

# Amateur Radio General Class Exam Questions and Answers for July 2011 to July 2015

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## 0.1 Preamble

The following is the entire question pool for the General class amateur radio exam with answers. The text comes from the NCVEC National Conference of Volunteer Examiners website <http://www.ncvec.org/page.php?id=> on November 21 2013 and edited to remove the distractors (wrong answers). For questions with the answer "All of the above" the distractors were left in place for the information of anyone using this document. This document also lacks the list of corrections and modifications the original had.

Each subelement indicates the number of groups and the number of exam questions that comes from that subelement. Questions are formatted as Question Number (Letter of the correct Answer) [FCC rule number if applicable] question, the letter and answer for the correct response is listed on the second line.

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# Syllabus

## General Class Question Pool Syllabus 2011-2015

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

G1A - General Class control operator frequency privileges; primary and secondary allocations

G1B - Antenna structure limitations; good engineering and good amateur practice; beacon operation; restricted operation; retransmitting radio signals

G1C - Transmitter power regulations; data emission standards

G1D - Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification

G1E - Control categories; repeater regulations; harmful interference; third party rules; ITU regions

### SUBELEMENT G2 - OPERATING PROCEDURES [5 Exam Questions - 5 Groups]

G2A Phone operating procedures; USB/LSB utilization conventions; procedural signals; breaking into a QSO in progress; VOX operation

G2B - Operating courtesy; band plans, emergencies, including drills and emergency communications

G2C - CW operating procedures and procedural signals, Q signals and common abbreviations; full break in

G2D - Amateur Auxiliary; minimizing interference; HF operations

G2E - Digital operating: procedures, procedural signals and common abbreviations

### SUBELEMENT G3 - RADIO WAVE PROPAGATION [3 Exam Questions - 3 Groups]

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

G3B - Maximum Usable Frequency; Lowest Usable Frequency; propagation

G3C - Ionospheric layers; critical angle and frequency; HF scatter; Near Vertical Incidence Sky waves

### SUBELEMENT G4 - AMATEUR RADIO PRACTICES [5 Exam Questions - 5 groups]

G4A - Station Operation and setup

G4B - Test and monitoring equipment; two-tone test

G4C - Interference with consumer electronics; grounding; DSP

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

G4E - HF mobile radio installations; emergency and battery powered operation

### SUBELEMENT G5 - ELECTRICAL PRINCIPLES [3 exam questions - 3 groups]

G5A - Reactance; inductance; capacitance; impedance; impedance matching

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 [3 exam question - 3 groups]

G6A - Resistors; capacitors; inductors

G6B - Rectifiers; solid state diodes and transistors; vacuum tubes; batteries

G6C - Analog and digital integrated circuits (IC's); microprocessors; memory; I/O devices; microwave IC's (MMIC's ); display devices

### SUBELEMENT G7 - PRACTICAL CIRCUITS [3 exam question - 3 groups]

G7A - Power supplies; schematic symbols

G7B - Digital circuits; amplifiers and oscillators

G7C - Receivers and transmitters; filters, oscillators

SUBELEMENT G8 - SIGNALS AND EMISSIONS [2 exam questions - 2 groups]

G8A - Carriers and modulation: AM; FM; single and double sideband; modulation envelope; overmodulation

G8B - Frequency mixing; multiplication; HF data communications; bandwidths of various modes; deviation

SUBELEMENT G9 - ANTENNAS AND FEED LINES [4 exam questions - 4 groups]

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

G9B - Basic antennas

G9C - Directional antennas

G9D - Specialized antennas

SUBELEMENT G0 - ELECTRICAL AND RF SAFETY [2 exam Questions - 2 groups]

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

G0B - Safety in the ham shack: electrical shock and treatment, safety grounding, fusing, interlocks, wiring, antenna and tower safety

General Class Question Pool Effective July 1, 2011 - June 30, 2015

# Chapter 1

## Subelement G1 - Commission's Rules: 5 Questions

### 1.1 G1A - General Class control operator frequency privileges; primary and secondary allocations

G1A01 (C) [97.301(d), 97.303(s)] On which of the following bands is a General Class license holder granted all amateur frequency privileges?

C. 160, 60, 30, 17, 12, and 10 meters

G1A02 (B) [97.305] On which of the following bands is phone operation prohibited?

B. 30 meters

G1A03 (B) [97.305] On which of the following bands is image transmission prohibited?

B. 30 meters

G1A04 (D) [97.303 (s)] Which of the following amateur bands is restricted to communication on only specific channels, rather than frequency ranges?

D. 60 meters

G1A05 (A) [97.301(d)] Which of the following frequencies is in the General Class portion of the 40 meter band?

A. 7.250 MHz

G1A06 (D) [97.301(d)] Which of the following frequencies is in the 12 meter band?

D. 24.940 MHz

G1A07 (C) [97.301(d)] Which of the following frequencies is within the General Class portion of the 75 meter phone band?

C. 3900 kHz

G1A08 (C) [97.301(d)] Which of the following frequencies is within the General Class portion of the 20 meter phone band?

C. 14305 kHz

G1A09 (C) [97.301(d)] Which of the following frequencies is within the General Class portion of the 80 meter band?

C. 3560 kHz

G1A10 (C) [97.301(d)] Which of the following frequencies is within the General Class portion of the 15 meter band?

C. 21300 kHz

G1A11 (D) [97.301(d)] Which of the following frequencies is available to a control operator holding a General Class license?

A. 28.020 MHz

B. 28.350 MHz

C. 28.550 MHz

D. All of these choices are correct

G1A12 (B) [97.301] When General Class licensees are not permitted to use the entire voice portion of a particular band, which portion of the voice segment is generally available to them?

B. The upper frequency end

G1A13 (D) [97.303] Which, if any, amateur band is shared with the Citizens Radio Service?

D. None

G1A14 (C) [97.303] Which of the following applies when the FCC rules designate the Amateur Service as a secondary user on a band?

C. Amateur stations are allowed to use the band only if they do not cause harmful interference to primary users

G1A15 (D) [97.303] What is the appropriate action if, when operating on either the 30 or 60 meter bands, a station in the primary service interferes with your contact?

D. Move to a clear frequency

## **1.2 G1B - Antenna structure limitations; good engineering and good amateur practice; beacon operation; restricted operation; retransmitting radio signals**

G1B01 (C) [97.15(a)] What is the maximum height above ground to which an antenna structure may be erected without requiring notification to the FAA and registration with the FCC, provided it is not at or near a public use airport?

C. 200 feet

G1B02 (D) [97.203(b)] With which of the following conditions must beacon stations comply?

D. There must be no more than one beacon signal in the same band from a single location

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

G1B04 (A) [97.113(b)] Which of the following must be true before amateur stations may provide communications to broadcasters for dissemination to the public?

A. The communications must directly relate to the immediate safety of human life or protection of property



and there must be no other means of communication reasonably available before or at the time of the event

G1B05 (D) [97.113(a)(5),(e)] When may music be transmitted by an amateur station?

D. When it is an incidental part of a manned space craft retransmission

G1B06 (B) [97.113(a)(4) and 97.207(f)] When is an amateur station permitted to transmit secret codes?

B. To control a space station

G1B07 (B) [97.113(a)(4)] What are the restrictions on the use of abbreviations or procedural signals in the Amateur Service?

B. They may be used if they do not obscure the meaning of a message

G1B08 (D) When choosing a transmitting frequency, what should you do to comply with good amateur practice?

A. Review FCC Part 97 Rules regarding permitted frequencies and emissions.

B. Follow generally accepted band plans agreed to by the Amateur Radio community.

C. Before transmitting, listen to avoid interfering with ongoing communication

D. All of these choices are correct

G1B09 (A) [97.113(a)(3)] When may an amateur station transmit communications in which the licensee or control operator has a pecuniary (monetary) interest?

A. When other amateurs are being notified of the sale of apparatus normally used in an amateur station and such activity is not done on a regular basis

G1B10 (C) [97.203(c)] What is the power limit for beacon stations?

C. 100 watts PEP output

G1B11 (C) [97.101(a)] How does the FCC require an amateur station to be operated in all respects not specifically covered by the Part 97 rules?

C. In conformance with good engineering and good amateur practice

G1B12 (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

## 1.3 G1C - Transmitter power regulations; data emission standards

G1C01 (A) [97.313(c)(1)] What is the maximum transmitting power an amateur station may use on 10.140 MHz?

A. 200 watts PEP output

G1C02 (C) [97.313(a),(b)] What is the maximum transmitting power an amateur station may use on the 12 meter band?

C. 1500 watts PEP output

G1C03 (A) [97.303s] What is the maximum bandwidth permitted by FCC rules for Amateur Radio

stations when transmitting on USB frequencies in the 60 meter band?

A. 2.8 kHz

G1C04 (A) [97.313] Which of the following is a limitation on transmitter power on the 14 MHz band?

A. Only the minimum power necessary to carry out the desired communications should be used

G1C05 (C) [97.313] Which of the following is a limitation on transmitter power on the 28 MHz band?

C. 1500 watts PEP output

G1C06 (D) [97.313] Which of the following is a limitation on transmitter power on 1.8 MHz band?

D. 1500 watts PEP output

G1C07 (D) [97.305(c), 97.307(f)(3)] What is the maximum symbol rate permitted for RTTY or data emission transmission on the 20 meter band?

D. 300 baud

G1C08 (D) [97.307(f)(3)] What is the maximum symbol rate permitted for RTTY or data emission transmitted at frequencies below 28 MHz?

D. 300 baud

G1C09 (A) [97.305(c) and 97.307(f)(5)] What is the maximum symbol rate permitted for RTTY or data emission transmitted on the 1.25 meter and 70 centimeter bands

A. 56 kilobaud

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?

C. 1200 baud

G1C11 (B) [97.305(c) and 97.307(f)(5)] What is the maximum symbol rate permitted for RTTY or data emission transmissions on the 2 meter band?

B. 19.6 kilobaud

## **1.4 G1D - Volunteer Examiners and Volunteer Examiner Coordinators; temporary identification**

G1D01 (C) [97.119(f)(2)] Which of the following is a proper way to identify when transmitting using phone on General Class frequencies if you have a CSCE for the required elements but your upgrade from Technician has not appeared in the FCC database?

C. Give your call sign followed by "slant AG"

G1D02 (C) [97.509(b)(3)(i)] What license examinations may you administer when you are an accredited VE holding a General Class operator license?

C. Technician only

G1D03 (C) [97.9(b)] On which of the following band segments may you operate if you are a Technician Class operator and have a CSCE for General Class privileges?

C. On any General or Technician Class band segment

G1D04 (A) [97.509(a)(b)] Which of the following is a requirement for administering a Technician Class operator examination?

A. At least three VEC accredited General Class or higher VEs must be present

G1D05 (D) [97.509(b)(3)(i)] Which of the following is sufficient for you to be an administering VE for a Technician Class operator license examination?

D. An FCC General Class or higher license and VEC accreditation

G1D06 (A) [97.119(f)(2)] When must you add the special identifier "AG" after your call sign if you are a Technician Class licensee and have a CSCE for General Class operator privileges, but the FCC has not yet posted your upgrade on its Web site?

A. Whenever you operate using General Class frequency privileges

G1D07 (C) [97.509(b)(1)] Volunteer Examiners are accredited by what organization?

C. A Volunteer Examiner Coordinator

G1D08 (B) [97.509(b)(3)] Which of the following criteria must be met for a non-U.S. citizen to be an accredited Volunteer Examiner?

B. The person must hold an FCC granted Amateur Radio license of General Class or above

G1D09 (C) [97.9(b)] How long is a Certificate of Successful Completion of Examination (CSCE) valid for exam element credit?

C. 365 days

G1D10 (B) [97.509(b)(2)] What is the minimum age that one must be to qualify as an accredited Volunteer Examiner?

B. 18 years

## **1.5 G1E - Control categories; repeater regulations; harmful interference; third party rules; ITU regions**

G1E01 (A) [97.115(b)(2)] Which of the following would disqualify a third party from participating in stating a message over an amateur station?

A. The third party's amateur license had ever been revoked

G1E02 (D) [97.205(a)] When may a 10 meter repeater retransmit the 2 meter signal from a station having a Technician Class control operator?

D. Only if the 10 meter repeater control operator holds at least a General Class license

G1E03 (B) [97.301(d)] In what ITU region is operation in the 7.175 to 7.300 MHz band permitted for a control operator holding an FCC-issued General Class license?

B. Region 2

G1E04 (D) [97.13(b),97.311(b),97.303] Which of the following conditions require an Amateur Radio station licensee 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 of these choices are correct

G1E05 (C) [97.115(a)(2),97.117] What types of messages for a third party in another country may be transmitted by an amateur station?

- C. Only messages relating to Amateur Radio or remarks of a personal character, or messages relating to emergencies or disaster relief

G1E06 (A) [97.205(c)] Which of the following applies in the event of interference between a coordinated repeater and an uncoordinated repeater?

- A. The licensee of the non-coordinated repeater has primary responsibility to resolve the interference

G1E07 (C) [97.115(a)(2)] With which foreign countries is third party traffic prohibited, except for messages directly involving emergencies or disaster relief communications?

- C. Every foreign country, unless there is a third party agreement in effect with that country

G1E08 (B) [97.115(a)(b)] Which of the following is a requirement for a non-licensed person to communicate with a foreign Amateur Radio station from a station with an FCC granted license at which a licensed control operator is present?

- B. The foreign amateur station must be in a country with which the United States has a third party agreement

G1E09 (C) [97.119(b)(2)] What language must you use when identifying your station if you are using a language other than English in making a contact using phone emission?

- C. English

G1E10 (D) [97.205(b)] What portion of the 10 meter band is available for repeater use?

- D. The portion above 29.5 MHz

# Chapter 2

## Subelement G2 - Operating Procedures: 5 Questions

### 2.1 G2A - Phone operating procedures; USB/LSB utilization conventions; procedural signals; breaking into a QSO in progress; VOX operation

G2A01 (A) Which sideband is most commonly used for voice communications on frequencies of 14 MHz or higher?

A. Upper sideband

G2A02 (B) Which of the following modes is most commonly used for voice communications on the 160, 75, and 40 meter bands?

B. Lower sideband

G2A03 (A) Which of the following is most commonly used for SSB voice communications in the VHF and UHF bands?

A. Upper sideband

G2A04 (A) Which mode is most commonly used for voice communications on the 17 and 12 meter bands?

A. Upper sideband

G2A05 (C) Which mode of voice communication is most commonly used on the high frequency amateur bands?

C. Single sideband

G2A06 (B) Which of the following is an advantage when using single sideband as compared to other analog voice modes on the HF amateur bands?

B. Less bandwidth used and higher power efficiency

G2A07 (B) Which of the following statements is true of the single sideband (SSB) voice mode?

B. Only one sideband is transmitted; the other sideband and carrier are suppressed

G2A08 (B) Which of the following is a recommended way to break into a conversation when using phone?

B. Say your call sign during a break between transmissions from the other stations

G2A09 (D) Why do most amateur stations use lower sideband on the 160, 75 and 40 meter bands?

D. Current amateur practice is to use lower sideband on these frequency bands

G2A10 (B) Which of the following statements is true of SSB VOX operation?

B. VOX allows "hands free" operation

G2A11 (C) What does the expression "CQ DX" usually indicate?

C. The caller is looking for any station outside their own country

## **2.2 G2B - Operating courtesy; band plans; emergencies, including drills and emergency communications**

G2B01 (C) Which of the following is true concerning access to frequencies?

C. No one has priority access to frequencies, common courtesy should be a guide

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?

B. Acknowledge the station in distress and determine what assistance may be needed

G2B03 (C) If propagation changes during your contact and you notice increasing interference from other activity on the same frequency, what should you do?

C. As a common courtesy, move your contact to another frequency

G2B04 (B) When selecting a CW transmitting frequency, what minimum frequency separation should you allow in order to minimize interference to stations on adjacent frequencies?

B. 150 to 500 Hz

G2B05 (B) What is the customary minimum frequency separation between SSB signals under normal conditions?

B. Approximately 3 kHz

G2B06 (A) What is a practical way to avoid harmful interference when selecting a frequency to call 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

G2B07 (C) Which of the following complies with good amateur practice when choosing a frequency on which to initiate a call?

C. Follow the voluntary band plan for the operating mode you intend to use

G2B08 (A) What is the "DX window" in a voluntary band plan?

A. A portion of the band that should not be used for contacts between stations within the 48 contiguous United States

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

G2B10 (D) [97.407(b)] When may the FCC restrict normal frequency operations of amateur stations participating in RACES?

D. When the President's War Emergency Powers have been invoked

G2B11 (A) [97.405] What frequency should be used to send a distress call?

A. Whatever frequency has the best chance of communicating the distress message

G2B12 (C) [97.405(b)] When is an amateur station allowed to use any means at its disposal to assist another station in distress?

C. At any time during an actual emergency

## **2.3 G2C - CW operating procedures and procedural signals; Q signals and common abbreviations: full break in**

G2C01 (D) Which of the following describes full break-in telegraphy (QSK)?

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

G2C03 (C) What does it mean when a CW operator sends "KN" at the end of a transmission?

C. Listening only for a specific station or stations

G2C04 (D) What does it mean when a CW operator sends "CL" at the end of a transmission?

D. Closing station

G2C05 (B) What is the best speed to use answering a CQ in Morse Code?

B. The speed at which the CQ was sent

G2C06 (D) What does the term "zero beat" mean in CW operation?

D. Matching your 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

G2C08 (C) What prosign is sent to indicate the end of a formal message when using CW?

C. AR

G2C09 (C) What does the Q signal "QSL" mean?

C. I acknowledge receipt

G2C10 (B) What does the Q signal "QRQ" mean?

B. Send faster

G2C11 (D) What does the Q signal "QRV" mean?  
D. I am ready to receive messages

## 2.4 G2D - Amateur Auxiliary; minimizing interference; HF operations

G2D01 (A) What is the Amateur Auxiliary to the FCC?

A. Amateur volunteers who are formally enlisted to monitor the airwaves for rules violations

G2D02 (B) Which of the following are objectives of the Amateur Auxiliary?

B. To encourage amateur self regulation and compliance with the rules

G2D03 (B) What skills learned during "hidden transmitter hunts" are of help to the Amateur Auxiliary?

B. Direction finding used to locate stations violating FCC Rules

G2D04 (B) Which of the following describes an azimuthal projection map?

B. A world map projection centered on a particular location

G2D05 (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?

B. When the contact is with amateurs in any country except those whose administrations have notified the ITU that they object to such communications

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

C. 180 degrees from its short-path heading

G2D07 (A) [97.303s] Which of the following is required by the FCC rules when operating in the 60 meter band?

A. If you are using other than a dipole antenna, you must keep a record of the gain of your antenna

G2D08 (D) Why do many amateurs keep a log even though the FCC doesn't require it?

D. To help with a reply if the FCC requests information

G2D09 (D) What information is traditionally contained in a station log?

A. Date and time of contact

B. Band and/or frequency of the contact

C. Call sign of station contacted and the signal report given

D. All of these choices are correct

G2D10 (B) What is QRP operation?

B. Low power transmit operation

G2D11 (C) Which HF antenna would be the best to use for minimizing interference?

C. A unidirectional antenna



## 2.5 G2E - Digital operating: procedures, procedural signals and common abbreviations

G2E01 (D) Which mode is normally used when sending an RTTY signal via AFSK with an SSB transmitter?

D. LSB

G2E02 (A) How many data bits are sent in a single PSK31 character?

A. The number varies

G2E03 (C) What part of a data packet contains the routing and handling information?

C. Header

G2E04 (B) What segment of the 20 meter band is most often used for data transmissions?

B. 14.070 - 14.100 MHz

G2E05 (C) Which of the following describes Baudot code?

C. A 5-bit code with additional start and stop bits

G2E06 (B) What is the most common frequency shift for RTTY emissions in the amateur HF bands?

B. 170 Hz

G2E07 (B) What does the abbreviation "RTTY" stand for?

B. Radioteletype

G2E08 (A) What segment of the 80 meter band is most commonly used for data transmissions?

A. 3570 - 3600 kHz

G2E09 (D) In what segment of the 20 meter band are most PSK31 operations commonly found?

D. Below the RTTY segment, near 14.070 MHz

G2E11 (B) What does the abbreviation "MFSK" stand for?

B. Multi (or Multiple) Frequency Shift Keying

G2E12 (B) How does the receiving station respond to an ARQ data mode packet containing errors?

B. Requests the packet be retransmitted

G2E13 (A) In the PACTOR protocol, what is meant by an NAK response to a transmitted packet?

A. The receiver is requesting the packet be re-transmitted

# Chapter 3

## Subelement G3 - Radio Wave Propagation: 3 Questions

### 3.1 G3A - Sunspots and solar radiation; ionospheric disturbances; propagation forecasting and indices

G3A01 (A) What is the sunspot number?

A. A measure of solar activity based on counting sunspots and sunspot groups

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

B. It disrupts signals on lower frequencies more than those on higher frequencies

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

C. 8 minutes

G3A04 (D) Which of the following amateur radio HF frequencies are least reliable for long distance communications during periods of low solar activity?

D. 21 MHz and higher

G3A05 (D) [Modified] What is the solar-flux index?

D. A measure of solar radiation at 10.7 cm

G3A06 (D) What is a geomagnetic storm?

D. A temporary disturbance in the Earth's magnetosphere

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

D. At any point in the solar cycle

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

B. Degraded high-latitude HF propagation

G3A09 (C) What effect do high sunspot numbers have on radio communications?

C. Long-distance communication in the upper HF and lower VHF range is enhanced

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

C. The Sun's rotation on its axis

G3A11 (D) Approximately how long is the typical sunspot cycle?

D. 11 years

G3A12 (B) What does the K-index indicate?

B. The short term stability of the Earth's magnetic field

G3A13 (C) What does the A-index indicate?

C. The long term stability of the Earth's geomagnetic field

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

B. HF communications are disturbed

G3A15 (D) How long does it take charged particles from coronal mass ejections to affect radio-wave propagation on the Earth?

D. 20 to 40 hours

G3A16 (A) What is a possible benefit to radio communications resulting from periods of high geomagnetic activity?

A. Aurora that can reflect VHF signals

## **3.2 G3B - Maximum Usable Frequency; Lowest Usable Frequency; propagation**

G3B01 (D) How might a sky-wave signal sound if it arrives at your receiver by both short path and long path propagation?

D. A well-defined echo might be heard

G3B02 (A) Which of the following is a good indicator of the possibility of sky-wave propagation on the 6 meter band?

A. Short skip sky-wave propagation on the 10 meter band

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

A. Select a frequency just below the MUF

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

A. Listen for signals from an international beacon

G3B05 (A) What usually happens to radio waves with frequencies below the Maximum Usable Frequency (MUF) and above the Lowest Usable Frequency (LUF) when they are sent into the ionosphere?

A. They are bent back to the Earth

G3B06 (C) What usually happens to radio waves with frequencies below the Lowest Usable Frequency (LUF)?

C. They are completely absorbed by the ionosphere

G3B07 (A) What does LUF stand for?

A. The Lowest Usable Frequency for communications between two points

G3B08 (B) What does MUF stand for?

B. The Maximum Usable Frequency for communications between two points

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

C. 2,500 miles

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

B. 1,200 miles

G3B11 (A) What happens to HF propagation when the Lowest Usable Frequency (LUF) exceeds the Maximum Usable Frequency (MUF)?

A. No HF radio frequency will support ordinary skywave communications over the path

G3B12 (D) What factors affect the Maximum Usable Frequency (MUF)?

A. Path distance and location

B. Time of day and season

C. Solar radiation and ionospheric disturbances

D. All of these choices are correct

### **3.3 G3C - Ionospheric layers; critical angle and frequency; HF scatter; Near Vertical Incidence Sky waves**

G3C01 (A) Which of the following ionospheric layers is closest to the surface of the Earth?

A. The D layer

G3C02 (A) Where on the Earth do ionospheric layers reach their maximum height?

A. Where the Sun is overhead

G3C03 (C) Why is the F2 region mainly responsible for the longest distance radio wave propagation?

C. Because it is the highest ionospheric region

G3C04 (D) What does the term "critical angle" mean as used in radio wave propagation?

D. The highest takeoff angle that will return a radio wave to the 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?

C. The D layer absorbs signals at these frequencies during daylight hours

G3C06 (B) What is a characteristic of HF scatter signals?

B. They have a wavering sound

G3C07 (D) What makes HF scatter signals often sound distorted?

D. Energy is scattered into the skip zone through several different radio wave 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

G3C09 (B) What type of radio wave propagation allows a signal to be detected at a distance too far for ground wave propagation but too near for normal sky-wave propagation?

B. Scatter

G3C10 (D) Which of the following might be an indication that signals heard on the HF bands are being received via scatter propagation?

D. The signal is heard on a frequency above the Maximum Usable Frequency

G3C11 (B) Which of the following antenna types will be most effective for skip communications on 40 meters during the day?

B. Horizontal dipoles placed between  $1/8$  and  $1/4$  wavelength above the ground

G3C12 (D) Which ionospheric layer is the most absorbent of long skip signals during daylight hours on frequencies below 10 MHz?

D. The D layer

G3C13 (B) What is Near Vertical Incidence Sky-wave (NVIS) propagation?

B. Short distance HF propagation using high elevation angles

# Chapter 4

## Subelement G4 - Amateur Radio Practices: 5 Questions

### 4.1 G4A - Station Operation and set up

G4A01 (B) What is the purpose of the "notch filter" found on many HF transceivers?

B. To reduce interference from carriers in the receiver passband

G4A02 (C) What is one advantage of selecting the opposite or "reverse" sideband when receiving CW signals on a typical HF transceiver?

C. It may be possible to reduce or eliminate interference from other signals

G4A03 (C) What is normally meant by operating a transceiver in "split" mode?

C. The transceiver is set to different transmit and receive frequencies

G4A04 (B) What reading on the plate current meter of a vacuum tube RF power amplifier indicates correct adjustment of the plate tuning control?

B. A pronounced dip

G4A05 (C) What is a purpose of using Automatic Level Control (ALC) with a RF power amplifier?

C. To reduce distortion due to excessive drive

G4A06 (C) What type of device is often used to enable matching the transmitter output to an impedance other than 50 ohms?

C. Antenna coupler

G4A07 (D) What condition can lead to permanent damage when using a solid-state RF power amplifier?

D. Excessive drive power

G4A08 (D) What is the correct adjustment for the load or coupling control of a vacuum tube RF power amplifier?

D. Maximum power output without exceeding maximum allowable plate current

G4A09 (C) Why is a time delay sometimes included in a transmitter keying circuit?

C. To allow time for transmit-receive changeover operations to complete properly before RF output is allowed

- G4A10 (B) What is the purpose of an electronic keyer?
- B. Automatic generation of strings of dots and dashes for CW operation

- G4A11 (A) Which of the following is a use for the IF shift control on a receiver?
- A. To avoid interference from stations very close to the receive frequency

- G4A12 (C) Which of the following is a common use for the dual VFO feature on a transceiver?
- C. To permit ease of monitoring the transmit and receive frequencies when they are not the same

- G4A13 (A) What is one reason to use the attenuator function that is present on many HF transceivers?
- A. To reduce signal overload due to strong incoming signals

- G4A14 (B) How should the transceiver audio input be adjusted when transmitting PSK31 data signals?
- B. So that the transceiver ALC system does not activate

## 4.2 G4B - Test and monitoring equipment; two-tone test

- G4B01 (D) What item of test equipment contains horizontal and vertical channel amplifiers?
- D. An oscilloscope

- G4B02 (D) Which of the following is an advantage of an oscilloscope versus a digital voltmeter?
- D. Complex waveforms can be measured

- G4B03 (A) Which of the following is the best instrument to use when checking the keying waveform of a CW transmitter?
- A. An oscilloscope

- G4B04 (D) What signal source is connected to the vertical input of an oscilloscope when checking the RF envelope pattern of a transmitted signal?
- D. The attenuated RF output of the transmitter

- G4B05 (D) Why is high input impedance desirable for a voltmeter?
- D. It decreases the loading on circuits being measured

- G4B06 (C) What is an advantage of a digital voltmeter as compared to an analog voltmeter?
- C. Better precision for most uses

- G4B07 (A) Which of the following might be a use for a field strength meter?
- A. Close-in radio direction-finding

- G4B08 (A) Which of the following instruments may be used to monitor relative RF output when making antenna and transmitter adjustments?
- A. A field-strength meter

- G4B09 (B) Which of the following can be determined with a field strength meter?
- B. The radiation pattern of an antenna

G4B10 (A) Which of the following can be determined with a directional wattmeter?

A. Standing wave ratio

G4B11 (C) Which of the following must be connected to an antenna analyzer when it is being used for SWR measurements?

C. Antenna and feed line

G4B12 (B) What problem can occur when making measurements on an antenna system with an antenna analyzer?

B. Strong signals from nearby transmitters can affect the accuracy of measurements

G4B13 (C) What is a use for an antenna analyzer other than measuring the SWR of an antenna system?

C. Determining the impedance of an unknown or unmarked coaxial cable

G4B14 (D) What is an instance in which the use of an instrument with analog readout may be preferred over an instrument with a numerical digital readout?

D. When adjusting tuned circuits

G4B15 (A) What type of transmitter performance does a two-tone test analyze?

A. Linearity

G4B16 (B) What signals are used to conduct a two-tone test?

B. Two non-harmonically related audio signals

## **4.3 G4C - Interference with consumer electronics; grounding; DSP**

G4C01 (B) Which of the following might be useful in reducing RF interference to audio-frequency devices?

B. Bypass capacitor

G4C02 (C) Which of the following could be a cause of interference covering a wide range of frequencies?

C. Arcing at a poor electrical connection

G4C03 (C) What sound is heard from an audio device or telephone if there is interference from a nearby single-sideband phone transmitter?

C. Distorted speech

G4C04 (A) What is the effect on an audio device or telephone system if there is interference from a nearby CW transmitter?

A. On-and-off humming or clicking

G4C05 (D) What might be the problem if you receive an RF burn when touching your equipment while transmitting on an HF band, assuming the equipment is connected to a ground rod?

D. The ground wire has high impedance on that frequency

G4C06 (C) What effect can be caused by a resonant ground connection?

C. High RF voltages on the enclosures of station equipment



G4C07 (A) What is one good way to avoid unwanted effects of stray RF energy in an amateur station?  
A. Connect all equipment grounds together

G4C08 (A) Which of the following would reduce RF interference caused by common-mode current on an audio cable?  
A. Placing a ferrite bead around the cable

G4C09 (D) How can a ground loop be avoided?  
D. Connect all ground conductors to a single point

G4C10 (A) What could be a symptom of a ground loop somewhere in your station?  
A. You receive reports of "hum" on your station's transmitted signal

G4C11 (B) Which of the following is one use for a Digital Signal Processor in an amateur station?  
B. To remove noise from received signals

G4C12 (A) Which of the following is an advantage of a receiver Digital Signal Processor IF filter as compared to an analog filter?  
A. A wide range of filter bandwidths and shapes can be created

G4C13 (B) Which of the following can perform automatic notching of interfering carriers?  
B. A Digital Signal Processor (DSP) filter

## **4.4 G4D - Speech processors; S meters; sideband operation near band edges**

G4D01 (A) What is the purpose of a speech processor as used in a modern transceiver?  
A. Increase the intelligibility of transmitted phone signals during poor conditions

G4D02 (B) Which of the following describes how a speech processor affects a transmitted single sideband phone signal?  
B. It increases average power

G4D03 (D) Which of the following can be the result of an incorrectly adjusted speech processor?  
A. Distorted speech  
B. Splatter  
C. Excessive background pickup  
D. All of these choices are correct

G4D04 (C) What does an S meter measure?  
C. Received signal strength

G4D05 (D) How does an S meter reading of 20 dB over S-9 compare to an S-9 signal, assuming a properly calibrated S meter?  
D. It is 100 times stronger

G4D06 (A) Where is an S meter found?

A. In a receiver

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?

C. Approximately 4 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?

C. 7.175 to 7.178 MHz

G4D09 (B) What frequency range is occupied by a 3 kHz USB signal with the displayed carrier frequency set to 14.347 MHz?

B. 14.347 to 14.350 MHz

G4D10 (A) How close to the lower-edge of the 40 meter General Class phone segment should your displayed carrier frequency be when using 3 kHz wide-LSB?

A. 3 kHz above the edge of the segment

G4D11 (B) How close to the upper edge of the 20 meter General Class band should your displayed carrier frequency be when using 3 kHz wide-USB?

B. 3 kHz below the edge of the band

## **4.5 G4E - HF mobile radio installations; emergency and battery powered operation**

G4E01 (C) What is a "capacitance hat", when referring to a mobile antenna?

C. A device to electrically lengthen a physically short antenna

G4E02 (D) What is the purpose of a "corona ball" on a HF mobile antenna?

D. To reduce high voltage discharge from the tip of the antenna

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

G4E04 (B) Why is it best NOT to draw the DC power for a 100-watt HF transceiver from an automobile's auxiliary power socket?

B. The socket's wiring may be inadequate for the current being drawn by the transceiver

G4E05 (C) Which of the following most limits the effectiveness of an HF mobile transceiver operating in the 75 meter band?

C. The antenna system

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

C. Operating bandwidth may be very limited

G4E07 (D) Which of the following is the most likely to cause interfering signals to be heard in the receiver of an HF mobile installation in a recent model vehicle?

D. The vehicle control computer

G4E08 (A) What is the name of the process by which sunlight is changed directly into electricity?

A. Photovoltaic conversion

G4E09 (B) What is the approximate open-circuit voltage from a modern, well-illuminated photovoltaic cell?

B. 0.5 VDC

G4E10 (B) What is the reason a series diode is connected between a solar panel and a storage battery that is being charged by the panel?

B. The diode prevents self discharge of the battery though the panel during times of low or no illumination

G4E11 (C) Which of the following is a disadvantage of using wind as the primary source of power for an emergency station?

C. A large energy storage system is needed to supply power when the wind is not blowing

# Chapter 5

## Subelement G5 - Electrical Principles: 3 Questions

### 5.1 G5A - Reactance; inductance; capacitance; impedance; impedance matching

G5A01 (C) What is impedance?

C. The opposition to the flow of current in an AC circuit

G5A02 (B) What is reactance?

B. Opposition to the flow of alternating current caused by capacitance or inductance

G5A03 (D) Which of the following causes opposition to the flow of alternating current in an inductor?

D. Reactance

G5A04 (C) Which of the following causes opposition to the flow of alternating current in a capacitor?

C. Reactance

G5A05 (D) How does an inductor react to AC?

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

G5A08 (A) Why is impedance matching important?

A. So the source can deliver maximum power to the load

G5A09 (B) What unit is used to measure reactance?

B. Ohm

G5A10 (B) What unit is used to measure impedance?

B. Ohm

G5A11 (A) Which of the following describes one method of impedance matching between two AC circuits?

A. Insert an LC network between the two circuits

G5A12 (B) What is one reason to use an impedance matching transformer?

B. To maximize the transfer of power

G5A13 (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 of these choices are correct

## **5.2 G5B - The Decibel; current and voltage dividers; electrical power calculations; sine wave root-mean-square (RMS) values; PEP calculations**

G5B01 (B) A two-times increase or decrease in power results in a change of how many dB?

B. Approximately 3 dB

G5B02 (C) How does the total current relate to the individual currents in each branch of a parallel circuit?

C. It equals the sum of the currents through each branch

G5B03 (B) How many watts of electrical power are used if 400 VDC is supplied to an 800-ohm load?

B. 200 watts

G5B04 (A) How many watts of electrical power are used by a 12-VDC light bulb that draws 0.2 amperes?

A. 2.4 watts

G5B05 (A) How many watts are dissipated when a current of 7.0 milliamperes flows through 1.25 kilohms?

A. Approximately 61 milliwatts

G5B06 (B) What is the output PEP from a transmitter if an oscilloscope measures 200 volts peak-to-peak across a 50-ohm dummy load connected to the transmitter output?

B. 100 watts

G5B07 (C) Which value of an AC signal results in the same power dissipation as a DC voltage of the same value?

C. The RMS value

G5B08 (D) What is the peak-to-peak voltage of a sine wave that has an RMS voltage of 120 volts?

D. 339.4 volts

G5B09 (B) What is the RMS voltage of a sine wave with a value of 17 volts peak?

B. 12 volts

G5B10 (C) What percentage of power loss would result from a transmission line loss of 1 dB?

C. 20.5

G5B11 (B) What is the ratio of peak envelope power to average power for an unmodulated carrier?  
B. 1.00

G5B12 (B) What would be the RMS voltage across a 50-ohm dummy load dissipating 1200 watts?  
B. 245 volts

G5B13 (B) What is the output PEP of an unmodulated carrier if an average reading wattmeter connected to the transmitter output indicates 1060 watts?  
B. 1060 watts

G5B14 (B) What is the output PEP from a transmitter if an oscilloscope measures 500 volts peak-to-peak across a 50-ohm resistor connected to the transmitter output?  
B. 625 watts

### **5.3 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?  
C. Mutual inductance

G5C02 (B) Which part of a transformer is normally connected to the incoming source of energy?  
B. The primary

G5C03 (B) Which of the following components should be added to an existing resistor to increase the resistance?  
B. A resistor in series

G5C04 (C) What is the total resistance of three 100-ohm resistors in parallel?  
C. 33.3 ohms

G5C05 (C) If three equal value resistors in parallel produce 50 ohms of resistance, and the same three resistors in series produce 450 ohms, what is the value of each resistor?  
C. 150 ohms

G5C06 (C) What is the RMS voltage across a 500-turn secondary winding in a transformer if the 2250-turn primary is connected to 120 VAC?  
C. 26.7 volts

G5C07 (A) What is the turns ratio of a transformer used to match an audio amplifier having a 600-ohm output impedance to a speaker having a 4-ohm impedance?  
A. 12.2 to 1

G5C08 (D) What is the equivalent capacitance of two 5000 picofarad capacitors and one 750 picofarad capacitor connected in parallel?  
D. 10750 picofarads

G5C09 (C) What is the capacitance of three 100 microfarad capacitors connected in series?  
C. 33.3 microfarads

G5C10 (C) What is the inductance of three 10 millihenry inductors connected in parallel?  
C. 3.3 millihenrys

G5C11 (C) What is the inductance of a 20 millihenry inductor in series with a 50 millihenry inductor?  
C. 70 millihenrys

G5C12 (B) What is the capacitance of a 20 microfarad capacitor in series with a 50 microfarad capacitor?  
B. 14.3 microfarads

G5C13 (C) Which of the following components should be added to a capacitor to increase the capacitance?  
C. A capacitor in parallel

G5C14 (D) Which of the following components should be added to an inductor to increase the inductance?  
D. An inductor in series

G5C15 (A) What is the total resistance of a 10 ohm, a 20 ohm, and a 50 ohm resistor in parallel?  
A. 5.9 ohms

# Chapter 6

## Subelement G6 - Circuit Components: 3 Questions

### 6.1 G6A - Resistors; capacitors; inductors

G6A01 (A) Which of the following is an important characteristic for capacitors used to filter the DC output of a switching power supply?

A. Low equivalent series resistance

G6A02 (D) Which of the following types of capacitors are often used in power supply circuits to filter the rectified AC?

D. Electrolytic

G6A03 (D) Which of the following is an advantage of ceramic capacitors as compared to other types of capacitors?

D. Comparatively low cost

G6A04 (C) Which of the following is an advantage of an electrolytic capacitor?

C. High capacitance for given volume

G6A05 (A) Which of the following is one effect of lead inductance in a capacitor used at VHF and above?

A. Effective capacitance may be reduced

G6A06 (C) What will happen to the resistance if the temperature of a resistor is increased?

C. It will change depending on the resistor's temperature coefficient

G6A07 (B) Which of the following is a reason not to use wire-wound resistors in an RF circuit?

B. The resistor's inductance could make circuit performance unpredictable

G6A08 (B) Which of the following describes a thermistor?

B. A device having a specific change in resistance with temperature variations

G6A09 (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 of these choices are correct

G6A10 (C) How should the winding axes of solenoid inductors be placed to minimize their mutual inductance?

C. At right angles

G6A11 (B) Why would it be important to minimize the mutual inductance between two inductors?

B. To reduce unwanted coupling between circuits

G6A12 (D) What is a common name for an inductor used to help smooth the DC output from the rectifier in a conventional power supply?

D. Filter choke

G6A13 (B) What is an effect of inter-turn capacitance in an inductor?

B. The inductor may become self resonant at some frequencies

## **6.2 G6B - Rectifiers; solid state diodes and transistors; vacuum tubes; batteries**

G6B01 (C) What is the peak-inverse-voltage rating of a rectifier?

C. The maximum voltage the rectifier will handle in the non-conducting direction

G6B02 (A) What are two major ratings that must not be exceeded for silicon diode rectifiers?

A. Peak inverse voltage; average forward current

G6B03 (B) What is the approximate junction threshold voltage of a germanium diode?

B. 0.3 volts

G6B04 (C) When two or more diodes are connected in parallel to increase current handling capacity, what is the purpose of the resistor connected in series with each diode?

C. To ensure that one diode doesn't carry most of the current

G6B05 (C) What is the approximate junction threshold voltage of a conventional silicon diode?

C. 0.7 volts

G6B06 (A) Which of the following is an advantage of using a Schottky diode in an RF switching circuit as compared to a standard silicon diode?

A. Lower capacitance

G6B07 (A) What are the stable operating points for a bipolar transistor used as a switch in a logic circuit?

A. Its saturation and cut-off regions

G6B08 (D) Why must the cases of some large power transistors be insulated from ground?

D. To avoid shorting the collector or drain voltage to ground

G6B09 (B) Which of the following describes the construction of a MOSFET?

B. The gate is separated from the channel with a thin insulating layer

G6B10 (A) Which element of a triode vacuum tube is used to regulate the flow of electrons between cathode and plate?

A. Control grid

G6B11 (B) Which of the following solid state devices is most like a vacuum tube in its general operating characteristics?

B. A Field Effect Transistor

G6B12 (A) What is the primary purpose of a screen grid in a vacuum tube?

A. To reduce grid-to-plate capacitance

G6B13 (B) What is an advantage of the low internal resistance of nickel-cadmium batteries?

B. High discharge current

G6B14 (C) What is the minimum allowable discharge voltage for maximum life of a standard 12 volt lead acid battery?

C. 10.5 volts

G6B15 (D) When is it acceptable to recharge a carbon-zinc primary cell?

D. Never

### **6.3 G6C - Analog and digital integrated circuits (IC's); micro-processors; memory; I/O devices; microwave IC's (MMIC's); display devices**

G6C01 (D) Which of the following is an analog integrated circuit?

D. Linear voltage regulator

G6C02 (B) What is meant by the term MMIC?

B. Monolithic Microwave Integrated Circuit

G6C03 (A) Which of the following is an advantage of CMOS integrated circuits compared to TTL integrated circuits?

A. Low power consumption

G6C04 (B) What is meant by the term ROM?

B. Read Only Memory

G6C05 (C) What is meant when memory is characterized as "non-volatile"?

C. The stored information is maintained even if power is removed

G6C06 (D) Which of the following describes an integrated circuit operational amplifier?

D. Analog

G6C07 (D) What is one disadvantage of an incandescent indicator compared to an LED?  
D. High power consumption

G6C08 (D) How is an LED biased when emitting light?  
D. Forward Biased

G6C09 (A) Which of the following is a characteristic of a liquid crystal display?  
A. It requires ambient or back lighting

G6C10 (A) What two devices in an Amateur Radio station might be connected using a USB interface?  
A. Computer and transceiver

G6C11 (B) What is a microprocessor?  
B. A computer on a single integrated circuit

G6C12 (D) Which of the following connectors would be a good choice for a serial data port?  
D. DE-9

G6C13 (C) Which of these connector types is commonly used for RF service at frequencies up to 150 MHz?  
C. PL-259

G6C14 (C) Which of these connector types is commonly used for audio signals in Amateur Radio stations?  
C. RCA Phono

G6C15 (B) What is the main reason to use keyed connectors instead of non-keyed types?  
B. Reduced chance of incorrect mating

G6C16 (A) Which of the following describes a type-N connector?  
A. A moisture-resistant RF connector useful to 10 GHz

G6C17 (C) What is the general description of a DIN type connector?  
C. A family of multiple circuit connectors suitable for audio and control signals

G6C18 (B) What is a type SMA connector?  
B. A small threaded connector suitable for signals up to several GHz

# Chapter 7

## Subelement G7 - Practical Circuits: 3 Questions

### 7.1 G7A Power supplies; and schematic symbols

G7A01 (B) What safety feature does a power-supply bleeder resistor provide?

B. It discharges the filter capacitors

G7A02 (D) Which of the following components are used in a power-supply filter network?

D. Capacitors and inductors

G7A03 (D) What is the peak-inverse-voltage across the rectifiers in a full-wave bridge power supply?

D. Equal to the normal peak output voltage of the power supply

G7A04 (D) What is the peak-inverse-voltage across the rectifier in a half-wave power supply?

D. Two times the normal peak output voltage of the power supply

G7A05 (B) What portion of the AC cycle is converted to DC by a half-wave rectifier?

B. 180 degrees

G7A06 (D) What portion of the AC cycle is converted to DC by a full-wave rectifier?

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

G7A08(C) Which of the following is an advantage of a switch-mode power supply as compared to a linear power supply?

C. High frequency operation allows the use of smaller components

G7A09 (C) Which symbol in figure G7-1 represents a field effect transistor?

C. Symbol 1

G7A10 (D) Which symbol in figure G7-1 represents a Zener diode?

D. Symbol 5

### B. Symbol 2

### C. Symbol 6

### A. Symbol 7

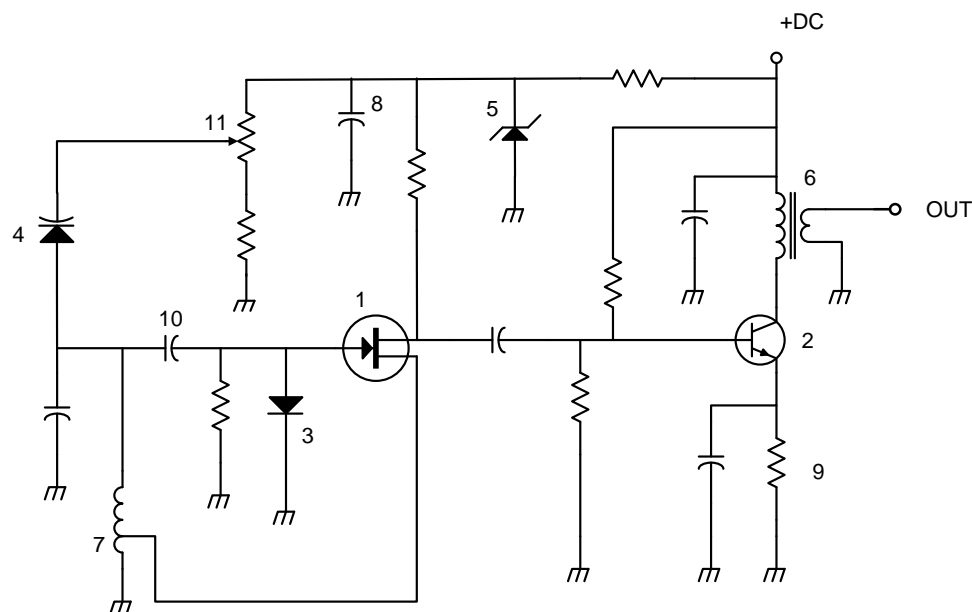


Figure G7-1

### A. Microcontroller

A. Binary "ones" and "zeros" are easy to represent with an "on" or "off" state

G7B03 (B) Which of the following describes the function of a two input AND gate?

B. Output is high only when both inputs are high

G7B04 (C) Which of the following describes the function of a two input NOR gate?

C. Output is low when either or both inputs are high

G7B05 (C) How many states does a 3-bit binary counter have?

C. 8

G7B06 (A) What is a shift register?

A. A clocked array of circuits that passes data in steps along the array

G7B07 (D) What are the basic components of virtually all sine wave oscillators?

D. A filter and an amplifier operating in a feedback loop

G7B08 (B) How is the efficiency of an RF power amplifier determined?

B. Divide the RF output power by the DC input power

G7B09 (C) What determines the frequency of an LC oscillator?

C. The inductance and capacitance in the tank circuit

G7B10 (D) Which of the following is a characteristic of a Class A amplifier?

D. Low distortion

G7B11 (B) For which of the following modes is a Class C power stage appropriate for amplifying a modulated signal?

B. CW

G7B12 (D) Which of these classes of amplifiers has the highest efficiency?

D. Class C

G7B13 (B) What is the reason for neutralizing the final amplifier stage of a transmitter?

B. To eliminate self-oscillations

G7B14 (B) Which of the following describes a linear amplifier?

B. An amplifier in which the output preserves the input waveform

## **7.3 G7C - Receivers and transmitters; filters, oscillators**

G7C01 (B) Which of the following is used to process signals from the balanced modulator and send them to the mixer in a single-sideband phone transmitter?

B. Filter

G7C02 (D) Which circuit is used to combine signals from the carrier oscillator and speech amplifier and send the result to the filter in a typical single-sideband phone transmitter?

D. Balanced modulator

G7C03 (C) What circuit is used to process signals from the RF amplifier and local oscillator and send the result to the IF filter in a superheterodyne receiver?

C. Mixer

G7C04 (D) What circuit is used to combine signals from the IF amplifier and BFO and send the result to the AF amplifier in a single-sideband receiver?

D. Product detector

G7C05 (D) Which of the following is an advantage of a transceiver controlled by a direct digital synthesizer (DDS)?

D. Variable frequency with the stability of a crystal oscillator

G7C06 (B) What should be the impedance of a low-pass filter as compared to the impedance of the transmission line into which it is inserted?

B. About the same

G7C07 (C) What is the simplest combination of stages that implement a superheterodyne receiver?

C. HF oscillator, mixer, detector

G7C08 (D) What type of circuit is used in many FM receivers to convert signals coming from the IF amplifier to audio?

D. Discriminator

G7C09 (D) Which of the following is needed for a Digital Signal Processor IF filter?

A. An analog to digital converter

B. A digital to analog converter

C. A digital processor chip

D. All of the these choices are correct

G7C10 (B) How is Digital Signal Processor filtering accomplished?

B. By converting the signal from analog to digital and using digital processing

G7C11 (A) What is meant by the term "software defined radio" (SDR)?

A. A radio in which most major signal processing functions are performed by software

# Chapter 8

## Subelement G8 - Signals and Emissions: 2 Questions

### 8.1 G8A - Carriers and modulation: AM; FM; single and double sideband; modulation envelope; overmodulation

G8A01 (D) What is the name of the process that changes the envelope of an RF wave to carry information?  
D. Amplitude modulation

G8A02 (B) What is the name of the process that changes the phase angle of an RF wave to convey information?  
B. Phase modulation

G8A03 (D) What is the name of the process which changes the frequency of an RF wave to convey information?  
D. Frequency modulation

G8A04 (B) What emission is produced by a reactance modulator connected to an RF power amplifier?  
B. Phase modulation

G8A05 (D) What type of modulation varies the instantaneous power level of the RF signal?  
D. Amplitude modulation

G8A06 (C) What is one advantage of carrier suppression in a single-sideband phone transmission?  
C. The available transmitter power can be used more effectively

G8A07 (A) Which of the following phone emissions uses the narrowest frequency bandwidth?  
A. Single sideband

G8A08 (D) Which of the following is an effect of over-modulation?  
D. Excessive bandwidth

G8A09 (B) What control is typically adjusted for proper ALC setting on an amateur single sideband transceiver?  
B. Transmit audio or microphone gain

G8A10 (C) What is meant by flat-topping of a single-sideband phone transmission?



### C. Signal distortion caused by excessive drive

G8A11 (A) What happens to the RF carrier signal when a modulating audio signal is applied to an FM transmitter?

A. The carrier frequency changes proportionally to the instantaneous amplitude of the modulating signal

G8A12 (A) What signal(s) would be found at the output of a properly adjusted balanced modulator?

A. Both upper and lower sidebands

## 8.2 G8B - Frequency mixing; multiplication; HF data communications; bandwidths of various modes; deviation

G8B01 (A) What receiver stage combines a 14.250 MHz input signal with a 13.795 MHz oscillator signal to produce a 455 kHz intermediate frequency (IF) signal?

A. Mixer

G8B02 (B) If a receiver mixes a 13.800 MHz VFO with a 14.255 MHz received signal to produce a 455 kHz intermediate frequency (IF) signal, what type of interference will a 13.345 MHz signal produce in the receiver?

B. Image response

G8B03 (A) What is another term for the mixing of two RF signals?

A. Heterodyning

G8B04 (D) What is the name of the stage in a VHF FM transmitter that generates a harmonic of a lower frequency signal to reach the desired operating frequency?

D. Multiplier

G8B05 (C) Why isn't frequency modulated (FM) phone used below 29.5 MHz?

C. The wide bandwidth is prohibited by FCC rules

G8B06 (D) What is the total bandwidth of an FM-phone transmission having a 5 kHz deviation and a 3 kHz modulating frequency?

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?

B. 416.7 Hz

G8B08 (B) Why is it important to know the duty cycle of the data mode you are using when transmitting?

B. Some modes have high duty cycles which could exceed the transmitter's average power rating.

G8B09 (D) Why is it good to match receiver bandwidth to the bandwidth of the operating mode?

D. It results in the best signal to noise ratio

G8B10 (A) What does the number 31 represent in PSK31?

A. The approximate transmitted symbol rate

G8B11 (C) How does forward error correction allow the receiver to correct errors in received data packets?

C. By transmitting redundant information with the data

G8B12 (B) What is the relationship between transmitted symbol rate and bandwidth?

B. Higher symbol rates require higher bandwidth

# Chapter 9

## Subelement G9 - Antennas and Feed Lines: 4 Questions

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

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

A. The distance between the centers of the conductors and the radius of the conductors

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

B. 50 and 75 ohms

G9A03 (D) What is the characteristic impedance of flat ribbon TV type twinlead?

D. 300 ohms

G9A04 (C) What is the reason for the occurrence of reflected power at the point where a feed line connects to an antenna?

C. A difference between feed-line impedance and antenna feed-point impedance

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

B. It increases

G9A06 (D) In what values are RF feed line losses usually expressed?

D. dB per 100 ft

G9A07 (D) What must be done to prevent standing waves on an antenna feed line?

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

B. 5 to 1

G9A09 (A) What standing wave ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 200-ohm impedance?

A. 4:1

G9A10 (D) What standing wave ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 10-ohm impedance?

D. 5:1

G9A11 (B) What standing wave ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 50-ohm impedance?

B. 1:1

G9A12 (A) What would be the SWR if you feed a vertical antenna that has a 25-ohm feed-point impedance with 50-ohm coaxial cable?

A. 2:1

G9A13 (C) What would be the SWR if you feed an antenna that has a 300-ohm feed-point impedance with 50-ohm coaxial cable?

C. 6:1

## 9.2 G9B - Basic antennas

G9B01 (B) What is one disadvantage of a directly fed random-wire antenna?

B. You may experience RF burns when touching metal objects in your station

G9B02 (D) What is an advantage of downward sloping radials on a quarter wave ground-plane antenna?

D. They bring the feed-point impedance closer to 50 ohms

G9B03 (B) What happens to the feed-point impedance of a ground-plane antenna when its radials are changed from horizontal to downward-sloping?

B. It increases

G9B04 (A) What is the low angle azimuthal radiation pattern of an ideal half-wavelength dipole antenna installed  $1/2$  wavelength high and parallel to the Earth?

A. It is a figure-eight at right angles to the antenna

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

C. If the antenna is less than  $1/2$  wavelength high, the azimuthal pattern is almost omnidirectional

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

C. On the surface or buried a few inches below the ground

G9B07 (B) How does the feed-point impedance of a  $1/2$  wave dipole antenna change as the antenna is lowered from  $1/4$  wave above ground?

B. It steadily decreases

G9B08 (A) How does the feed-point impedance of a 1/2 wave dipole change as the feed-point location is moved from the center toward the ends?

A. It steadily increases

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

A. Lower ground reflection losses

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

D. 32 feet

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

C. 131 feet

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

A. 8 feet

### 9.3 G9C - Directional antennas

G9C01 (A) Which of the following would increase the bandwidth of a Yagi antenna?

A. Larger diameter elements

G9C02 (B) What is the approximate length of the driven element of a Yagi antenna?

B. 1/2 wavelength

G9C03 (B) Which statement about a three-element, single-band Yagi antenna is true?

B. The director is normally the shortest parasitic element

G9C04 (A) Which statement about a three-element; single-band Yagi antenna is true?

A. The reflector is normally the longest parasitic element

G9C05 (A) How does increasing boom length and adding directors affect a Yagi antenna?

A. Gain increases

G9C06 (C) Which of the following is a reason why a Yagi antenna is often used for radio communications on the 20 meter band?

C. It helps reduce interference from other stations to the side or behind the antenna

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

C. The power radiated in the major radiation lobe compared to the power radiated in exactly the opposite direction

G9C08 (D) What is meant by the "main lobe" of a directive antenna?

D. The direction of maximum radiated field strength from the antenna

G9C09 (A) What is the approximate maximum theoretical forward gain of a three element, single-band Yagi antenna?

A. 9.7 dBi

G9C10 (D) Which of the following is a Yagi antenna design variable that could be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth?

- 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 of these choices are correct

G9C11 (A) What is the purpose of a gamma match used with Yagi antennas?

- A. To match the relatively low feed-point impedance to 50 ohms

G9C12 (A) Which of the following is an advantage of using a gamma match for impedance matching of a Yagi antenna to 50-ohm coax feed line?

- A. It does not require that the elements be insulated from the boom

G9C13 (A) Approximately how long is each side of a quad antenna driven element?

- A.  $1/4$  wavelength

G9C14 (B) How does the forward gain of a two-element quad antenna compare to the forward gain of a three-element Yagi antenna?

- B. About the same

G9C15 (B) Approximately how long is each side of a quad antenna reflector element?

- B. Slightly more than  $1/4$  wavelength

G9C16 (D) How does the gain of a two-element delta-loop beam compare to the gain of a two-element quad antenna?

- D. About the same

G9C17 (B) Approximately how long is each leg of a symmetrical delta-loop antenna?

- B.  $1/3$  wavelength

G9C18 (A) What happens when the feed point of a quad antenna is changed from the center of either horizontal wire to the center of either vertical wire?

- A. The polarization of the radiated signal changes from horizontal to vertical

G9C19 (D) What configuration of the loops of a two-element quad antenna must be used for the antenna to operate as a beam antenna, assuming one of the elements is used as a reflector?

- D. The reflector element must be approximately 5% longer than the driven element

G9C20 (B) How does the gain of two 3-element horizontally polarized Yagi antennas spaced vertically  $1/2$  wavelength apart typically compare to the gain of a single 3-element Yagi?

- B. Approximately 3 dB higher

## 9.4 G9D - Specialized antennas

G9D01 (D) What does the term "NVIS" mean as related to antennas?

D. Near Vertical Incidence Sky wave

G9D02 (B) Which of the following is an advantage of an NVIS antenna?

B. High vertical angle radiation for working stations within a radius of a few hundred kilometers

G9D03 (D) At what height above ground is an NVIS antenna typically installed?

D. Between  $1/10$  and  $1/4$  wavelength

G9D04 (A) What is the primary purpose of antenna traps?

A. To permit multiband operation

G9D05 (D) What is the advantage of vertical stacking of horizontally polarized Yagi antennas?

D. Narrows the main lobe in elevation

G9D06 (A) Which of the following is an advantage of a log periodic antenna?

A. Wide bandwidth

G9D07 (A) Which of the following describes a log periodic antenna?

A. Length and spacing of the elements increases logarithmically from one end of the boom to the other

G9D08 (B) Why is a Beverage antenna not used for transmitting?

B. It has high losses compared to other types of antennas

G9D09 (B) Which of the following is an application for a Beverage antenna?

B. Directional receiving for low HF bands

G9D10 (D) Which of the following describes a Beverage antenna?

D. A very long and low directional receiving antenna

G9D11 (D) Which of the following is a disadvantage of multiband antennas?

D. They have poor harmonic rejection

# Chapter 10

## Subelement G0 - Electrical and RF Safety: 2 Questions

### 10.1 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

G0A02 (D) Which of the following properties is important in estimating whether an RF signal exceeds the maximum permissible exposure (MPE)?

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

G0A04 (D) What does "time averaging" mean in reference to RF radiation exposure?

- D. The total RF exposure averaged over a certain time

G0A05 (A) What must you do if an evaluation of your station shows RF energy radiated from your station exceeds permissible limits?

- A. Take action to prevent human exposure to the excessive RF fields

G0A07 (A) What effect does transmitter duty cycle have when evaluating RF exposure?

- A. A lower transmitter duty cycle permits greater short-term exposure levels

G0A08 (C) Which of the following steps must an amateur operator take to ensure compliance with RF safety regulations when transmitter power exceeds levels specified in part 97.13?

- C. Perform a routine RF exposure evaluation



G0A09 (B) What type of instrument can be used to accurately measure an RF field?  
B. A calibrated field-strength meter with a calibrated antenna

G0A10 (D) What is one thing that can be done if evaluation shows that a neighbor might receive more than the allowable limit of RF exposure from the main lobe of a directional antenna?  
D. Take precautions to ensure that the antenna cannot be pointed in their direction

G0A11 (C) What precaution should you take if you install an indoor transmitting antenna?  
C. Make sure that MPE limits are not exceeded in occupied areas

G0A12 (B) What precaution should you take whenever you make adjustments or repairs to an antenna?  
B. Turn off the transmitter and disconnect the feed line

G0A13 (D) What precaution should be taken when installing a ground-mounted antenna?  
D. It should be installed so no one can be exposed to RF radiation in excess of maximum permissible limits

## **10.2 G0B - Safety in the ham shack: electrical shock and treatment, safety grounding, fusing, interlocks, wiring, antenna and tower safety**

G0B01 (A) Which wire or wires in a four-conductor line cord should be attached to fuses or circuit breakers in a device operated from a 240-VAC single-phase source?  
A. Only the hot wires

G0B02 (C) What is the minimum wire size that may be safely used for a circuit that draws up to 20 amperes of continuous current?  
C. AWG number 12

G0B03 (D) Which size of fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring?  
D. 15 amperes

G0B04 (A) Which of the following is a primary reason for not placing a gasoline-fueled generator inside an occupied area?  
A. Danger of carbon monoxide poisoning

G0B05 (B) Which of the following conditions will cause a Ground Fault Circuit Interrupter (GFCI) to disconnect the 120 or 240 Volt AC line power to a device?  
B. Current flowing from one or more of the hot wires directly to ground

G0B06 (D) Why must the metal enclosure of every item of station equipment be grounded?  
D. It ensures that hazardous voltages cannot appear on the chassis

G0B07 (B) Which of the following should be observed for safety when climbing on a tower using a safety belt or harness?  
B. Always attach the belt safety hook to the belt D-ring with the hook opening away from the tower

G0B08 (B) What should be done by any person preparing to climb a tower that supports electrically powered devices?

B. Make sure all circuits that supply power to the tower are locked out and tagged

G0B09 (D) Why should soldered joints not be used with the wires that connect the base of a tower to a system of ground rods?

D. A soldered joint will likely be destroyed by the heat of a lightning strike

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

G0B11 (D) Which of the following is good engineering practice for lightning protection grounds?

D. They must be bonded together with all other grounds

G0B12 (C) What is the purpose of a transmitter power supply interlock?

C. To ensure that dangerous voltages are removed if the cabinet is opened

G0B13 (A) What must you do when powering your house from an emergency generator?

A. Disconnect the incoming utility power feed

G0B14 (C) Which of the following is covered by the National Electrical Code?

C. Electrical safety inside the ham shack

G0B15 (A) Which of the following is true of an emergency generator installation?

A. The generator should be located in a well ventilated area

G0B16 (C) When might a lead acid storage battery give off explosive hydrogen gas?

C. When being charged