

## Element 3 Study Guide

2023-2027 FCC Element 3 Question Pool  
Effective for VEC Examinations on  
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### **SUBELEMENT G1 - COMMISSION'S RULES - [5 Exam Questions - 5 Groups] 57 Questions**

#### **G1A - General class control operator frequency privileges; primary and secondary allocations**

G1A01 [97.301(d)]

The 80, 40, 20, and 15m HF/MF amateur bands have portions where General class licensees cannot transmit.

G1A02 [97.305]

Phone operation is prohibited on the 30m band.

G1A03 [97.305]

Image transmission is prohibited on the 30m band.

G1A04 [97.303(h)]

The 60m amateur band is restricted to communication only on specific channels, rather than frequency ranges.

G1A05 [97.301(d)]

General class licensees prohibited from operating as control operator on frequencies between 7.125 MHz to 7.175 MHz.

G1A06 [97.303]

When the FCC rules designate the amateur service as a secondary user on a band, amateur stations must not cause harmful interference to primary users and must accept interference from primary users.

G1A07 [97.305(a)]

Stations with a General class control operator may transmit CW emissions on the entire 10m band.

G1A08 [97.301(b)]

The 80m, 40m, 20m, and 15m HF bands have segments exclusively allocated to Amateur Extra licensees.

G1A09 [97.301(d)]

21300 kHz is within the General class portion of the 15-meter band.

G1A10 [97.205(b)]

The portion above 29.5MHz of the 10-meter band is available for repeater use.

G1A11 [97.301]

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

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

G1B01 [97.15(a)]

The maximum height above ground for an antenna structure near a public use airport without requiring notification to the FAA and registration with the FCC is 200 feet.

G1B02 [97.203(b)]

No more than one beacon station may transmit in the same band from the same station location

G1B03 [97.3(a)(9)]

As identified in the FCC rules, a purpose of a beacon station is observation of propagation and reception.

G1B04 [97.113(c)]

All amateur stations are permitted to occasionally retransmit weather and propagation forecast information from US government stations.

G1B05 [97.111((5)(b)]

One-way transmissions to assist with learning the International Morse code are permitted, but unidentified test transmissions of less than 10 seconds in duration are not, nor are regular transmissions offering equipment for sale, even if intended for amateur radio use

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

With regard to radio antenna structures, state and local governments are required to reasonably accommodate Amateur Service communications and regulations must constitute the minimum practical to accommodate a legitimate purpose of the state or local entity.

G1B07 [97.113(a)(4)]

Abbreviations or procedural signals may be used in the amateur service only if they do not obscure the meaning of a message.

G1B08 [97.111(a)(1)]

It is permissible to communicate with amateur stations in countries outside the areas administered by the Federal Communications Commission when the contact is with amateurs in any country except those whose administrations have notified the ITU that they object to such communications.

G1B09 [97.203(d)]

Automatically controlled beacons are permitted only on HF frequencies 28.20MHz to 28.30MHz.

G1B10 [97.203(c)]

Beacon stations are limited to 100 watts PEP (Peak Envelope Power).

G1B11 [97.101(a)]

The FCC 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.

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

G1C01 [97.313(c)(1)]

The maximum transmitting power an amateur station may use on 10.140MHz is 200 watts PEP output.

G1C02 [97.313]

The maximum transmitting power an amateur station may use on the 12-meter band is 1500 watts PEP output.

G1C03 [97.303(h)(1)]

The maximum bandwidth permitted by FCC rules for amateur radio stations transmitting on USB (Upper Side-Band) frequencies in the 60-meter band is 2.8kHz.

G1C04 [97.303(i)]

When operating in the 60m band, the FCC rules require you to keep a record of the gain of your antenna if using an antenna other than a dipole.

G1C05 [97.313]

The limit for transmitter power on the 28 MHz band for a General Class control operator is 1500 watts PEP output.

G1C06 [97.313]

The limit for transmitter power on the 1.8 MHz band is 1500 watts PEP output.

G1C07 [97.309(a)(4)]

Before using a new digital protocol on the air, the technical characteristics of the protocol must be publicly documented.

G1C08 [97.307(f)(3)] - Question removed due to FCC lifting restriction on symbol rate

~~The maximum symbol rate permitted for RTTY or data emission transmitted at frequencies below 28MHz is 300 baud.~~

G1C09

What is the maximum power limit on the 60-meter band is ERP (Effective Radiated Power) of 100 watts PEP (Peak Envelope Power) with respect to a dipole.

G1C10 [97.305(c) and 97.307(f)(4)] - Question removed due to FCC lifting restriction on symbol rate

~~The maximum symbol rate permitted for RTTY or data emission transmissions on the 10-meter band is 1200 baud.~~

G1C11 [97.313]

PEP output from the transmitter is the measurement specified by FCC rules that regulate maximum power.

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

G1D01 [97.501, 97.505(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 may receive partial credit for the elements represented by an expired amateur radio license.

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

As an accredited Volunteer Examiner holding a General class operator license you may only administer Technician license examinations.

G1D03 [97.9(b)]

If you are a Technician class operator and have an unexpired Certificate of Successful Completion of Examination (CSCE) for General class privileges you may operate on any General or Technician class band segment.

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

At least three Volunteer Examiners of General class or higher are required to observe the administration of a Technician class license examination.

G1D05 [97.7]

When operating a US station by remote control from outside the country, a US operator/primary station license is required of the control operator.

G1D06 [97.119(f)(2)]

Until an upgrade to General class is shown in the FCC database, a Technician licensee must identify with "AG" after their call sign whenever they operate using General class frequency privileges.

G1D07 [97.509(b)(1)]

Volunteer Examiners are accredited by a Volunteer Examiner Coordinator.

G1D08 [97.509(b)(3)]

In order for a non-US citizen to be an accredited Volunteer Examiner, the person must hold an FCC granted amateur radio license of General class or above.

G1D09 [97.9(b)]

A Certificate of Successful Completion of Examination (CSCE) is valid for exam element credit for 365 days.

G1D10 [97.509(b)(2)]

The minimum age that one must be to qualify as an accredited Volunteer Examiner is 18 years.

G1D11 [97.505]

To obtain a new General class license after a previously held license has expired and the two-year grace period has passed the applicant must show proof of the appropriate expired license grant and pass the current Element 2 exam.

G1D12 [97.507]

When operating a station in South America by remote control over the internet from the US, only the regulations of the remote station's country apply.

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

G1E01 [97.115(b)(2)]

If a third party's amateur license has been revoked and not reinstated, they would be disqualified from participating in sending a message via an amateur station.

G1E02 [97.205(b)]

A 10-meter repeater may retransmit the 2-meter signal from a station that has a Technician class control operator only if the 10-meter repeater control operator holds at least a General class license.

G1E03 [97.221]

To conduct communications with a digital station operating under automatic control outside the automatic control band segments the station initiating the contact must be under local or remote control.

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

A licensed amateur radio operator must take specific steps to avoid harmful interference to other users or facilities when operating within one mile of an FCC Monitoring Station, when using a band where the Amateur Service is secondary, or when a station is transmitting spread spectrum emissions.

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

Messages sent to a third party in a country with which there is a Third-Party Agreement are restricted to messages relating to amateur radio, or remarks of a personal character, or messages relating to emergencies or disaster relief.

G1E06 [97.301, ITU Radio Regulations]

The frequency allocations of ITU region 2 apply to radio amateurs operating in North and South America.

G1E07 [97.111]

An amateur station may not communicate with non-licensed Wi-Fi stations in part of the 2.4GHz band.

G1E08 [97.313(j)]

The maximum PEP output allowed for spread spectrum transmissions is 10 Watts.

G1E09 [97.115] - Question Deleted (section not renumbered)

~~Under no circumstances are messages that are sent via digital modes exempt from Part 97 third-party rules that apply to other modes of communication.~~

G1E10 [97.101]

An amateur operator should normally avoid transmitting on 14.100, 18.110, 21.150, 24.930 and 28.200 MHz because a system of propagation beacon stations operates on those frequencies.

G1E11 [97.221, 97.305]

Automatically controlled stations transmitting RTTY or data emissions may communicate with other automatically controlled digital stations anywhere in the 6-meter or shorter wavelength bands, and in limited segments of some of the HF bands.

G1E12 [97.115]

Third-party messages may be transmitted via remote control under any circumstances in which third party messages are permitted by FCC rules.

## **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

Upper sideband is the mode most commonly used for voice communications on frequencies of 14 MHz or higher.

G2A02

Lower sideband is the mode most commonly used for voice communications on the 160-, 75-, and 40-meter bands.

G2A03

Upper sideband is the mode most commonly used for SSB voice communications in the VHF and UHF bands.

G2A04

Upper sideband is the mode most commonly used for voice communications on the 17- and 12-meter bands.

G2A05

Single sideband is the mode of voice communication most commonly used on the HF amateur bands.

G2A06

An advantage of using single sideband, as compared to other analog voice modes on the HF amateur bands is less bandwidth used and greater power efficiency.

G2A07

Single sideband (SSB) means only one sideband is transmitted; the other sideband and carrier are suppressed.

G2A08

The recommended way to break into a phone contact is to say your call sign once.

G2A09

Most amateur stations use lower sideband on the 160-, 75-, and 40-meter bands because it is commonly accepted amateur practice.

G2A10

VOX operation versus PTT operation allows "hands free" operation.

G2A11

Generally, any stations outside the lower 48 states should respond to a station in the contiguous 48 states calling "CQ DX".

G2A12

Transmit audio or microphone gain is the control typically adjusted for proper ALC setting on a single sideband transceiver.

## **G2B - Operating effectively; band plans; drills and emergencies; RACES operation**

G2B01 [97.101(b), (c)]

Except during emergencies, no amateur station has priority access to any frequency.

G2B02

The first thing you should do if you are communicating with another amateur station and hear a station in distress break in is to acknowledge the station in distress and determine what assistance may be needed.

G2B03

If propagation changes during a contact creating interference from other stations using the frequency good amateur practice is to attempt to resolve the interference problem with the other stations in a mutually acceptable manner.

G2B04

When selecting a CW transmitting frequency, a minimum separation of 150Hz to 500HZ should be used to minimize interference to other stations.

G2B05

When selecting an SSB transmitting frequency, a minimum separation of 2kHz to 3kHz should be used to minimize interference to stations on adjacent frequencies.

G2B06

You can avoid harmful interference on an apparently clear frequency by 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 before calling CQ on CW or phone.

G2B07

Following the voluntary band plan complies with commonly accepted amateur practice when choosing a frequency on which to initiate a call.

G2B08

The voluntary band plan restricts US stations transmitting within the 48 contiguous states in the 50.1 MHz to 50.125 MHz band segment to contacts with stations not within the 48 contiguous states.

G2B09 [97.407(a)]

Only a person holding an FCC-issued amateur operator license may be the control operator of an amateur station transmitting in RACES to assist relief operations during a disaster.

G2B10

Having a backup frequency in case of interference or poor conditions is good amateur practice for net management.

G2B11 [97.407(d)(4)]

Without special authorization RACES training drills and tests may be routinely conducted no more than 1 hour per week.

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

G2C01

Full break-in CW operation (QSK) means transmitting stations can receive between code characters and elements.

G2C02

If a CW station sends "QRS you should send slower."

G2C03

When a CW operator sends "KN" at the end of a transmission it means they are listening only for a specific station or stations.

G2C04

The Q signal "QRL?" means "Are you busy?" or "Is this frequency in use?"

G2C05

The best speed to use when answering a CQ in Morse code is the fastest speed at which you are comfortable copying, but no faster than the CQ.

G2C06

In CW operation the term "zero beat" means matching the transmit frequency to the frequency of a received signal.

G2C07

When sending CW, a "C" when added to the RST report means a chirpy or unstable signal.

G2C08

AR is the prosign sent to indicate the end of a formal message when using CW.

G2C09

The Q signal "QSL" means I have received and understood.

G2C10

The Q signal "QRN" means I am troubled by static.

G2C11

The Q signal "QRV" means I am ready to receive.

## **G2D - Volunteer Monitor Program; HF operations**

G2D01

The Volunteer Monitor Program are amateur volunteers who are formally enlisted to monitor the airwaves for rules violations.

G2D02

Objectives of the Volunteer Monitor Program are to encourage amateur radio operators to self-regulate and comply with the rules.

G2D03

To localize a station whose continuous carrier is holding a repeater on in their area, Volunteer Monitors may compare beam headings on the repeater input from their home locations with that of other Volunteer Monitors.



G2D04

An azimuthal projection map is a map that shows true bearings and distances from a specific location.

G2D05

You can indicate you are looking for an HF contact with any station by repeating "CQ" a few times, followed by "this is," then your call sign a few times, then pause to listen, repeat as necessary.

G2D06

When making a "long-path" contact with another station a directional antenna is pointed 180 degrees from the station's short-path heading.

G2D07

Alpha, Bravo, Charlie, Delta are examples of the NATO Phonetic Alphabet.

G2D08

Many amateurs keep a station log to help with a reply if the FCC requests information about your station.

G2D09

When participating in a contest on HF frequencies you are required to identify your station according to normal FCC regulations.

G2D10

QRP operation is low-power transmit operation.

G2D11

Signal reports are typically exchanged at the beginning of an HF contact to allow each station to operate according to conditions.

## **G2E - Digital mode operating procedures**

G2E01

LSB is the mode normally used when sending RTTY signals via AFSK with an SSB transmitter.

G2E02

VARA is a digital protocol used with Winlink.

G2E03

Frequent retries or timeouts, long pauses in message transmission, or failure to establish a connection between stations may result from other signals interfering with a PACTOR or VARA transmission.

G2E04

When choosing a transmitting frequency to answer a station calling CQ using FT8 good practice is to find a clear frequency during the alternate time slot to the calling station.

G2E05

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

G2E06

170 Hz is the most common frequency shift for RTTY emissions in the amateur HF bands.

G2E07

Computer time accurate to within approximately 1 second is required when using FT8.

G2E08

Most digital mode operations are commonly found in the segment between 14.070 MHz and 14.100 MHz of the 20-meter band.

G2E09

Joining an existing PACTOR contact is not possible, because PACTOR connections are limited to two stations.

G2E10

Transmitting a connect message on the station's published frequency is a way to establish contact with a digital messaging system gateway station.

G2E11

The primary purpose of an Amateur Radio Emergency Data Network (AREDN) mesh network is to provide high-speed data services during an emergency or community event.

G2E12

Winlink is an amateur radio wireless network to send and receive email on the internet, a form of Packet Radio, and a wireless network capable of both VHF and HF band operation.

G2E13

Another name for a Winlink Remote Message Server is a gateway.

G2E14

If you cannot decode an RTTY or other FSK signal even though it is apparently tuned in properly, the mark and space frequencies may be reversed, you may have selected the wrong baud rate, or you may be listening on the wrong sideband.

G2E15

A common location for FT8 is approximately 14.074MHz to 14.077MHz.

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

### **G3A - Sunspots and solar radiation; geomagnetic field and stability indices**

G3A01

Higher sunspot numbers generally indicate a greater probability of good propagation at higher frequencies.

G3A02

A sudden ionospheric disturbance disrupts signals on lower frequencies more than those on higher frequencies.

G3A03

The increased ultraviolet and X-ray radiation from a solar flare takes about 8 minutes to affect radio propagation on Earth.

G3A04

15 meters, 12 meters, and 10 meters are the least reliable bands for long-distance communications during periods of low solar activity.

G3A05

The solar flux index is a measure of solar radiation with a wavelength of 10.7 centimeters.

G3A06

A geomagnetic storm is a temporary disturbance in Earth's geomagnetic field.

G3A07

The 20-meter band usually supports worldwide propagation at any point in the solar cycle during daylight hours.

G3A08

A geomagnetic storm can affect HF propagation by degrading high-latitude HF propagation.

G3A09

High geomagnetic activity can benefit radio communications by creating auroras that can reflect VHF signals.

G3A10

HF propagation conditions can vary periodically in a 26- to 28-day cycle due to rotation of the Sun's surface layers around its axis.

G3A11

It takes a coronal mass ejection 15 hours to several days to affect radio propagation on Earth.

G3A12

The K-index measures the short-term stability of Earth's geomagnetic field.

G3A13

The A-index measures the long-term stability of Earth's geomagnetic field.

G3A14

The charged particles that reach Earth from solar coronal holes generally affect long distance radio communication by disturbing HF communication.

### **G3B - Maximum Usable Frequency; Lowest Usable Frequency; short path and long path propagation; determining propagation conditions; ionospheric refraction**

G3B01

A characteristic of skywave signals arriving at your location by both short-path and long-path propagation is a slightly delayed echo might be heard.

G3B02

Factors affect the MUF include path distance and location, time of day and season, and solar radiation and ionospheric disturbances.

G3B03

Frequencies just below the MUF will have the least attenuation for long-distance skip propagation.

G3B04

A way to determine current propagation on a desired band from your station is to use a network of automated receiving stations on the internet to see where your transmissions are being received.

G3B05

The ionosphere refracts radio waves frequencies below the MUF and above the LUF back to Earth.

G3B06

Radio waves with frequencies below the LUF are usually attenuated before reaching the destination.

G3B07

LUF stands for the Lowest Usable Frequency for communications between two specific points.

G3B08

MUF stands for the Maximum Usable Frequency for communications between two points.

G3B09

The approximate maximum distance along the Earth's surface normally covered in one hop using the F2 region is 2,500 miles.

G3B10

The approximate maximum distance along the Earth's surface normally covered in one hop using the E region is 1,200 miles.

G3B11

When the LUF exceeds the MUF propagation via ordinary skywave communications is not possible over that path.

G3B12

High levels of atmospheric noise or static is typical of the lower HF frequencies during the summer.

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

G3C01

The D region is the ionospheric region is closest to the surface of Earth.

G3C02

The term "critical frequency" at a given incidence angle is the highest frequency which is refracted back to Earth.

G3C03

Skip propagation via the F2 region is longer than that via the other ionospheric regions because it is the highest.

G3C04

The term "critical angle" as applied to radio wave propagation means the highest takeoff angle that will return a radio wave to Earth under specific ionospheric conditions.

G3C05

Long-distance communication on the 40-, 60-, 80-, and 160-meter bands more difficult during the day because the D region absorbs signals at these frequencies during daylight hours.

G3C06

A characteristic of HF scatter is signals will have a fluttering sound.

G3C07

HF scatter signals often sound distorted because energy is scattered into the skip zone through several different paths.

G3C08

HF scatter signals in the skip zone usually weak because only a small part of the signal energy is scattered into the skip zone.

G3C09

Scatter propagation allows signals to be heard in the transmitting station's skip zone.

G3C10

Near vertical incidence skywave (NVIS) propagation is short distance MF or HF propagation at high elevation angles.

G3C11

The D region is the ionospheric region which is the most absorbent of signals below 10 MHz during daylight hours.

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

### **G4A - Station configuration and operation**

G4A01

The purpose of the notch filter found on many HF transceivers is to reduce interference from carriers in the receiver passband.

G4A02

The benefit of using the opposite or "reverse" sideband when receiving CW is it may be possible to reduce or eliminate interference from other signals.

G4A03

A noise blanker works by reducing receiver gain during a noise pulse.

G4A04

The correct setting of a vacuum-tube RF power amplifier's TUNE control results in a pronounced dip in the plate current.

G4A05

An automatic level control (ALC) is used with an RF power amplifier to prevent excessive drive.

G4A06

The purpose of an antenna tuner is to increase power transfer from the transmitter to the feed line.

G4A07

As a receiver's noise reduction control level is increased received signals may become distorted.

G4A08

The correct adjustment for the LOAD or COUPLING control of a vacuum tube RF power amplifier results in desired power output without exceeding maximum allowable plate current.

G4A09

The purpose of delaying RF output after activating a transmitter's keying line to an external amplifier is to allow time for the amplifier to switch the antenna between the transceiver and the amplifier output.

G4A10

The function of an electronic keyer is automatic generation of dots and dashes for CW operation.

G4A11

The ALC system should be inactive when transmitting AFSK data signals because the ALC action distorts the signal.

G4A12

A common use of the dual-VFO feature on a transceiver is to transmit on one frequency and listen on another.

G4A13

The purpose of using a receive attenuator is to prevent receiver overload from strong incoming signals.

## **G4B - Tests and test equipment**

G4B01

An oscilloscope is an item of test equipment which contains horizontal and vertical channel amplifiers.

G4B02

An advantage of an oscilloscope versus a digital voltmeter is complex waveforms can be measured.

G4B03

An oscilloscope is a better instrument to use for checking the keying waveform of a CW transmitter than a field strength meter, a sidetone monitor, or a wave meter.

G4B04

The attenuated RF output of the transmitter is the signal source connected to the vertical input of an oscilloscope when checking the RF envelope pattern of a transmitted signal.

G4B05

Voltmeters have high input impedance because it decreases the loading on circuits being measured.

G4B06

An advantage of a digital multimeter compared to an analog multimeter is higher precision.

G4B07

Two non-harmonically related audio signals are used to conduct a two-tone test.

G4B08

A two-tone test analyzes a transmitter's linearity.

G4B09

An analog multimeter is preferred to a digital multimeter when adjusting circuits for maximum or minimum values.

G4B10

Standing wave ratio can be determined with a directional wattmeter.

G4B11

Antenna and feed line must be connected to an antenna analyzer when it is being used for SWR measurements.

G4B12

Strong signals from nearby transmitters can affect an antenna analyzer due to received power interfering with SWR readings.

G4B13

An antenna analyzer can measure the impedance of coaxial cable, but not the front-to-back ratio of an antenna, power output from a transmitter, or gain of a directional antenna.

## **G4C - Interference to consumer electronics; grounding and bonding**

G4C01

A bypass capacitor might be useful in reducing RF interference to audio frequency circuits.

G4C02

Arcing at a poor electrical connection could be a cause of interference covering a wide range of frequencies.

G4C03

Distorted speech is heard from an audio device experiencing RF interference from a single sideband phone transmitter.

G4C04

On-and-off humming or clicking is heard from an audio device experiencing RF interference from a CW transmitter.

G4C05

A possible cause of high voltages that produce RF burns is the ground wire having high impedance on that frequency.

G4C06

A possible effect of a resonant ground connection is high RF voltages on the enclosures of station equipment.

G4C07

Soldered joints not be used in lightning protection ground connections because a soldered joint will likely be destroyed by the heat of a lightning strike.

G4C08

Placing a ferrite choke on an audio cable would reduce RF interference caused by common-mode current on the cable.

G4C09

The effects of ground loops be minimized by bond equipment enclosures together.

G4C10

A symptom caused by a ground loop in your station's audio connections is you might receive reports of "hum" on your station's transmitted signal.

G4C11

Bonding all equipment enclosures together is a technique to help minimize RF "hot spots" in an amateur station.

G4C12

All metal enclosures of station equipment must be grounded because it ensures that hazardous voltages cannot appear on the chassis.



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

G4D01

The purpose of a speech processor in a transceiver is to increase the apparent loudness of transmitted voice signals.

G4D02

A speech processor increases average power of a single sideband phone signal.

G4D03

An incorrectly adjusted speech processor can result in distorted speech, excess intermodulation products, and excessive background noise.

G4D04

An S meter measures received signal strength.

G4D05

Assuming a properly calibrated S meter, a signal that reads 20 dB over S9 is 100 times more powerful than one that reads S9 on a receiver.

G4D06

One S unit typically represents a change in signal strength of 6 dB.

G4D07

The power output of a transmitter must be raised approximately 4 times to change the S meter reading on a distant receiver from S8 to S9.

G4D08

When the displayed carrier frequency is set to 7.178MHz a 3kHz LSB signal will occupy the frequency range from 7.175MHz to 7.178MHz.

G4D09

With the displayed carrier frequency set to 14.347MHz, a 3kHz USB signal will occupy a frequency range from 14.347MHz to 14.350MHz.

G4D10

When using 3kHz wide LSB your displayed carrier frequency should be at least 3kHz above the lower edge of the band's phone segment.

G4D11

When using 3kHz wide USB your displayed carrier frequency should be at least 3kHz below the upper edge of the band's phone segment.

## **G4E - Mobile and portable HF stations; alternative energy source operation**

G4E01

The purpose of a capacitance hat on a mobile antenna is to electrically lengthen a physically short antenna.

G4E02

The purpose of a corona ball on an HF mobile antenna is to reduce RF voltage discharge from the tip of the antenna while transmitting.

G4E03

Direct, fused power connections to the battery using heavy-gauge wire would be the best for a 100-watt HF mobile installation.

G4E04

DC power for a 100-watt HF transceiver not be supplied by a vehicle's auxiliary power socket because the socket's wiring may be inadequate for the current drawn by the transceiver.

G4E05

Efficiency of the electrically short antenna is what most limits an HF mobile installation.

G4E06

One disadvantage of using a shortened mobile antenna as opposed to a full-size antenna is operating bandwidth may be very limited.

G4E07

An HF transceiver installed in a vehicle may suffer receive interference caused by the battery charging system, the fuel delivery system, or the control computers.

G4E08

The individual cells in a solar panel are connected together in series-parallel configuration.

G4E09

The approximate open-circuit voltage from a fully illuminated silicon photovoltaic cell is 0.5VDC.

G4E10

A series diode should be connected between a solar panel and a storage battery that is being charged by the panel to prevent discharge of the battery through the panel during times of low or no illumination.

G4E11

A precaution which should be taken when connecting a solar panel to a lithium iron phosphate battery is 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

When inductive and capacitive reactance are equal in a series LC circuit resonance causes impedance to be very low.

G5A02

Reactance is opposition to the flow of alternating current caused by capacitance or inductance.

G5A03

Reactance is opposition to the flow of alternating current in an inductor.

G5A04

Reactance is opposition to the flow of alternating current in a capacitor.

G5A05

As the frequency of the applied AC increases, the reactance of an inductor increases.

G5A06

As the frequency of the applied AC increases, the reactance of a capacitor decreases.

G5A07

Admittance is the term for the inverse of impedance.

G5A08

Impedance is the ratio of voltage to current.

G5A09

The Ohm is the unit used to measure reactance

G5A10

A transformer, a Pi-network, or a length of transmission line can be used for impedance matching at radio frequencies.

G5A11

X is the letter is used to represent reactance.

G5A12

In an LC circuit at resonance 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

Approximately 3dB change represents a factor of two increase or decrease in power.

G5B02

The total current in a circuit of parallel resistors equals the sum of the currents through each of the individual branch currents.

G5B03

200 watts of electrical power are consumed if 400VDC is supplied to an 800-ohm load.

G5B04

2.4 watts of electrical power are consumed by a 12VDC light bulb that draws 0.2 amperes.

G5B05

Approximately 61 milliwatts are consumed when a current of 7.0 milliamperes flows through a 1,250-ohm resistance.

G5B06

100 watts PEP are produced by 200 volts peak-to-peak across a 50-ohm dummy load.  
? Not produced, but consumed ?

G5B07

The RMS value of an AC signal produces the same power dissipation in a resistor as a DC voltage of the same value.

G5B08

339.4 volts is the peak-to-peak voltage of a sine wave with an RMS voltage of 120 volts.

G5B09

12 volts is the RMS voltage of a sine wave with a value of 17 volts peak.

G5B10

20.6 percent of power loss is equivalent to a loss of 1dB.

G5B11

1.00 is the ratio of PEP to average power for an unmodulated carrier.

G5B12

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

G5B13

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

G5B14

625 watts is the output PEP of 500 volts peak-to-peak across a 50-ohm load.

## **G5C - Resistors, capacitors, and inductors in series and parallel; transformers**

G5C01

Mutual inductance causes a voltage to appear across the secondary winding of a transformer when an AC voltage source is connected across its primary winding.

G5C02

If an output signal is applied to the secondary winding of a 4:1 voltage step-down transformer instead of the primary winding the input voltage is multiplied by 4.

G5C03

The total resistance of a 10-, a 20-, and a 50-ohm resistor connected in parallel is 5.9 ohms.

G5C04

The approximate total resistance of a 100- and a 200-ohm resistor in parallel is 67 ohms.

G5C05

The primary winding wire of a voltage step-up transformer is usually a larger size than that of the secondary winding to accommodate the higher current of the primary.

G5C06

The voltage output of a transformer with a 500-turn primary and a 1500-turn secondary when 120VAC is applied to the primary is 360 volts.

G5C07

A 3.5 to 1 transformer turns ratio matches an antenna's 600-ohm feed point impedance to a 50-ohm coaxial cable.

G5C08

The equivalent capacitance of two 5.0-nanofarad capacitors and one 750-picofarad capacitor connected in parallel is 10.750 nanofarads.

G5C09

The capacitance of three 100-microfarad capacitors connected in series is 33.3 microfarads.

G5C10

The inductance of three 10-millihenry inductors connected in parallel is 3.3 millihenries.

G5C11

The inductance of a circuit with a 20-millihenry inductor connected in series with a 50-millihenry inductor is 70 millihenries.

G5C12

The capacitance of a 20-microfarad capacitor connected in series with a 50-microfarad capacitor is 14.3 microfarads.

G5C13

Another capacitor should be connected in parallel increase capacitance of a capacitor.

G5C14

Another inductor should be connected in series to an inductor to increase inductance.

## **SUBELEMENT G6 - CIRCUIT COMPONENTS [2 Exam Questions - 2 Groups]**

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

G6A01

The minimum allowable discharge voltage for maximum life of a standard 12-volt lead-acid battery is 10.5 volts.

G6A02

An advantage of batteries with low internal resistance is high discharge current.

G6A03

The approximate forward threshold voltage of a germanium diode is 0.3 volts.

G6A04

High capacitance for a given volume is characteristic of an electrolytic capacitor.

G6A05

The approximate forward threshold voltage of a silicon junction diode is 0.7 volts.

G6A06

Wire-wound resistors should not be used in RF circuits because the resistor's inductance could make circuit performance unpredictable.

G6A07

Saturation and cutoff are the operating points for a bipolar transistor used as a switch.

G6A08

Comparatively low cost is characteristic of low voltage ceramic capacitors.

G6A09

MOSFET construction can be described as having the gate separated from the channel by a thin insulating layer.

G6A10

The control grid is the element of a vacuum tube which regulates the flow of electrons between cathode and plate.

G6A11

When an inductor is operated above its self-resonant frequency it becomes capacitive.

G6A12

The primary purpose of a screen grid in a vacuum tube is to reduce grid-to-plate capacitance.

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

G6B01

The performance of a ferrite core at different frequencies is determined by the composition, or "mix," of materials used.

G6B02

The term MMIC means Monolithic Microwave Integrated Circuit.

G6B03

An advantage of CMOS integrated circuits compared to TTL integrated circuits is low power consumption.

G6B04

A typical upper frequency limit for low SWR operation of 50-ohm BNC connectors is 4GHz.

G6B05

Advantages of using a ferrite core toroidal inductor are large values of inductance may be obtained, the magnetic properties of the core may be optimized for a specific range of frequencies, and most of the magnetic field is contained in the core.

G6B06

An integrated circuit operational amplifier is an analog device.

G6B07

A type N connector can be described as a moisture-resistant RF connector useful to 10GHz.

G6B08

An LED is forward biased when emitting light.

G6B09 - This question has been withdrawn by the Question Pool Committee

~~A liquid crystal display has higher contrast in high ambient lighting compared to an LED display.~~

G6B10

A ferrite bead or core reduces common-mode RF current on the shield of a coaxial cable by creating an impedance in the current's path.

G6B11

An SMA connector is a small threaded connector suitable for signals up to several GHz.

G6B12

RCA Phono connector types are commonly used for low frequency or dc signal connections to a transceiver.

## **SUBELEMENT G7 - PRACTICAL CIRCUITS [3 Exam Questions - 3 Groups]**

### **G7A - Power supplies; schematic symbols**

G7A01

The function of a power supply bleeder resistor is to discharge the filter capacitors when power is removed.

G7A02

Capacitors and inductors are components used in a power supply filter network.

G7A03

A full-wave rectifier circuit uses two diodes and a center-tapped transformer.

G7A04

A characteristic of a half-wave rectifier in a power supply is only one diode is required.

G7A05

180 degrees of the AC cycle is converted to DC by a half-wave rectifier.

G7A06

360 degrees of the AC cycle is converted to DC by a full-wave rectifier.


G7A07

The output waveform of an unfiltered full-wave rectifier connected to a resistive load is a series of DC pulses at twice the frequency of the AC input.

G7A08

A characteristic of a switchmode power supply as compared to a linear power supply is high-frequency operation allows the use of smaller components.

G7A09

In figure G7-1 symbol 1 represents a field effect transistor. 


G7A10

Symbol 5 in figure G7-1 represents a Zener diode. 

G7A11

Symbol 2 in figure G7-1 represents an NPN junction transistor. 

G7A12

Symbol 6 in Figure G7-1 represents a solid core transformer. 

G7A13

Symbol 7 in Figure G7-1 represents a tapped inductor. 

### **G7B - Digital circuits; amplifiers and oscillators**

G7B01

The purpose of neutralizing an amplifier is to eliminate self-oscillations.

G7B02

Class C amplifiers have higher efficiency than Class A, Class B or Class AB amplifiers.



G7B03

The function of a two-input AND gate can be described as output is high only when both inputs are high.

G7B04

In a Class A amplifier the amplifying device conducts 100% of the time.

G7B05

A 3-bit binary counter has 8 states.

G7B06

A shift register is a clocked array of circuits that passes data in steps along the array.

G7B07

A filter and an amplifier operating in a feedback loop are basic components of a sine wave oscillator.

G7B08

The efficiency of an RF power amplifier is determined by dividing the RF output power by the DC input power.

G7B09

The frequency of an LC oscillator is determined by the inductance and capacitance in the tank circuit.

G7B10

A linear amplifier can be described as an amplifier in which the output preserves the input waveform.

G7B11

A Class C power stage would be appropriate for amplifying an FM modulated signal, but not for SSB or AM.

## **G7C - Transceiver design; filters; oscillators; digital signal processing (DSP)**

G7C01

A filter circuit is used to select one of the sidebands from a balanced modulator.

G7C02

Double-sideband modulated RF is the output produced by a balanced modulator.

G7C03

One reason to use an impedance matching transformer at a transmitter output is to present the desired impedance to the transmitter and feed line.

G7C04

A product detector is used in a single sideband receiver to extract the modulated signal.

G7C05

A characteristic of a direct digital synthesizer (DDS) is variable output frequency with the stability of a crystal oscillator.

G7C06

An advantage of a digital signal processing (DSP) filter compared to an analog filter is a wide range of filter bandwidths and shapes can be created.

G7C07

Insertion loss is the term which specifies a filter's attenuation inside its passband.

G7C08

Receiver sensitivity can be affected by input amplifier gain, demodulator stage bandwidth, and input amplifier noise figure.

G7C09

The phase difference between the I and Q RF signals that software-defined radio (SDR) equipment uses for modulation and demodulation is 90 degrees.

G7C10

An advantage of using I-Q modulation with software-defined radios (SDRs) is all types of modulation can be created with appropriate processing.

G7C11

Filtering, detection, and modulation are functions performed by software in a software-defined radio (SDR).

G7C12

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

G7C13

Ultimate rejection is the term which specifies a filter's maximum ability to reject signals outside its passband.

G7C14

The bandwidth of a band-pass filter is measured between the upper and lower half-power frequencies.

## **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

Direct binary FSK modulation is generated by changing an oscillator's frequency directly with a digital control signal.

G8A02

Phase modulation is the name of the process that changes the phase angle of an RF signal to convey information.

G8A03

Frequency modulation is the name of the process that changes the instantaneous frequency of an RF wave to convey information.

G8A04

Phase modulation is the emission is produced by a reactance modulator connected to a transmitter RF amplifier stage.

G8A05

Amplitude modulation is the type of modulation which varies the instantaneous power level of the RF signal.

G8A06

Some characteristics of QPSK31 are it is sideband sensitive, its encoding provides error correction, and its bandwidth is approximately the same as BPSK31.

G8A07

Single sideband phone emissions uses narrower bandwidth than vestigial sideband, phase modulation, or frequency modulation.

G8A08

An effect of overmodulation is excessive bandwidth.

G8A09

T8 uses 8-tone frequency shift keying modulation.

G8A10

When referring to an amplitude-modulated phone signal the term "flat-topping" means signal distortion caused by excessive drive or speech levels.

G8A11

The modulation envelope of an AM signal is the waveform created by connecting the peak values of the modulated signal.

G8A12

QPSK modulation is modulation in which digital data is transmitted using 0-, 90-, 180- and 270- degrees phase shift to represent pairs of bits.

G8A13

A link budget is the sum of transmit power and antenna gains minus system losses as seen at the receiver.

G8A14

Link margin is the difference between received power level and minimum required signal level at the input to the receiver.

## **G8B - Frequency changing; bandwidths of various modes; deviation; intermodulation**

G8B01

Local oscillator mixer input is varied or tuned to convert signals of different frequencies to an intermediate frequency (IF).

G8B02

The term for interference from a signal at twice the IF frequency from the desired signal is image response.

G8B03

Another term for the mixing of two RF signals is heterodyning.

G8B04

The stage in a VHF FM transmitter that generates a harmonic of a lower frequency signal to reach the desired operating frequency is the multiplier.

G8B05

Odd-order intermodulation products are closest to the original signal frequencies.

G8B06

The total bandwidth of an FM phone transmission having 5kHz deviation and 3kHz modulating frequency is 16kHz.

G8B07

The frequency deviation for a 12.21MHz reactance modulated oscillator in a 5kHz deviation, 146.52MHz FM phone transmitter is 416.7Hz.

G8B08

It is important to know the duty cycle of the mode you are using when transmitting because some modes have high duty cycles that could exceed the transmitter's average power rating.

G8B09

It is good to match receiver bandwidth to the bandwidth of the operating mode because it results in the best signal-to-noise ratio.

G8B10

Higher transmitted symbol rates require wider bandwidth.

G8B11

The sum and difference frequencies of a mixer's Local Oscillator (LO) and RF input frequencies are found in the output.

G8B12

Intermodulation is the process which combines two signals in a non-linear circuit to produce unwanted spurious outputs.

G8B13

$2F_1 - F_2$  is an odd-order intermodulation product of frequencies  $F_1$  and  $F_2$ .

## **G8C - Digital emission modes**

G8C01

On the 2.4 GHz band amateurs share channels with the unlicensed Wi-Fi service.

G8C02

WSPR is a digital mode used as a low-power beacon for assessing HF propagation.

G8C03

The header part of a packet radio frame contains the routing and handling information.

G8C04

Baudot code can be described as a 5-bit code with additional start and stop bits.

G8C05

In an ARQ mode, a NAK response to a transmitted packet is a request for retransmission of the packet.

G8C06

The connection is dropped as a result of a failure to exchange information due to excessive transmission attempts when using an ARQ mode.

G8C07

FT8 is a narrow-band digital mode which can receive signals with very low signal-to-noise ratios.

G8C08

In PSK31 upper case letters use longer Varicode bit sequences and thus slow down transmission.

G8C09

In mesh network microwave nodes if one node fails, a packet may still reach its target station via an alternate node.

G8C10

Forward error correction (FEC) allows the receiver to correct data errors by transmitting redundant information with the data.

G8C11

The two separate frequencies of a Frequency Shift Keyed (FSK) signal are identified as mark and space.

G8C12

Varicode is used for sending characters in a PSK31 signal.

G8C13

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

G8C14

On a waterfall display frequency is shown horizontal, signal strength is intensity, time is vertical.

G8C15

An FT8 signal report of +3 means the signal-to-noise ratio is equivalent to +3dB in a 2.5 kHz bandwidth.

G8C16

DMR, D-STAR, and SystemFusion provide digital voice modes.

## **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

The distance between the centers of the conductors and the radius of the conductors determine the characteristic impedance of a parallel conductor feed line.

G9A02

High Standing Wave Ratio (SWR) increases loss in a lossy transmission line.

G9A03

The nominal characteristic impedance of "window line" transmission line is 450 ohms.

G9A04

A difference between feed line impedance and antenna feed point impedance causes reflected power at an antenna's feed point.

G9A05

The attenuation of coaxial cable increases with increasing frequency.

G9A06

RF feed line loss is usually expressed in decibels per 100 feet.

G9A07

To prevent standing waves on a feed line connected to an antenna the antenna feed point impedance must be matched to the characteristic impedance of the feed line.

G9A08

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, the resulting SWR on the feed line is 5:1.

G9A09

A 4:1 standing wave ratio results from connecting a 50-ohm feed line to a 200-ohm resistive load.

G9A10

A 5:1 standing wave ratio results from connecting a 50-ohm feed line to a 10-ohm resistive load?

G9A11

Higher loss in a transmission line reduces SWR measured at the input to the transmission line.

### **G9B - Basic dipole and monopole antennas**

G9B01

A characteristic of connecting a random-wire HF antenna directly to the transmitter is station equipment may carry significant RF current.

G9B02

Sloping the radials downward is a common way to adjust the feed point impedance of an elevated quarter-wave ground-plane vertical antenna to be approximately 50 ohms.

G9B03

Omnidirectional in azimuth best describes the radiation pattern of a quarter-wave ground-plane vertical antenna.

G9B04

The radiation pattern of a dipole antenna in free space in a plane containing the conductor is a figure-eight at right angles to the antenna.

G9B05

The azimuthal radiation pattern of a horizontal dipole HF antenna is almost omnidirectional if the antenna is less than  $1/2$  wavelength high.

G9B06

The radial wires of a ground-mounted vertical antenna system should be placed on the surface or buried a few inches below the ground.

G9B07

The feed point impedance of a horizontal  $1/2$  wave dipole antenna steadily decreases as the antenna height is reduced to  $1/10$  wavelength above ground.

G9B08

The feed point impedance of a  $1/2$  wave dipole steadily increases as the feed point is moved from the center toward the ends.

G9B09

An advantage of using a horizontally polarized as compared to a vertically polarized HF antenna is lower ground losses.

G9B10

The approximate length for a  $1/2$  wave dipole antenna cut for 14.250 MHz is 33 feet.

G9B11

The approximate length for a  $1/2$  wave dipole antenna cut for 3.550 MHz is 132 feet.

G9B12

The approximate length for a  $1/4$  wave monopole antenna cut for 28.5 MHz is 8 feet.

## **G9C - Directional antennas**

G9C01

Larger-diameter elements would increase the bandwidth of a Yagi antenna.

G9C02

The approximate length of the driven element of a Yagi antenna is  $1/2$  wavelength.

G9C03

The reflector on a three-element Yagi antenna is longer than the driven element, and the director is shorter.

G9C04

The antenna gain in dBi is 2.15 dB higher compared to gain stated in dBd for the same antenna.

G9C05

The primary effect of increasing boom length and adding directors to a Yagi antenna is gain increases.



G9C06 - This question has been withdrawn by the Question Pool Committee

~~The forward gain of a two-element quad antenna is about the same as the forward gain of a three-element Yagi antenna.~~

G9C07

In reference to a Yagi antenna, "front-to-back ratio" means the power radiated in the major lobe compared to that in the opposite direction.

G9C08

The "main lobe" of a directive antenna means the direction of maximum radiated field strength from the antenna.

G9C09

The gain of two three-element, horizontally polarized Yagi antennas spaced vertically  $1/2$  wavelength apart is typically approximately 3dB higher than the gain of a single three-element Yagi

G9C10

The physical length of the boom, the number of elements on the boom, and the spacing of each element along the boom can be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth of a Yagi antenna.

G9C11

A beta or hairpin match is a shorted transmission line stub placed at the feed point of a Yagi antenna to provide impedance matching.

G9C12

A characteristic of using a gamma match with a Yagi antenna is it does not require the driven element to be insulated from the boom.

## **G9D - Specialized antenna types and applications**

G9D01

A horizontal dipole placed between  $1/10$  and  $1/4$  wavelength above the ground will be more effective as a near vertical incidence skywave (NVIS) antenna for short-skip communications on 40 meters during the day than a vertical antenna placed between  $1/4$  and  $1/2$  wavelength above the ground, a horizontal dipole placed at approximately  $1/2$  wavelength above the ground, or a vertical dipole placed at approximately  $1/2$  wavelength above the ground.

G9D02

The feed point impedance of an end-fed half-wave antenna is very high.

G9D03

The maximum radiation from a VHF/UHF "halo" antenna is omnidirectional in the plane of the halo.

G9D04

The primary function of antenna traps is to enable multiband operation.

G9D05

An advantage of vertically stacking horizontally polarized Yagi antennas is it narrows the main lobe in elevation.

G9D06

Wide bandwidth is an advantage of a log-periodic antenna.

G9D07

A log-periodic antenna can be described as having element length and spacing vary logarithmically along the boom.

G9D08

A "screwdriver" mobile antenna adjusts its feed point impedance by varying the base loading inductance.

G9D09

What The primary use of a Beverage antenna is for directional receiving for low HF bands.

G9D10

An electrically small loop (less than 1/3 wavelength in circumference) has nulls broadside to its radiation pattern.

G9D11

A disadvantage of multiband antennas is they have poor harmonic rejection.

G9D12

The common name of a dipole with a single central support is an inverted V.

G9D13 - This question has been withdrawn by the Question Pool Committee

~~The combined vertically and horizontally polarized radiation pattern of a multi-wavelength, horizontal loop antenna is virtually omnidirectional with a lower peak vertical radiation angle than a dipole.~~

## **SUBELEMENT G0 - ELECTRICAL AND RF SAFETY [2 Exam Questions - 2 Groups]**

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

G0A01

One way that RF energy can affect human body tissue is it heats body tissue.

G0A02

Duty cycle, frequency, and power density are all factors used to determine RF exposure from a transmitted signal.

G0A03 [97.13(c)(1)]

You can determine that your station complies with FCC RF exposure regulations by calculation based on FCC OET Bulletin 65, by calculation based on computer modeling, or by measurement of field strength using calibrated equipment.

G0A04

When evaluating RF radiation exposure, "time averaging" means the total RF exposure averaged over a certain period.

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

If an evaluation of your station shows that the RF energy radiated by your station exceeds permissible limits for possible human absorption, you must take action to prevent human exposure to the excessive RF fields.

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

If your station fails to meet the FCC RF exposure exemption criteria you must perform an RF Exposure Evaluation in accordance with FCC OET Bulletin 65.

G0A07

The effect of modulation duty cycle on RF exposure means a lower duty cycle permits greater power levels to be transmitted.

G0A08 [97.13(c)(2)]

To ensure compliance with RF safety regulations an amateur operator must perform a routine RF exposure evaluation and prevent access to any identified high exposure areas.

G0A09

A calibrated field strength meter with a calibrated antenna can be used to accurately measure an RF field strength.

G0A10

If evaluation shows that a neighbor might experience more than the allowable limit of RF exposure from the main lobe of a directional, you should take precautions to ensure that the antenna cannot be pointed in their direction when they are present.

G0A11

If you install an indoor transmitting antenna you should take precaution to make sure that MPE limits are not exceeded in occupied areas.

G0A12 [1.1307(1)(b)(3)(i)(A)]

All stations with a time-averaged transmission of more than one milliwatt are subject to the FCC rules on RF exposure.

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

G0B01

Only the hot wires in a four-conductor 240 VAC circuit should be attached to fuses or circuit breakers.

G0B02

According to the National Electrical Code, AWG number 12 is the minimum wire size that may be used safely for wiring with a 20-ampere circuit breaker.

G0B03

A15 ampere fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring.

G0B04

The station's lightning protection ground system be located outside the building.

G0B05

Current flowing from one or more of the hot wires directly to ground will cause a ground fault circuit interrupter (GFCI) to disconnect AC power.

G0B06

Electrical safety of a station is covered by the National Electrical Code.

G0B07

When climbing a tower using a safety harness one should confirm that the harness is rated for the weight of the climber and that it is within its allowable service life.

G0B08

Before climbing a tower that supports electrically powered devices one should make sure all circuits that supply power to the tower are locked out and tagged.

G0B09

An emergency generator should be operated in a well-ventilated area.

G0B10

A danger from lead-tin solder is lead can contaminate food if hands are not washed carefully after handling the solder.

G0B11

Lightning protection ground rods must be bonded together with all other grounds.

G0B12

The purpose of a power supply interlock is to ensure that dangerous voltages are removed if the cabinet is opened.

G0B13

Lightning arrestors should be located where the feed lines enter the building.

End of Questions

1 Diagram required for certain questions in section G7 and is included on the following page

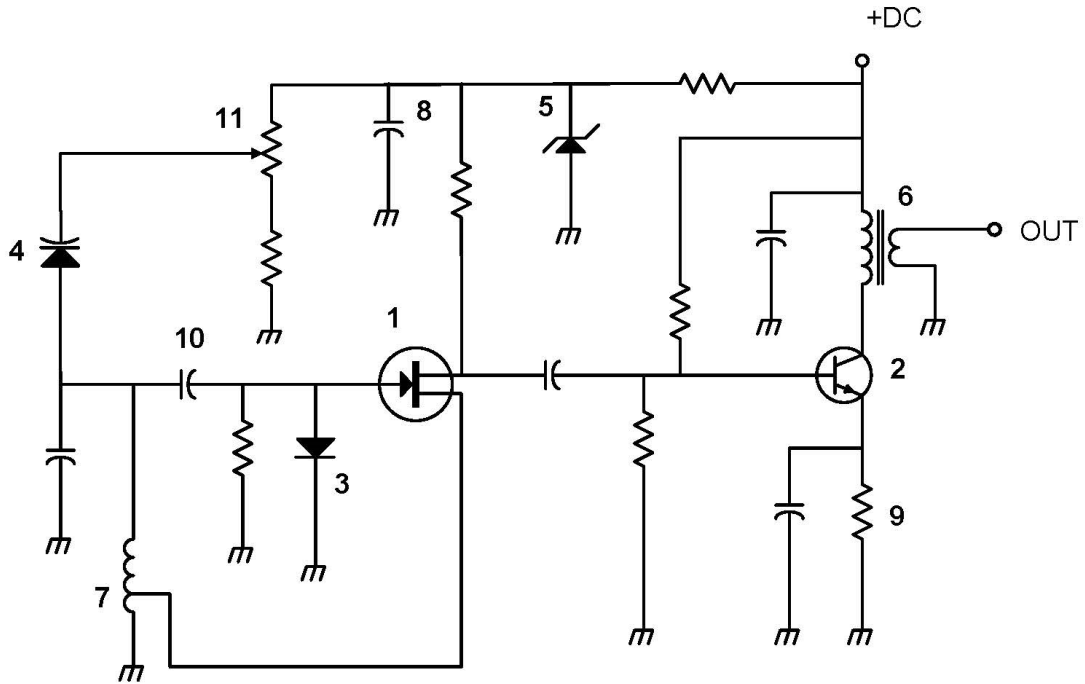


Figure G7-1