waveform of a CW transmitter?

- A. An oscilloscope

- B. A field strength meter
- C. A sidetone monitor
- D. A wavemeter

~~

G4B04 (D)

What signal source is connected to the vertical input of an oscilloscope when checking the RF envelope pattern of a transmitted signal?

- A. The local oscillator of the transmitter
- B. An external RF oscillator
- C. The transmitter balanced mixer output
- D. The attenuated RF output of the transmitter

~~

G4B05 (D)

Why do voltmeters have high input impedance?

- A. It improves the frequency response
- B. It allows for higher voltages to be safely measured
- C. It improves the resolution of the readings
- D. It decreases the loading on circuits being measured

~~

G4B06 (C)

What is an advantage of a digital multimeter as compared to an analog multimeter?

- A. Better for measuring computer circuits
- B. Less prone to overload
- C. Higher precision
- D. Faster response

~~

G4B07 (B)

What signals are used to conduct a two-tone test?

- A. Two audio signals of the same frequency shifted 90 degrees
- B. Two non-harmonically related audio signals
- C. Two swept frequency tones
- D. Two audio frequency range square wave signals of equal amplitude

~~

G4B08 (A)

What transmitter performance parameter does a two-tone test analyze?

- A. Linearity
- B. Percentage of suppression of the carrier and undesired sideband for SSB
- C. Percentage of frequency modulation
- D. Percentage of carrier phase shift

~~

G4B09 (D)

When is an analog multimeter preferred to a digital multimeter?

- A. When testing logic circuits
- B. When high precision is desired
- C. When measuring the frequency of an oscillator
- D. When adjusting circuits for maximum or minimum values

~~

G4B10 (A)

Which of the following can be determined with a directional wattmeter?

- A. Standing wave ratio
- B. Antenna front-to-back ratio
- C. RF interference
- D. Radio wave propagation

~~

G4B11 (C)

Which of the following must be connected to an antenna analyzer when it is being used for SWR measurements?

- A. Receiver
- B. Transmitter
- C. Antenna and feed line
- D. All these choices are correct

~~

G4B12 (B)

What effect can strong signals from nearby transmitters have on an antenna analyzer?

- A. Desensitization which can cause intermodulation products which interfere with impedance readings
- B. Received power that interferes with SWR readings
- C. Generation of harmonics which interfere with frequency readings
- D. All these choices are correct

~~

G4B13 (C)

Which of the following can be measured with an antenna analyzer?

- A. Front-to-back ratio of an antenna
- B. Power output from a transmitter
- C. Impedance of coaxial cable
- D. Gain of a directional antenna

~~

G4C – Interference to consumer electronics; grounding and bonding

G4C01 (B)

Which of the following might be useful in reducing RF interference to audio frequency circuits?

- A. Bypass inductor
- B. Bypass capacitor
- C. Forward-biased diode
- D. Reverse-biased diode

~~

G4C02 (C)

Which of the following could be a cause of interference covering a wide range of frequencies?

- A. Not using a balun or line isolator to feed balanced antennas
- B. Lack of rectification of the transmitter's signal in power conductors
- C. Arcing at a poor electrical connection
- D. Using a balun to feed an unbalanced antenna

~~

G4C03 (C)

What sound is heard from an audio device experiencing RF interference from a single sideband phone transmitter?

- A. A steady hum whenever the transmitter is on the air
- B. On-and-off humming or clicking
- C. Distorted speech
- D. Clearly audible speech

~~

G4C04 (A)

What sound is heard from an audio device experiencing RF interference from a CW transmitter?

- A. On-and-off humming or clicking
- B. A CW signal at a nearly pure audio frequency
- C. A chirpy CW signal
- D. Severely distorted audio

~~

G4C05 (D)

What is a possible cause of high voltages that produce RF burns?

- A. Flat braid rather than round wire has been used for the ground wire
- B. Insulated wire has been used for the ground wire
- C. The ground rod is resonant
- D. The ground wire has high impedance on that frequency

~~

G4C06 (C)

What is a possible effect of a resonant ground connection?

- A. Overheating of ground straps
- B. Corrosion of the ground rod
- C. High RF voltages on the enclosures of station equipment
- D. A ground loop

~~

G4C07 (A)

Why should soldered joints not be used in lightning protection ground connections?

- A. A soldered joint will likely be destroyed by the heat of a lightning strike
- B. Solder flux will prevent a low conductivity connection
- C. Solder has too high a dielectric constant to provide adequate lightning protection

D. All these choices are correct

~~

G4C08 (A)

Which of the following would reduce RF interference caused by common-mode current on an audio cable?

- A. Place a ferrite choke on the cable
- B. Connect the center conductor to the shield of all cables to short circuit the RFI signal
- C. Ground the center conductor of the audio cable causing the interference
- D. Add an additional insulating jacket to the cable

~~

G4C09 (D)

How can the effects of ground loops be minimized?

- A. Connect all ground conductors in series
- B. Connect the AC neutral conductor to the ground wire
- C. Avoid using lock washers and star washers when making ground connections
- D. Bond equipment enclosures together

~~

G4C10 (A)

What could be a symptom caused by a ground loop in your station's audio connections?

- A. You receive reports of "hum" on your station's transmitted signal
- B. The SWR reading for one or more antennas is suddenly very high
- C. An item of station equipment starts to draw excessive amounts of current
- D. You receive reports of harmonic interference from your station

~~

G4C11 (C)

What technique helps to minimize RF "hot spots" in an amateur station?

- A. Building all equipment in a metal enclosure
- B. Using surge suppressor power outlets
- C. Bonding all equipment enclosures together
- D. Placing low-pass filters on all feed lines

~~

G4C12 (D)

Why must all metal enclosures of station equipment be grounded?

- A. It prevents a blown fuse in the event of an internal short circuit
- B. It prevents signal overload
- C. It ensures that the neutral wire is grounded
- D. It ensures that hazardous voltages cannot appear on the chassis

~~

G4D – Speech processors; S meters; sideband operation near band edges

G4D01 (A)

What is the purpose of a speech processor in a transceiver?

- A. Increase the apparent loudness of transmitted voice signals
- B. Increase transmitter bass response for more natural-sounding SSB signals
- C. Prevent distortion of voice signals
- D. Decrease high-frequency voice output to prevent out-of-band operation

~~

G4D02 (B)

How does a speech processor affect a single sideband phone signal?

- A. It increases peak power
- B. It increases average power
- C. It reduces harmonic distortion
- D. It reduces intermodulation distortion

~~

G4D03 (D)

What is the effect of an incorrectly adjusted speech processor?

- A. Distorted speech
- B. Excess intermodulation products
- C. Excessive background noise
- D. All these choices are correct

~~

G4D04 (C)

What does an S meter measure?

- A. Carrier suppression
- B. Impedance
- C. Received signal strength
- D. Transmitter power output

~~

G4D05 (D)

How does a signal that reads 20 dB over S9 compare to one that reads S9 on a receiver, assuming a properly calibrated S meter?

- A. It is 10 times less powerful
- B. It is 20 times less powerful
- C. It is 20 times more powerful
- D. It is 100 times more powerful

~~

G4D06 (A)

How much change in signal strength is typically represented by one S unit?

- A. 6 dB
- B. 12 dB
- C. 15 dB
- D. 18 dB

~~

G4D07 (C)

How much must the power output of a transmitter be raised to change the S meter reading on a distant receiver from S8 to S9?

- A. Approximately 1.5 times
- B. Approximately 2 times
- C. Approximately 4 times
- D. Approximately 8 times

~~

G4D08 (C)

What frequency range is occupied by a 3 kHz LSB signal when the displayed carrier frequency is set to 7.178 MHz?

- A. 7.178 MHz to 7.181 MHz
- B. 7.178 MHz to 7.184 MHz
- C. 7.175 MHz to 7.178 MHz
- D. 7.1765 MHz to 7.1795 MHz

~~

G4D09 (B)

What frequency range is occupied by a 3 kHz USB signal with the displayed carrier frequency set to 14.347 MHz?

- A. 14.347 MHz to 14.647 MHz
- B. 14.347 MHz to 14.350 MHz
- C. 14.344 MHz to 14.347 MHz
- D. 14.3455 MHz to 14.3485 MHz

~~

G4D10 (A)

How close to the lower edge of a band's phone segment should your displayed carrier frequency be when using 3 kHz wide LSB?

- A. At least 3 kHz above the edge of the segment
- B. At least 3 kHz below the edge of the segment
- C. At least 1 kHz below the edge of the segment
- D. At least 1 kHz above the edge of the segment

~~

G4D11 (B)

How close to the upper edge of a band's phone segment should your displayed carrier frequency be when using 3 kHz wide USB?

- A. At least 3 kHz above the edge of the band
- B. At least 3 kHz below the edge of the band
- C. At least 1 kHz above the edge of the segment
- D. At least 1 kHz below the edge of the segment

~~

G4E – Mobile and portable HF stations; alternative energy source operation

G4E01 (C)

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

- A. To increase the power handling capacity of a whip antenna
- B. To reduce radiation resistance
- C. To electrically lengthen a physically short antenna
- D. To lower the radiation angle

~~

G4E02 (D)

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

- A. To narrow the operating bandwidth of the antenna
- B. To increase the "Q" of the antenna
- C. To reduce the chance of damage if the antenna should strike an object
- D. To reduce RF voltage discharge from the tip of the antenna while transmitting

~~

G4E03 (A)

Which of the following direct, fused power connections would be the best for a 100-watt HF mobile installation?

- A. To the battery using heavy-gauge wire
- B. To the alternator or generator using heavy-gauge wire
- C. To the battery using insulated heavy duty balanced transmission line
- D. To the alternator or generator using insulated heavy duty balanced transmission line

~~

G4E04 (B)

Why should DC power for a 100-watt HF transceiver not be supplied by a vehicle's auxiliary power socket?

- A. The socket is not wired with an RF-shielded power cable
- B. The socket's wiring may be inadequate for the current drawn by the transceiver
- C. The DC polarity of the socket is reversed from the polarity of modern HF transceivers
- D. Drawing more than 50 watts from this socket could cause the engine to overheat

~~

G4E05 (C)

Which of the following most limits an HF mobile installation?

- A. "Picket fencing"
- B. The wire gauge of the DC power line to the transceiver
- C. Efficiency of the electrically short antenna
- D. FCC rules limiting mobile output power on the 75-meter band

~~

G4E06 (C)

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

- A. Short antennas are more likely to cause distortion of transmitted signals
- B. Q of the antenna will be very low
- C. Operating bandwidth may be very limited
- D. Harmonic radiation may increase

~~

G4E07 (D)

Which of the following may cause receive interference to an HF transceiver installed in a vehicle?

- A. The battery charging system
- B. The fuel delivery system
- C. The control computers
- D. All these choices are correct

~~

G4E08 (A)

In what configuration are the individual cells in a solar panel connected together?

- A. Series-parallel
- B. Shunt
- C. Bypass
- D. Full-wave bridge

~~

G4E09 (B)

What is the approximate open-circuit voltage from a fully illuminated silicon photovoltaic cell?

- A. 0.02 VDC
- B. 0.5 VDC
- C. 0.2 VDC
- D. 1.38 VDC

~~

G4E10 (B)

Why should a series diode be connected between a solar panel and a storage battery that is being charged by the panel?

- A. To prevent overload by regulating the charging voltage
- B. To prevent discharge of the battery through the panel during times of low or no illumination
- C. To limit the current flowing from the panel to a safe value
- D. To prevent damage to the battery due to excessive voltage at high illumination levels

~~

G4E11 (D)

What precaution should be taken when connecting a solar panel to a lithium iron phosphate battery?

- A. Ground the solar panel outer metal framework
- B. Ensure the battery is placed terminals-up
- C. A series resistor must be in place
- D. The solar panel must have a charge controller

~~

SUBELEMENT G5 – ELECTRICAL PRINCIPLES [3 Exam Questions – 3 Groups]

G5A – Reactance; inductance; capacitance; impedance; impedance transformation; resonance

G5A01 (C)

What happens when inductive and capacitive reactance are equal in a series LC circuit?

- A. Resonance causes impedance to be very high
- B. Impedance is equal to the geometric mean of the inductance and capacitance

- C. Resonance causes impedance to be very low
- D. Impedance is equal to the arithmetic mean of the inductance and capacitance

~~

G5A02 (B)

What is reactance?

- A. Opposition to the flow of direct current caused by resistance
- B. Opposition to the flow of alternating current caused by capacitance or inductance
- C. Reinforcement of the flow of direct current caused by resistance
- D. Reinforcement of the flow of alternating current caused by capacitance or inductance

~~

G5A03 (D)

Which of the following is opposition to the flow of alternating current in an inductor?

- A. Conductance
- B. Reluctance
- C. Admittance
- D. Reactance

~~

G5A04 (C)

Which of the following is opposition to the flow of alternating current in a capacitor?

- A. Conductance
- B. Reluctance
- C. Reactance
- D. Admittance

~~

G5A05 (D)

How does an inductor react to AC?

- A. As the frequency of the applied AC increases, the reactance decreases
- B. As the amplitude of the applied AC increases, the reactance increases
- C. As the amplitude of the applied AC increases, the reactance decreases
- D. As the frequency of the applied AC increases, the reactance increases

~~

G5A06 (A)

How does a capacitor react to AC?

- A. As the frequency of the applied AC increases, the reactance decreases
- B. As the frequency of the applied AC increases, the reactance increases
- C. As the amplitude of the applied AC increases, the reactance increases
- D. As the amplitude of the applied AC increases, the reactance decreases

~~

G5A07 (D)

What is the term for the inverse of impedance?

- A. Conductance
- B. Susceptance

- C. Reluctance
- D. Admittance

~~

G5A08 (C)

What is impedance?

- A. The ratio of current to voltage
- B. The product of current and voltage
- C. The ratio of voltage to current
- D. The product of current and reactance

~~

G5A09 (B)

What unit is used to measure reactance?

- A. Farad
- B. Ohm
- C. Ampere
- D. Siemens

~~

G5A10 (D)

Which of the following devices can be used for impedance matching at radio frequencies?

- A. A transformer
- B. A Pi-network
- C. A length of transmission line
- D. All these choices are correct

~~

G5A11 (B)

What letter is used to represent reactance?

- A. Z
- B. X
- C. B
- D. Y

~~

G5A12 (D)

What occurs in an LC circuit at resonance?

- A. Current and voltage are equal
- B. Resistance is cancelled
- C. The circuit radiates all its energy in the form of radio waves
- D. Inductive reactance and capacitive reactance cancel

~~

G5B – The decibel; current and voltage dividers; electrical power calculations; sine wave root-mean-square (RMS) values; PEP calculations

G5B01 (B)

What dB change represents a factor of two increase or decrease in power?

- A. Approximately 2 dB
- B. Approximately 3 dB
- C. Approximately 6 dB
- D. Approximately 9 dB

~~

G5B02 (C)

How does the total current relate to the individual currents in a circuit of parallel resistors?

- A. It equals the average of the branch currents
- B. It decreases as more parallel branches are added to the circuit
- C. It equals the sum of the currents through each branch
- D. It is the sum of the reciprocal of each individual voltage drop

~~

G5B03 (B)

How many watts of electrical power are consumed if 400 VDC is supplied to an 800-ohm load?

- A. 0.5 watts
- B. 200 watts
- C. 400 watts
- D. 3200 watts

~~

G5B04 (A)

How many watts of electrical power are consumed by a 12 VDC light bulb that draws 0.2 amperes?

- A. 2.4 watts
- B. 24 watts
- C. 6 watts
- D. 60 watts

~~

G5B05 (A)

How many watts are consumed when a current of 7.0 milliamperes flows through a 1,250-ohm resistance?

- A. Approximately 61 milliwatts
- B. Approximately 61 watts
- C. Approximately 11 milliwatts
- D. Approximately 11 watts

~~

G5B06 (B)

What is the PEP produced by 200 volts peak-to-peak across a 50-ohm dummy load?

- A. 1.4 watts
- B. 100 watts
- C. 353.5 watts
- D. 400 watts

~~

G5B07 (C)

What value of an AC signal produces the same power dissipation in a resistor as a DC voltage of the same value?

- A. The peak-to-peak value
- B. The peak value
- C. The RMS value
- D. The reciprocal of the RMS value

~~

G5B08 (D)

What is the peak-to-peak voltage of a sine wave with an RMS voltage of 120 volts?

- A. 84.8 volts
- B. 169.7 volts
- C. 240.0 volts
- D. 339.4 volts

~~

G5B09 (B)

What is the RMS voltage of a sine wave with a value of 17 volts peak?

- A. 8.5 volts
- B. 12 volts
- C. 24 volts
- D. 34 volts

~~

G5B10 (C)

What percentage of power loss is equivalent to a loss of 1 dB?

- A. 10.9 percent
- B. 12.2 percent
- C. 20.6 percent
- D. 25.9 percent

~~

G5B11 (B)

What is the ratio of PEP to average power for an unmodulated carrier?

- A. 0.707
- B. 1.00
- C. 1.414
- D. 2.00

~~

G5B12 (B)

What is the RMS voltage across a 50-ohm dummy load dissipating 1200 watts?

- A. 173 volts
- B. 245 volts
- C. 346 volts
- D. 692 volts

~~

G5B13 (B)

What is the output PEP of an unmodulated carrier if the average power is 1060 watts?

- A. 530 watts
- B. 1060 watts
- C. 1500 watts
- D. 2120 watts

~~

G5B14 (B)

What is the output PEP of 500 volts peak-to-peak across a 50-ohm load?

- A. 8.75 watts
- B. 625 watts
- C. 2500 watts
- D. 5000 watts

~~

G5C – Resistors, capacitors, and inductors in series and parallel; transformers

G5C01 (C)

What causes a voltage to appear across the secondary winding of a transformer when an AC voltage source is connected across its primary winding?

- A. Capacitive coupling
- B. Displacement current coupling
- C. Mutual inductance
- D. Mutual capacitance

~~

G5C02 (A)

What is the output voltage if an input signal is applied to the secondary winding of a 4:1 voltage step-down transformer instead of the primary winding?

- A. The input voltage is multiplied by 4
- B. The input voltage is divided by 4
- C. Additional resistance must be added in series with the primary to prevent overload
- D. Additional resistance must be added in parallel with the secondary to prevent overload

~~

G5C03 (A)

What is the total resistance of a 10-, a 20-, and a 50-ohm resistor connected in parallel?

- A. 5.9 ohms
- B. 0.17 ohms
- C. 17 ohms
- D. 80 ohms

~~

G5C04 (D)

What is the approximate total resistance of a 100- and a 200-ohm resistor in parallel?

- A. 300 ohms

- B. 150 ohms
- C. 75 ohms
- D. 67 ohms

~~

G5C05 (B)

Why is the primary winding wire of a voltage step-up transformer usually a larger size than that of the secondary winding?

- A. To improve the coupling between the primary and secondary
- B. To accommodate the higher current of the primary
- C. To prevent parasitic oscillations due to resistive losses in the primary
- D. To ensure that the volume of the primary winding is equal to the volume of the secondary winding

~~

G5C06 (A)

What is the voltage output of a transformer with a 500-turn primary and a 1500-turn secondary when 120 VAC is applied to the primary?

- A. 360 volts
- B. 120 volts
- C. 40 volts
- D. 25.5 volts

~~

G5C07 (A)

What transformer turns ratio matches an antenna's 600-ohm feed point impedance to a 50-ohm coaxial cable?

- A. 3.5 to 1
- B. 12 to 1
- C. 24 to 1
- D. 144 to 1

~~

G5C08 (D)

What is the equivalent capacitance of two 5.0-nanofarad capacitors and one 750-picofarad capacitor connected in parallel?

- A. 576.9 nanofarads
- B. 1,733 picofarads
- C. 3,583 picofarads
- D. 10.750 nanofarads

~~

G5C09 (C)

What is the capacitance of three 100-microfarad capacitors connected in series?

- A. 0.33 microfarads
- B. 3.0 microfarads
- C. 33.3 microfarads
- D. 300 microfarads

~~

G5C10 (C)

What is the inductance of three 10-millihenry inductors connected in parallel?

- A. 0.30 henries
- B. 3.3 henries
- C. 3.3 millihenries
- D. 30 millihenries

~~

G5C11 (C)

What is the inductance of a circuit with a 20-millihenry inductor connected in series with a 50-millihenry inductor?

- A. 7 millihenries
- B. 14.3 millihenries
- C. 70 millihenries
- D. 1,000 millihenries

~~

G5C12 (B)

What is the capacitance of a 20-microfarad capacitor connected in series with a 50-microfarad capacitor?

- A. 0.07 microfarads
- B. 14.3 microfarads
- C. 70 microfarads
- D. 1,000 microfarads

~~

G5C13 (C)

Which of the following components should be added to a capacitor to increase the capacitance?

- A. An inductor in series
- B. An inductor in parallel
- C. A capacitor in parallel
- D. A capacitor in series

~~

G5C14 (D)

Which of the following components should be added to an inductor to increase the inductance?

- A. A capacitor in series
- B. A capacitor in parallel
- C. An inductor in parallel
- D. An inductor in series

~~

SUBELEMENT G6 – CIRCUIT COMPONENTS [2 Exam Questions – 2 Groups]

G6A – Resistors; capacitors; inductors; rectifiers; solid-state diodes and transistors; vacuum tubes; batteries

G6A01 (C)

What is the minimum allowable discharge voltage for maximum life of a standard 12-volt lead-acid battery?

- A. 6 volts
- B. 8.5 volts
- C. 10.5 volts
- D. 12 volts

~~

G6A02 (B)

What is an advantage of batteries with low internal resistance?

- A. Long life
- B. High discharge current
- C. High voltage
- D. Rapid recharge

~~

G6A03 (B)

What is the approximate forward threshold voltage of a germanium diode?

- A. 0.1 volt
- B. 0.3 volts
- C. 0.7 volts
- D. 1.0 volts

~~

G6A04 (C)

Which of the following is characteristic of an electrolytic capacitor?

- A. Tight tolerance
- B. Much less leakage than any other type
- C. High capacitance for a given volume
- D. Inexpensive RF capacitor

~~

G6A05 (C)

What is the approximate forward threshold voltage of a silicon junction diode?

- A. 0.1 volt
- B. 0.3 volts
- C. 0.7 volts
- D. 1.0 volts

~~

G6A06 (B)

Why should wire-wound resistors not be used in RF circuits?

- A. The resistor's tolerance value would not be adequate
- B. The resistor's inductance could make circuit performance unpredictable
- C. The resistor could overheat
- D. The resistor's internal capacitance would detune the circuit

~~

G6A07 (A)

What are the operating points for a bipolar transistor used as a switch?

- A. Saturation and cutoff
- B. The active region (between cutoff and saturation)
- C. Peak and valley current points
- D. Enhancement and depletion modes

~~

G6A08 (D)

Which of the following is characteristic of low voltage ceramic capacitors?

- A. Tight tolerance
- B. High stability
- C. High capacitance for given volume
- D. Comparatively low cost

~~

G6A09 (B)

Which of the following describes MOSFET construction?

- A. The gate is formed by a back-biased junction
- B. The gate is separated from the channel by a thin insulating layer
- C. The source is separated from the drain by a thin insulating layer
- D. The source is formed by depositing metal on silicon

~~

G6A10 (A)

Which element of a vacuum tube regulates the flow of electrons between cathode and plate?

- A. Control grid
- B. Suppressor grid
- C. Screen grid
- D. Trigger electrode

~~

G6A11 (C)

What happens when an inductor is operated above its self-resonant frequency?

- A. Its reactance increases
- B. Harmonics are generated
- C. It becomes capacitive
- D. Catastrophic failure is likely

~~

G6A12 (A)

What is the primary purpose of a screen grid in a vacuum tube?

- A. To reduce grid-to-plate capacitance
- B. To increase efficiency
- C. To increase the control grid resistance
- D. To decrease plate resistance

~~

G6B – Analog and digital integrated circuits (ICs); microwave ICs (MMICs); display devices; RF connectors; ferrite cores

G6B01 (C)

What determines the performance of a ferrite core at different frequencies?

- A. Its conductivity
- B. Its thickness
- C. The composition, or “mix,” of materials used
- D. The ratio of outer diameter to inner diameter

~~

G6B02 (B)

What is meant by the term MMIC?

- A. Multi-Mode Integrated Circuit
- B. Monolithic Microwave Integrated Circuit
- C. Metal Monolayer Integrated Circuit
- D. Mode Modulated Integrated Circuit

~~

G6B03 (A)

Which of the following is an advantage of CMOS integrated circuits compared to TTL integrated circuits?

- A. Low power consumption
- B. High power handling capability
- C. Better suited for RF amplification
- D. Better suited for power supply regulation

~~

G6B04 (C)

What is a typical upper frequency limit for low SWR operation of 50-ohm BNC connectors?

- A. 50 MHz
- B. 500 MHz
- C. 4 GHz
- D. 40 GHz

~~

G6B05 (D)

What is an advantage of using a ferrite core toroidal inductor?

- A. Large values of inductance may be obtained
- B. The magnetic properties of the core may be optimized for a specific range of frequencies
- C. Most of the magnetic field is contained in the core
- D. All these choices are correct

~~

G6B06 (D)

What kind of device is an integrated circuit operational amplifier?

- A. Digital
- B. MMIC
- C. Programmable Logic

D. Analog

~~

G6B07 (A)

Which of the following describes a type N connector?

- A. A moisture-resistant RF connector useful to 10 GHz
- B. A small bayonet connector used for data circuits
- C. A low noise figure VHF connector
- D. A nickel plated version of the PL-259

~~

G6B08 (D)

How is an LED biased when emitting light?

- A. In the tunnel-effect region
- B. At the Zener voltage
- C. Reverse biased
- D. Forward biased

~~

G6B09 Question Removed (section not renumbered)

G6B10 (A)

How does a ferrite bead or core reduce common-mode RF current on the shield of a coaxial cable?

- A. By creating an impedance in the current's path
- B. It converts common-mode current to differential mode current
- C. By creating an out-of-phase current to cancel the common-mode current
- D. Ferrites expel magnetic fields

~~

G6B11 (B)

What is an SMA connector?

- A. A type-S to type-M adaptor
- B. A small threaded connector suitable for signals up to several GHz
- C. A connector designed for serial multiple access signals
- D. A type of push-on connector intended for high-voltage applications

~~

G6B12 (C)

Which of these connector types is commonly used for low frequency or dc signal connections to a transceiver?

- A. PL-259
- B. BNC
- C. RCA Phono
- D. Type N

~~

SUBELEMENT G7 – PRACTICAL CIRCUITS [3 Exam Questions – 3 Groups]

G7A – Power supplies; schematic symbols

G7A01 (B)

What is the function of a power supply bleeder resistor?

- A. It acts as a fuse for excess voltage
- B. It discharges the filter capacitors when power is removed
- C. It removes shock hazards from the induction coils
- D. It eliminates ground loop current

~~

G7A02 (C)

Which of the following components are used in a power supply filter network?

- A. Diodes
- B. Transformers and transducers
- C. Capacitors and inductors
- D. All these choices are correct

~~

G7A03 (A)

Which type of rectifier circuit uses two diodes and a center-tapped transformer?

- A. Full-wave
- B. Full-wave bridge
- C. Half-wave
- D. Synchronous

~~

G7A04 (A)

What is characteristic of a half-wave rectifier in a power supply?

- A. Only one diode is required
- B. The ripple frequency is twice that of a full-wave rectifier
- C. More current can be drawn from the half-wave rectifier
- D. The output voltage is two times the peak input voltage

~~

G7A05 (B)

What portion of the AC cycle is converted to DC by a half-wave rectifier?

- A. 90 degrees
- B. 180 degrees
- C. 270 degrees
- D. 360 degrees

~~

G7A06 (D)

What portion of the AC cycle is converted to DC by a full-wave rectifier?

- A. 90 degrees
- B. 180 degrees
- C. 270 degrees

D. 360 degrees

~~

G7A07 (A)

What is the output waveform of an unfiltered full-wave rectifier connected to a resistive load?

- A. A series of DC pulses at twice the frequency of the AC input
- B. A series of DC pulses at the same frequency as the AC input
- C. A sine wave at half the frequency of the AC input
- D. A steady DC voltage

~~

G7A08 (C)

Which of the following is characteristic of a switchmode power supply as compared to a linear power supply?

- A. Faster switching time makes higher output voltage possible
- B. Fewer circuit components are required
- C. High-frequency operation allows the use of smaller components
- D. Inherently more stable

~~

G7A09 (C)

Which symbol in figure G7-1 represents a field effect transistor?

- A. Symbol 2
- B. Symbol 5
- C. Symbol 1
- D. Symbol 4

~~

G7A10 (D)

Which symbol in figure G7-1 represents a Zener diode?

- A. Symbol 4
- B. Symbol 1
- C. Symbol 11
- D. Symbol 5

~~

G7A11 (B)

Which symbol in figure G7-1 represents an NPN junction transistor?

- A. Symbol 1
- B. Symbol 2
- C. Symbol 7
- D. Symbol 11

~~

G7A12 (C)

Which symbol in Figure G7-1 represents a solid core transformer?

- A. Symbol 4
- B. Symbol 7
- C. Symbol 6

D. Symbol 1

~~

G7A13 (A)

Which symbol in Figure G7-1 represents a tapped inductor?

- A. Symbol 7
- B. Symbol 11
- C. Symbol 6
- D. Symbol 1

~~

G7B – Digital circuits; amplifiers and oscillators

G7B01 (B)

What is the purpose of neutralizing an amplifier?

- A. To limit the modulation index
- B. To eliminate self-oscillations
- C. To cut off the final amplifier during standby periods
- D. To keep the carrier on frequency

~~

G7B02 (D)

Which of these classes of amplifiers has the highest efficiency?

- A. Class A
- B. Class B
- C. Class AB
- D. Class C

~~

G7B03 (B)

Which of the following describes the function of a two-input AND gate?

- A. Output is high when either or both inputs are low
- B. Output is high only when both inputs are high
- C. Output is low when either or both inputs are high
- D. Output is low only when both inputs are high

~~

G7B04 (A)

In a Class A amplifier, what percentage of the time does the amplifying device conduct?

- A. 100%
- B. More than 50% but less than 100%
- C. 50%
- D. Less than 50%

~~

G7B05 (C)

How many states does a 3-bit binary counter have?

- A. 3
- B. 6
- C. 8
- D. 16

~~

G7B06 (A)

What is a shift register?

- A. A clocked array of circuits that passes data in steps along the array
- B. An array of operational amplifiers used for tri-state arithmetic operations
- C. A digital mixer
- D. An analog mixer

~~

G7B07 (D)

Which of the following are basic components of a sine wave oscillator?

- A. An amplifier and a divider
- B. A frequency multiplier and a mixer
- C. A circulator and a filter operating in a feed-forward loop
- D. A filter and an amplifier operating in a feedback loop

~~

G7B08 (B)

How is the efficiency of an RF power amplifier determined?

- A. Divide the DC input power by the DC output power
- B. Divide the RF output power by the DC input power
- C. Multiply the RF input power by the reciprocal of the RF output power
- D. Add the RF input power to the DC output power

~~

G7B09 (C)

What determines the frequency of an LC oscillator?

- A. The number of stages in the counter
- B. The number of stages in the divider
- C. The inductance and capacitance in the tank circuit
- D. The time delay of the lag circuit

~~

G7B10 (B)

Which of the following describes a linear amplifier?

- A. Any RF power amplifier used in conjunction with an amateur transceiver
- B. An amplifier in which the output preserves the input waveform
- C. A Class C high efficiency amplifier
- D. An amplifier used as a frequency multiplier

~~

G7B11 (B)

For which of the following modes is a Class C power stage appropriate for amplifying a modulated signal?

- A. SSB
- B. FM
- C. AM
- D. All these choices are correct

~~

G7C – Transceiver design; filters; oscillators; digital signal processing (DSP)

G7C01 (B)

What circuit is used to select one of the sidebands from a balanced modulator?

- A. Carrier oscillator
- B. Filter
- C. IF amplifier
- D. RF amplifier

~~

G7C02 (D)

What output is produced by a balanced modulator?

- A. Frequency modulated RF
- B. Audio with equalized frequency response
- C. Audio extracted from the modulation signal
- D. Double-sideband modulated RF

~~

G7C03 (B)

What is one reason to use an impedance matching transformer at a transmitter output?

- A. To minimize transmitter power output
- B. To present the desired impedance to the transmitter and feed line
- C. To reduce power supply ripple
- D. To minimize radiation resistance

~~

G7C04 (D)

How is a product detector used?

- A. Used in test gear to detect spurious mixing products
- B. Used in transmitter to perform frequency multiplication
- C. Used in an FM receiver to filter out unwanted sidebands
- D. Used in a single sideband receiver to extract the modulated signal

~~

G7C05 (D)

Which of the following is characteristic of a direct digital synthesizer (DDS)?

- A. Extremely narrow tuning range
- B. Relatively high-power output
- C. Pure sine wave output
- D. Variable output frequency with the stability of a crystal oscillator

~~

G7C06 (A)

Which of the following is an advantage of a digital signal processing (DSP) filter compared to an analog filter?

- A. A wide range of filter bandwidths and shapes can be created
- B. Fewer digital components are required
- C. Mixing products are greatly reduced
- D. The DSP filter is much more effective at VHF frequencies

~~

G7C07 (A)

What term specifies a filter's attenuation inside its passband?

- A. Insertion loss
- B. Return loss
- C. Q
- D. Ultimate rejection

~~

G7C08 (D)

Which parameter affects receiver sensitivity?

- A. Input amplifier gain
- B. Demodulator stage bandwidth
- C. Input amplifier noise figure
- D. All these choices are correct

~~

G7C09 (B)

What is the phase difference between the I and Q RF signals that software-defined radio (SDR) equipment uses for modulation and demodulation?

- A. Zero
- B. 90 degrees
- C. 180 degrees
- D. 45 degrees

~~

G7C10 (B)

What is an advantage of using I-Q modulation with software-defined radios (SDRs)?

- A. The need for high resolution analog-to-digital converters is eliminated
- B. All types of modulation can be created with appropriate processing
- C. Minimum detectable signal level is reduced
- D. Automatic conversion of the signal from digital to analog

~~

G7C11 (D)

Which of these functions is performed by software in a software-defined radio (SDR)?

- A. Filtering
- B. Detection
- C. Modulation
- D. All these choices are correct

~~

G7C12 (C)

What is the frequency above which a low-pass filter's output power is less than half the input power?

- A. Notch frequency
- B. Neper frequency
- C. Cutoff frequency
- D. Rolloff frequency

~~

G7C13 (D)

What term specifies a filter's maximum ability to reject signals outside its passband?

- A. Notch depth
- B. Rolloff
- C. Insertion loss
- D. Ultimate rejection

~~

G7C14 (A)

The bandwidth of a band-pass filter is measured between what two frequencies?

- A. Upper and lower half-power
- B. Cutoff and rolloff
- C. Pole and zero
- D. Image and harmonic

~~

SUBELEMENT G8 – SIGNALS AND EMISSIONS [3 Exam Questions – 3 Groups]

G8A – Carriers and modulation: AM, FM, and single sideband; modulation envelope; digital modulation; overmodulation; link budgets and link margins

G8A01 (B)

How is direct binary FSK modulation generated?

- A. By keying an FM transmitter with a sub-audible tone
- B. By changing an oscillator's frequency directly with a digital control signal
- C. By using a transceiver's computer data interface protocol to change frequencies
- D. By reconfiguring the CW keying input to act as a tone generator

~~

G8A02 (B)

What is the name of the process that changes the phase angle of an RF signal to convey information?

- A. Phase convolution
- B. Phase modulation
- C. Phase transformation
- D. Phase inversion

~~

G8A03 (D)

What is the name of the process that changes the instantaneous frequency of an RF wave to convey information?

- A. Frequency convolution
- B. Frequency transformation
- C. Frequency conversion
- D. Frequency modulation

~~

G8A04 (B)

What emission is produced by a reactance modulator connected to a transmitter RF amplifier stage?

- A. Multiplex modulation
- B. Phase modulation
- C. Amplitude modulation
- D. Pulse modulation

~~

G8A05 (D)

What type of modulation varies the instantaneous power level of the RF signal?

- A. Power modulation
- B. Phase modulation
- C. Frequency modulation
- D. Amplitude modulation

~~

G8A06 (D)

Which of the following is characteristic of QPSK31?

- A. It is sideband sensitive
- B. Its encoding provides error correction
- C. Its bandwidth is approximately the same as BPSK31
- D. All these choices are correct

~~

G8A07 (A)

Which of the following phone emissions uses the narrowest bandwidth?

- A. Single sideband
- B. Vestigial sideband
- C. Phase modulation
- D. Frequency modulation

~~

G8A08 (D)

Which of the following is an effect of overmodulation?

- A. Insufficient audio
- B. Insufficient bandwidth
- C. Frequency drift
- D. Excessive bandwidth

~~

G8A09 (A)

What type of modulation is used by FT8?

- A. 8-tone frequency shift keying
- B. Vestigial sideband
- C. Amplitude compressed AM
- D. 8-bit direct sequence spread spectrum

~~

G8A10 (C)

What is meant by the term "flat-topping," when referring to an amplitude-modulated phone signal?

- A. Signal distortion caused by insufficient collector current
- B. The transmitter's automatic level control (ALC) is properly adjusted
- C. Signal distortion caused by excessive drive or speech levels
- D. The transmitter's carrier is properly suppressed

~~

G8A11 (A)

What is the modulation envelope of an AM signal?

- A. The waveform created by connecting the peak values of the modulated signal
- B. The carrier frequency that contains the signal
- C. Spurious signals that envelop nearby frequencies
- D. The bandwidth of the modulated signal

~~

G8A12 (D)

What is QPSK modulation?

- A. Modulation using quasi-parallel to serial conversion to reduce bandwidth
- B. Modulation using quadra-pole sideband keying to generate spread spectrum signals
- C. Modulation using Fast Fourier Transforms to generate frequencies at the first, second, third, and fourth harmonics of the carrier frequency to improve noise immunity
- D. Modulation in which digital data is transmitted using 0-, 90-, 180- and 270-degrees phase shift to represent pairs of bits

~~

G8A13 (C)

What is a link budget?

- A. The financial costs associated with operating a radio link
- B. The sum of antenna gains minus system losses
- C. The sum of transmit power and antenna gains minus system losses as seen at the receiver
- D. The difference between transmit power and receiver sensitivity

~~

G8A14 (B)

What is link margin?

- A. The opposite of fade margin
- B. The difference between received power level and minimum required signal level at the input to the receiver
- C. Transmit power minus receiver sensitivity

D. Receiver sensitivity plus 3 dB

~~

G8B – Frequency changing; bandwidths of various modes; deviation; intermodulation

G8B01 (B)

Which mixer input is varied or tuned to convert signals of different frequencies to an intermediate frequency (IF)?

- A. Image frequency
- B. Local oscillator
- C. RF input
- D. Beat frequency oscillator

~~

G8B02 (B)

What is the term for interference from a signal at twice the IF frequency from the desired signal?

- A. Quadrature response
- B. Image response
- C. Mixer interference
- D. Intermediate interference

~~

G8B03 (A)

What is another term for the mixing of two RF signals?

- A. Heterodyning
- B. Synthesizing
- C. Frequency inversion
- D. Phase inversion

~~

G8B04 (D)

What is the stage in a VHF FM transmitter that generates a harmonic of a lower frequency signal to reach the desired operating frequency?

- A. Mixer
- B. Reactance modulator
- C. Balanced converter
- D. Multiplier

~~

G8B05 (C)

Which intermodulation products are closest to the original signal frequencies?

- A. Second harmonics
- B. Even-order
- C. Odd-order
- D. Intercept point

~~

G8B06 (D)

What is the total bandwidth of an FM phone transmission having 5 kHz deviation and 3 kHz modulating frequency?

- A. 3 kHz
- B. 5 kHz
- C. 8 kHz
- D. 16 kHz

~~

G8B07 (B)

What is the frequency deviation for a 12.21 MHz reactance modulated oscillator in a 5 kHz deviation, 146.52 MHz FM phone transmitter?

- A. 101.75 Hz
- B. 416.7 Hz
- C. 5 kHz
- D. 60 kHz

~~

G8B08 (B)

Why is it important to know the duty cycle of the mode you are using when transmitting?

- A. To aid in tuning your transmitter
- B. Some modes have high duty cycles that could exceed the transmitter's average power rating
- C. To allow time for the other station to break in during a transmission
- D. To prevent overmodulation

~~

G8B09 (D)

Why is it good to match receiver bandwidth to the bandwidth of the operating mode?

- A. It is required by FCC rules
- B. It minimizes power consumption in the receiver
- C. It improves impedance matching of the antenna
- D. It results in the best signal-to-noise ratio

~~

G8B10 (B)

What is the relationship between transmitted symbol rate and bandwidth?

- A. Symbol rate and bandwidth are not related
- B. Higher symbol rates require wider bandwidth
- C. Lower symbol rates require wider bandwidth
- D. Bandwidth is half the symbol rate

~~

G8B11 (C)

What combination of a mixer's Local Oscillator (LO) and RF input frequencies is found in the output?

- A. The ratio
- B. The average
- C. The sum and difference
- D. The arithmetic product

~~

G8B12 (A)

What process combines two signals in a non-linear circuit to produce unwanted spurious outputs?

- A. Intermodulation
- B. Heterodyning
- C. Detection
- D. Rolloff

~~

G8B13 (C)

Which of the following is an odd-order intermodulation product of frequencies F1 and F2?

- A. $5F1-3F2$
- B. $3F1-F2$
- C. $2F1-F2$
- D. All these choices are correct

~~

G8C – Digital emission modes

G8C01 (C)

On what band do amateurs share channels with the unlicensed Wi-Fi service?

- A. 432 MHz
- B. 902 MHz
- C. 2.4 GHz
- D. 10.7 GHz

~~

G8C02 (A)

Which digital mode is used as a low-power beacon for assessing HF propagation?

- A. WSPR
- B. MFSK16
- C. PSK31
- D. SSB-SC

~~

G8C03 (C)

What part of a packet radio frame contains the routing and handling information?

- A. Directory
- B. Preamble
- C. Header
- D. Trailer

~~

G8C04 (C)

Which of the following describes Baudot code?

- A. A 7-bit code with start, stop, and parity bits

- B. A code using error detection and correction
- C. A 5-bit code with additional start and stop bits
- D. A code using SELCAL and LISTEN

~~

G8C05 (A)

In an ARQ mode, what is meant by a NAK response to a transmitted packet?

- A. Request retransmission of the packet
- B. Packet was received without error
- C. Receiving station connected and ready for transmissions
- D. Entire file received correctly

~~

G8C06 (B)

What action results from a failure to exchange information due to excessive transmission attempts when using an ARQ mode?

- A. The checksum overflows
- B. The connection is dropped
- C. Packets will be routed incorrectly
- D. Encoding reverts to the default character set

~~

G8C07 (B)

Which of the following narrow-band digital modes can receive signals with very low signal-to-noise ratios?

- A. MSK144
- B. FT8
- C. AMTOR
- D. MFSK32

~~

G8C08 (B)

Which of the following statements is true about PSK31?

- A. Upper case letters are sent with more power
- B. Upper case letters use longer Varicode bit sequences and thus slow down transmission
- C. Error correction is used to ensure accurate message reception
- D. Higher power is needed as compared to RTTY for similar error rates

~~

G8C09 (B)

Which is true of mesh network microwave nodes?

- A. Having more nodes increases signal strengths
- B. If one node fails, a packet may still reach its target station via an alternate node
- C. Links between two nodes in a network may have different frequencies and bandwidths
- D. More nodes reduce overall microwave out of band interference

~~

G8C10 (C)

How does forward error correction (FEC) allow the receiver to correct data errors?

- A. By controlling transmitter output power for optimum signal strength
- B. By using the Varicode character set
- C. By transmitting redundant information with the data
- D. By using a parity bit with each character

~~

G8C11 (D)

How are the two separate frequencies of a Frequency Shift Keyed (FSK) signal identified?

- A. Dot and dash
- B. On and off
- C. High and low
- D. Mark and space

~~

G8C12 (A)

Which type of code is used for sending characters in a PSK31 signal?

- A. Varicode
- B. Viterbi
- C. Volumetric
- D. Binary

~~

G8C13 (D)

What is indicated on a waterfall display by one or more vertical lines on either side of a data mode or RTTY signal?

- A. Long path propagation
- B. Backscatter propagation
- C. Insufficient modulation
- D. Overmodulation

~~

G8C14 (C)

Which of the following describes a waterfall display?

- A. Frequency is horizontal, signal strength is vertical, time is intensity
- B. Frequency is vertical, signal strength is intensity, time is horizontal
- C. Frequency is horizontal, signal strength is intensity, time is vertical
- D. Frequency is vertical, signal strength is horizontal, time is intensity

~~

G8C15 (C)

What does an FT8 signal report of +3 mean?

- A. The signal is 3 times the noise level of an equivalent SSB signal
- B. The signal is S3 (weak signals)
- C. The signal-to-noise ratio is equivalent to +3dB in a 2.5 kHz bandwidth
- D. The signal is 3 dB over S9

~~

G8C16 (D)

Which of the following provide digital voice modes?

- A. WSPR, MFSK16, and EasyPAL
- B. FT8, FT4, and FST4
- C. Winlink, PACTOR II, and PACTOR III
- D. DMR, D-STAR, and SystemFusion

~~

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

G9A – Feed lines: characteristic impedance and attenuation; standing wave ratio (SWR) calculation, measurement, and effects; antenna feed point matching

G9A01 (A)

Which of the following factors determine the characteristic impedance of a parallel conductor 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

~~

G9A02 (B)

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

- A. There is no relationship between transmission line loss and SWR
- B. High SWR increases loss in a lossy transmission line
- C. High SWR makes it difficult to measure transmission line loss
- D. High SWR reduces the relative effect of transmission line loss

~~

G9A03 (D)

What is the nominal characteristic impedance of “window line” transmission line?

- A. 50 ohms
- B. 75 ohms
- C. 100 ohms
- D. 450 ohms

~~

G9A04 (C)

What causes reflected power at an antenna’s feed point?

- 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

~~

G9A05 (B)

How does the attenuation of coaxial cable change with increasing frequency?

- A. Attenuation is independent of frequency

- B. Attenuation increases
- C. Attenuation decreases
- D. Attenuation follows Marconi's Law of Attenuation

~~

G9A06 (D)

In what units is RF feed line loss usually expressed?

- A. Ohms per 1,000 feet
- B. Decibels per 1,000 feet
- C. Ohms per 100 feet
- D. Decibels per 100 feet

~~

G9A07 (D)

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

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

~~

G9A08 (B)

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

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

~~

G9A09 (A)

What standing wave ratio results from connecting a 50-ohm feed line to a 200-ohm resistive load?

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

~~

G9A10 (D)

What standing wave ratio results from connecting a 50-ohm feed line to a 10-ohm resistive load?

- A. 2:1
- B. 1:2
- C. 1:5
- D. 5:1

~~

G9A11 (A)

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

- A. Higher loss reduces SWR measured at the input to the line
- B. Higher loss increases SWR measured at the input to the line
- C. Higher loss increases the accuracy of SWR measured at the input to the line
- D. Transmission line loss does not affect the SWR measurement

~~

G9B – Basic dipole and monopole antennas

G9B01 (B)

What is a characteristic of a random-wire HF antenna connected directly to the transmitter?

- A. It must be longer than 1 wavelength
- B. Station equipment may carry significant RF current
- C. It produces only vertically polarized radiation
- D. It is more effective on the lower HF bands than on the higher bands

~~

G9B02 (B)

Which of the following is a common way to adjust the feed point impedance of an elevated 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 beyond one wavelength
- D. Coil the radials

~~

G9B03 (D)

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

~~

G9B04 (A)

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

~~

G9B05 (C)

How does antenna height affect the azimuthal radiation pattern of a horizontal dipole HF antenna at elevation angles higher than about 45 degrees?

- 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
~~

G9B06 (C)

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 or buried a few inches below the ground
- D. At the center of the antenna

~~

G9B07 (B)

How does the feed point impedance of a horizontal $1/2$ wave dipole antenna change as the antenna height is reduced to $1/10$ wavelength 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

~~

G9B08 (A)

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

~~

G9B09 (A)

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

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

~~

G9B10 (D)

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

~~

G9B11 (C)

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

~~

G9B12 (A)

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

- A. 8 feet
- B. 11 feet
- C. 16 feet
- D. 21 feet

~~

G9C – Directional antennas

G9C01 (A)

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

~~

G9C02 (B)

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

~~

G9C03 (A)

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

~~

G9C04 (B)

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

- A. Gain in dBi is 2.15 dB lower
- B. Gain in dBi is 2.15 dB higher
- C. Gain in dBd is 1.25 dBd lower
- D. Gain in dBd is 1.25 dBd higher

~~

G9C05 (A)

What is the primary effect of increasing boom length and adding directors to a Yagi antenna?

- A. Gain increases
- B. Beamwidth increases
- C. Front-to-back ratio decreases
- D. Resonant frequency is lower

~~

G9C06 Question Removed (section not renumbered)

G9C07 (C)

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

~~

G9C08 (D)

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

~~

G9C09 (B)

In free space, 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

~~

G9C10 (D)

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

~~

G9C11 (A)

What is a beta or hairpin match?

- A. A shorted transmission line stub placed at the feed point of a Yagi antenna to provide impedance matching
- B. A 1/4 wavelength section of 75-ohm coax in series with the feed point of a Yagi to provide impedance matching
- C. A series capacitor selected to cancel the inductive reactance of a folded dipole antenna
- D. A section of 300-ohm twin-lead transmission line used to match a folded dipole antenna

~~

G9C12 (A)

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

- A. It does not require the driven element to 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

~~

G9D – Specialized antenna types and applications

G9D01 (A)

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 horizontal dipole placed at approximately 1/2 wavelength above the ground
- D. A vertical dipole placed at approximately 1/2 wavelength above the ground

~~

G9D02 (D)

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

~~

G9D03 (C)

In which direction is the maximum radiation from a 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. On the same side as the feed point

~~

G9D04 (A)

What is the primary function of antenna traps?

- A. To enable multiband operation
- B. To notch spurious frequencies
- C. To provide balanced feed point impedance

D. To prevent out-of-band operation

~~

G9D05 (D)

What is an advantage of vertically stacking 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

~~

G9D06 (A)

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

~~

G9D07 (A)

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

~~

G9D08 (B)

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

~~

G9D09 (A)

What is the primary use of a Beverage antenna?

- A. Directional receiving for MF and 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

~~

G9D10 (B)

In which direction or directions does an electrically small loop (less than 1/10 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

~~

G9D11 (D)

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

~~

G9D12 (A)

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

- A. Inverted V
- B. Inverted L
- C. Sloper
- D. Lazy H

~~

G9D13 Question Removed (section not renumbered)

SUBELEMENT G0 – ELECTRICAL AND RF SAFETY [2 Exam Questions – 2 Groups]

G0A – RF safety principles, rules, and guidelines; routine station evaluation

G0A01 (A)

What is one way that RF energy can affect human body tissue?

- A. It heats body tissue
- B. It causes radiation poisoning
- C. It causes the blood count to reach a dangerously low level
- D. It cools body tissue

~~

G0A02 (D)

Which of the following is used to determine RF exposure from a transmitted signal?

- A. Its duty cycle
- B. Its frequency
- C. Its power density
- D. All these choices are correct

~~

G0A03 (D) [97.13(c)(1)]

How can you determine that your station complies with FCC RF exposure regulations?

- A. By calculation based on FCC OET Bulletin 65
- B. By calculation based on computer modeling

- C. By measurement of field strength using calibrated equipment
- D. All these choices are correct

~~

G0A04 (D)

What does "time averaging" mean when evaluating RF radiation exposure?

- A. The average amount of power developed by the transmitter over a specific 24-hour period
- B. The average time it takes RF radiation to have any long-term effect on the body
- C. The total time of the exposure
- D. The total RF exposure averaged over a certain period

~~

G0A05 (A) [97.13(c)(2), 1.1307(b)]

What must you do if an evaluation of your station shows that the RF energy radiated by your station exceeds permissible limits for possible human absorption?

- A. Take action to prevent human exposure to the excessive RF fields
- B. File an Environmental Impact Statement (EIS-97) with the FCC
- C. Secure written permission from your neighbors to operate above the controlled MPE limits
- D. All these choices are correct

~~

G0A06 (A) [97.13(c)(2), 1.1307(1)(b)(3)(i)]

What must you do if your station fails to meet the FCC RF exposure exemption criteria?

- A. Perform an RF Exposure Evaluation in accordance with FCC OET Bulletin 65
- B. Contact the FCC for permission to transmit
- C. Perform an RF exposure evaluation in accordance with World Meteorological Organization guidelines
- D. Use an FCC-approved band-pass filter

~~

G0A07 (A)

What is the effect of modulation duty cycle on RF exposure?

- A. A lower duty cycle permits greater power levels to be transmitted
- B. A higher duty cycle permits greater power levels to be transmitted
- C. Low duty cycle transmitters are exempt from RF exposure evaluation requirements
- D. High duty cycle transmitters are exempt from RF exposure requirements

~~

G0A08 (C) [97.13(c)(2)]

Which of the following steps must an amateur operator take to ensure compliance with RF safety regulations?

- A. Post a copy of FCC Part 97.13 in the station
- B. Notify neighbors within a 100-foot radius of the antenna of the existence of the station and power levels
- C. Perform a routine RF exposure evaluation and prevent access to any identified high exposure areas
- D. All these choices are correct

~~

G0A09 (B)

What type of instrument can be used to accurately measure an RF field strength?

- A. A receiver with digital signal processing (DSP) noise reduction

- B. A calibrated field strength meter with a calibrated antenna
- C. An SWR meter with a peak-reading function
- D. An oscilloscope with a high-stability crystal marker generator

~~

G0A10 (C)

What should be done if evaluation shows that a neighbor might experience more than the allowable limit of RF exposure from the main lobe of a directional antenna?

- A. Change to a non-polarized antenna with higher gain
- B. Use an antenna with a higher front-to-back ratio
- C. Take precautions to ensure that the antenna cannot be pointed in their direction when they are present
- D. All these choices are correct

~~

G0A11 (C)

What precaution should be taken if you install an indoor transmitting antenna?

- A. Locate the antenna close to your operating position to minimize feed-line radiation
- B. Position the antenna along the edge of a wall to reduce parasitic radiation
- C. Make sure that MPE limits are not exceeded in occupied areas
- D. Make sure the antenna is properly shielded

~~

G0A12 (D) [1.1307(1)(b)(3)(i)(A)]

What stations are subject to the FCC rules on RF exposure?

- A. All commercial stations; amateur radio stations are exempt
- B. Only stations with antennas lower than one wavelength above the ground
- C. Only stations transmitting more than 500 watts PEP
- D. All stations with a time-averaged transmission of more than one milliwatt

~~

G0B – Station safety: electrical shock, grounding, fusing, interlocks, and wiring; antenna and tower safety

G0B01 (A)

Which wire or wires in a four-conductor 240 VAC circuit should be attached to fuses or circuit breakers?

- A. Only the hot wires
- B. Only the neutral wire
- C. Only the ground wire
- D. All wires

~~

G0B02 (C)

According to the National Electrical Code, what is the minimum wire size that may be used safely for wiring with a 20-ampere circuit breaker?

- A. AWG number 20
- B. AWG number 16
- C. AWG number 12
- D. AWG number 8

~~

G0B03 (D)

Which size of fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring?

- A. 30 amperes
- B. 25 amperes
- C. 20 amperes
- D. 15 amperes

~~

G0B04 (B)

Where should the station's lightning protection ground system be located?

- A. As close to the station equipment as possible
- B. Outside the building
- C. Next to the closest power pole
- D. Parallel to the water supply line

~~

G0B05 (B)

Which of the following conditions will cause a ground fault circuit interrupter (GFCI) to disconnect AC power?

- A. Current flowing from one or more of the hot wires to the neutral wire
- B. Current flowing from one or more of the hot wires directly to ground
- C. Overvoltage on the hot wires
- D. All these choices are correct

~~

G0B06 (C)

Which of the following is covered by the National Electrical Code?

- A. Acceptable bandwidth limits
- B. Acceptable modulation limits
- C. Electrical safety of the station
- D. RF exposure limits of the human body

~~

G0B07 (B)

Which of these choices should be observed when climbing a tower using a safety harness?

- A. Always hold on to the tower with one hand
- B. Confirm that the harness is rated for the weight of the climber and that it is within its allowable service life
- C. Ensure that all heavy tools are securely fastened to the harness
- D. All these choices are correct

~~

G0B08 (B)

What should be done before climbing a tower that supports electrically powered devices?

- A. Notify the electric company that a person will be working on the tower
- B. Make sure all circuits that supply power to the tower are locked out and tagged
- C. Unground the base of the tower

D. All these choices are correct

~~

G0B09 (A)

Which of the following is true of an emergency generator installation?

- A. The generator should be operated in a well-ventilated area
- B. The generator must be insulated from ground
- C. Fuel should be stored near the generator for rapid refueling in case of an emergency
- D. All these choices are correct

~~

G0B10 (A)

Which of the following is a danger from lead-tin solder?

- A. Lead can contaminate food if hands are not washed carefully after handling the solder
- B. High voltages can cause lead-tin solder to disintegrate suddenly
- C. Tin in the solder can "cold flow," causing shorts in the circuit
- D. RF energy can convert the lead into a poisonous gas

~~

G0B11 (D)

Which of the following is required for lightning protection ground rods?

- A. They must be bonded to all buried water and gas lines
- B. Bends in ground wires must be made as close as possible to a right angle
- C. Lightning grounds must be connected to all ungrounded wiring
- D. They must be bonded together with all other grounds

~~

G0B12 (C)

What is the purpose of a power supply interlock?

- A. To prevent unauthorized changes to the circuit that would void the manufacturer's warranty
- B. To shut down the unit if it becomes too hot
- C. To ensure that dangerous voltages are removed if the cabinet is opened
- D. To shut off the power supply if too much voltage is produced

~~

G0B13 (A)

Where should lightning arrestors be located?

- A. Where the feed lines enter the building
- B. On the antenna, opposite the feed point
- C. In series with each ground lead
- D. At the closest power pole ground electrode

~~

~~~end of question pool text~~~

NOTE: One graphic is required for certain questions in section G7 and is included on the following page.



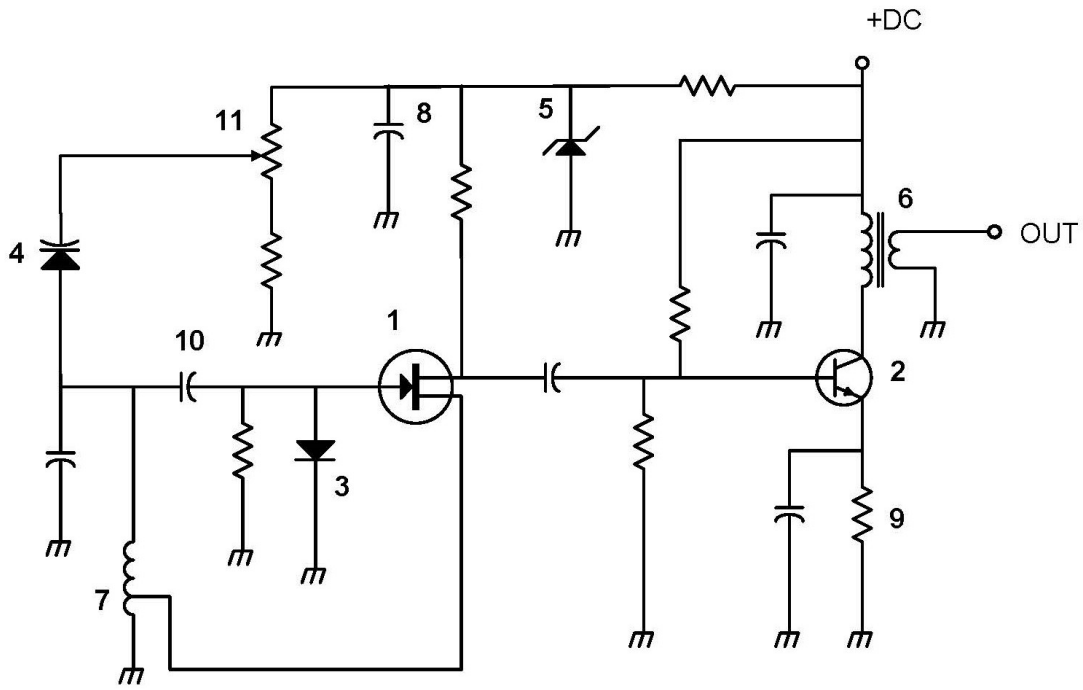


Figure G7-1