

The General Class Question Pool 2011-2015

Study Notes Produced by KH6IR.

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

None of the amateur bands is shared with the Citizens Radio Service. **200 feet** 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.

When General Class licensees are not permitted to use the entire voice portion of a particular band, **The upper frequency end** is generally available.

On the **30 meters** band phone operation & image transmission is prohibited. The **60 meters** amateur band is restricted to communication on only specific channels. On bands where FCC rules designate the Amateur Service as a secondary user **Amateur stations are allowed to use the band only if they do not cause harmful interference to primary users**. Thus when a station in the primary service interferes with your contact on either the 30 or 60 meter bands you should **Move to a clear frequency** The maximum bandwidth permitted by FCC rules for Amateur Radio stations when transmitting on USB frequencies in the 60 meter band is **2.8 kHz**

A General Class licensee is granted all amateur frequency privileges on the following bands **160, 60, 30, 17, 12, and 10 meters**. **3560 kHz** is within the General Class portion of the 80 meter band. **3900 kHz** is within the General Class portion of the 75 meter phone band. **7.250 MHz** is in the General Class portion of the 40 meter band. **14305 kHz** is within the General Class portion of the 20 meter phone band. **21300 kHz** is within the General Class portion of the 15 meter band. **24.940 MHz** is in the 12 meter band.

All of these choices are correct the following frequencies are available to a control operator holding a General Class license 28.020 MHz, 28.350 MHz, 28.550 MHz.

A limitation on transmitter power on the 14 MHz band is **Only the minimum power necessary to carry out the desired communications should be used**.

200 watts PEP output is the maximum transmitting power of an amateur station on 10.140 MHz **1500 watts PEP output** is a limitation on transmitter power on 1.8 MHz & 28 MHz bands. **1500 watts PEP output** is the maximum transmitting power an amateur station may use on the 12 meter band.

100 watts PEP output is the power limit for beacon stations. The purpose of a beacon station as identified in the FCC Rules is **Observation of propagation and reception**. A condition that beacon stations must comply is **There must be no more than one beacon signal in the same band from a single location**.

The following must be true before amateur stations may provide communications to broadcasters for dissemination to the public **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**

A restriction on the use of abbreviations or procedural signals in the Amateur Service is **They may be used if they do not obscure the meaning of a message**. An amateur station is permitted to transmit secret codes only **To control a**

space station. Music may be transmitted by an amateur station only **When it is an incidental part of a manned space craft retransmission**

An amateur station may transmit communications in which the licensee or control operator has a pecuniary (monetary) interest only **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.**

All of these choices are correct to comply with good amateur practice when choosing a transmitting frequency you should: Review FCC Part 97 Rules regarding permitted frequencies and emissions. Follow generally accepted band plans agreed to by the Amateur Radio community. Before transmitting, listen to avoid interfering with ongoing communication

The FCC requires an amateur station to be operated **In conformance with good engineering and good amateur practice** in all respects not covered by the Part 97 rules.

Below 28 MHz **300 baud** is the maximum symbol rate permitted for RTTY or data emission transmitted. Thus on the 20m band **300 baud** is the maximum symbol rate permitted for RTTY or data emission transmission. **1200 baud** is the maximum symbol rate permitted for RTTY or data emission transmissions on 10 meter band. **19.6 kilobaud** is the maximum symbol rate permitted for RTTY or data emission transmissions on the 2 meter band. **56 kilobaud** is the maximum symbol rate permitted for RTTY or data emission transmitted on the 1.25 meter and 70 centimeter bands

You may operate **On any General or Technician Class band segment** if you are a Technician Class operator and have a CSCE for General Class privileges. 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 is **Give your call sign followed by "slant AG"**. Thus **Whenever you operate using General Class frequency privileges** you must 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. Certificate of Successful Completion of Examination (CSCE) is valid for **365 days** as exam element credit.

Volunteer Examiners are accredited by **A Volunteer Examiner Coordinator** organization. As an accredited VE holding a General Class operator license you may administer **Technician only** license examinations. **At least three VEC accredited General Class or higher VEs must be present** for administering a Technician Class operator examination. **An FCC General Class or higher license and VEC accreditation** is sufficient for you to be an administering VE for a Technician Class operator license examination. For a non-U.S. citizen to be an accredited Volunteer Examiner **The person must hold an FCC granted Amateur Radio license of General Class or above.**

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

In the event of interference between a coordinated repeater and an uncoordinated repeater

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

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

A 10 meter repeater may retransmit the 2 meter signal from a station having a Technician Class control operator **Only if the 10 meter repeater control operator holds at least a General Class license**

In ITU **Region 2** operation in the 7.175 to 7.300 MHz band is permitted for a control operator holding an FCC-issued General Class license.

All of these choices are correct the following conditions require an Amateur Radio station licensee to 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 When a station is transmitting spread spectrum emissions

English language must be used when identifying your station if you are using a language other than English in making a contact using phone emission.

Only messages relating to Amateur Radio or remarks of a personal character, or messages relating to emergencies or disaster relief types of messages for a third party in another country may be transmitted by an amateur station.

Except for messages directly involving emergencies or disaster relief communications **Every foreign country, unless there is a third party agreement in effect with that country** prohibits is third party traffic.

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 is **The foreign amateur station must be in a country with which the United States has a third party agreement**

If **The third partys amateur license had ever been revoked** it would disqualify a third party from participating in stating a message over an amateur station.

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

Single sideband mode of voice communication is most commonly used on the high frequency amateur bands. In single sideband mode **Only one sideband is transmitted; the other sideband and carrier are suppressed.** An advantage when using single sideband as compared to other analog voice modes on the HF amateur bands is **Less bandwidth used and higher power efficiency.** **Approximately 3 kHz** is the minimum frequency separation between SSB signals under normal conditions.

On the 160, 75, & 40m bands it is **Current amateur practice is to use lower sideband on these frequency bands,** While **Upper sideband** is used for voice communications on the 17 and 12 meter bands or frequencies of 14 MHz or higher. **Upper sideband** is also used for SSB voice communications in the VHF and UHF bands.

A recommended way to break into a conversation when using phone modes is **Say your call sign during a break between transmissions from the other stations**

In SSB VOX operation **VOX allows "hands free" operation.**

The expression "CQ DX" usually indicates **The caller is looking for any station outside their own country.** In a voluntary band plan the "DX window" is **A portion of the band that should not be used for contacts between stations within the 48 contiguous United States**

Concerning access to frequencies, **No one has priority access to frequencies; common courtesy should be a guide.** However if propagation changes during your contact and you notice increasing interference from other activity on the same frequency, **As a common courtesy, move your contact to another frequency.** The first thing you should do if you are communicating with another amateur station and hear a station in distress break in is **Acknowledge the station in distress and determine what assistance may be needed.**

Whatever frequency has the best chance of communicating the distress message should be used to send a distress call. **When the President's War Emergency Powers have been invoked** the FCC can restrict normal frequency operations of amateur stations participating in RACES. **Only a person holding an FCC issued amateur operator license** can be the control operator of an amateur station transmitting in RACES to assist relief operations during a disaster. **At any time during an actual emergency** an amateur station is allowed to use any means at its disposal to assist another station in distress.

It is good amateur practice when choosing a frequency on which to initiate a call to **Follow the voluntary band plan for the operating mode you intend to use.**

A practical way to avoid harmful interference when selecting a frequency to call CQ on CW or phone is to **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.**

In selecting a CW transmitting frequency, **150 to 500 Hz** is the minimum frequency separation you should use in order to minimize interference to stations on adjacent frequencies.

Low power transmit operation is QRP.

Transmitting stations can receive between code characters and elements describes full break-in telegraphy (QSK).

If a CW station sends "QRS" you should **Send slower.**

The Q signal "QSL" means **I acknowledge receipt**

The Q signal "QRQ" means **Send faster**

The Q signal "QRV" means **I am ready to receive messages**

When a CW operator sends "KN" at the end of a transmission he/she is **Listening only for a specific station or stations. AR is sent to indicate the end of a formal message when using CW.** When a CW operator sends "CL" at the end of a transmission he/she is **Closing station.**

The best speed to use answering a CQ in Morse Code is **The speed at which the CQ was sent.**

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

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

Amateur volunteers who are formally enlisted to monitor the airwaves for rules violations are the Amateur Auxiliary to the FCC. Their objectives are **To encourage amateur self-regulation and compliance with the rules.** "Hidden transmitter hunts" help improve Amateur Auxiliary skills in **Direction finding used to locate stations violating FCC Rules**

A world map projection centered on a particular location describes an azimuthal projection map

It's 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.**

A directional antenna pointed **180 degrees from its short-path heading** when making a "long-path" contact. **A unidirectional antenna** HF antenna would be the best to use for minimizing interference. It's required by the FCC rules **If you are using other than a dipole antenna, you must keep a record of the gain of your antenna** used on 60 meter band.

To help with a reply if the FCC requests information many amateurs keep a log even though the FCC doesn't require it. Information traditionally contained in a station log are **All of these choices are correct** Date and time of contact, Band and/or frequency of the contact, Call sign of station contacted, and the signal report given.

Baudot code is **A 5-bit code with additional start and stop bits.**

The abbreviation "RTTY" stands for **Radioteletype** **LSB** is normally used when sending an RTTY signal via AFSK with an SSB transmitter. **170 Hz** is the most common frequency shift for RTTY emissions in the amateur HF bands.

The **Header** of a data packet contains the routing and handling information

The **3570- 3600 kHz** segment of the 80 meter band is used for data transmissions.

The **14.070 - 14.100 MHz** segment of 20 meter band is used for data transmissions. **Below the RTTY segment, near 14.070 MHz** of the 20 meter band is where PSK31 operations commonly found. **The number varies** in how many data bits are sent in a single PSK31 character.

The abbreviation "MFSK" stands for **Manual Frequency Shift Keying** An advantage of MFSK16 compared to other digital modes is **It offers good performance in weak signal environments without error correction**

The receiving station responds to an ARQ data mode packet containing errors by **Requests the packet be retransmitted.**

In the PACTOR protocol, an NAK response to a transmitted packet means **The receiver is requesting the packet be re-transmitted.**

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

The typical sunspot cycle is **11 years**. The sunspot number is **A measure of solar activity based on counting sunspots and sunspot groups**. An effect of high sunspot numbers on radio communications is **Long-distance communication in the upper HF and lower VHF range is enhanced. At any point in the solar cycle** the 20 meter band usually supports worldwide propagation during daylight hours. **21 MHz and higher** amateur radio HF frequencies are least reliable for long distance communications during periods of low solar activity.

An effect of Sudden Ionospheric Disturbance on the daytime propagation of HF radio waves is **It disrupts signals on lower frequencies more than those on higher frequencies**.

It takes Approximately **8 minutes** for increased ultraviolet and X-ray radiation from solar flares to affect radio-wave propagation on the Earth.

HF communications are disturbed by the charged particles that reach the Earth from solar coronal holes. It takes **20 to 40 hours** for charged particles from coronal mass ejections to affect radio-wave propagation on the Earth.

A measure of solar radiation at 10.7 cm is the solar-flux index

A temporary disturbance in the Earth's magnetosphere is a geomagnetic storm. One of its effects is **Degraded high-latitude HF propagation**. A possible benefit to radio communications resulting from periods of high geomagnetic activity is **Aurora that can reflect VHF signals**. The K-index indicates **The short term stability of the Earth's magnetic field**. The A-index indicates **The long term stability of the Earth's geomagnetic field**

The Sun's rotation on its axis causes HF propagation conditions to vary periodically in a 28-day cycle.

When a sky-wave signal arrives at your receiver by both short and long path propagation **A well-defined echo might be heard**.

Short skip sky-wave propagation on the 10 meter band is a good indicator of the possibility of sky-wave propagation on the 6 meter band.

LUF stands for **The Lowest Usable Frequency for communications between two points** As for radio waves with frequencies below the Lowest Usable Frequency (LUF) **They are completely absorbed by the ionosphere**. MUF stands for **The Maximum Usable Frequency for communications between two points. Select a frequency just below the MUF** for lowest attenuation when transmitting on HF. **Listen for signals from an international beacon** 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. When radio waves with frequencies below the Maximum Usable Frequency (MUF) and above the Lowest Usable Frequency (LUF) are sent into the ionosphere **They are bent back to the Earth**. In HF propagation when the Lowest Usable Frequency (LUF) exceeds the Maximum Usable Frequency (MUF) **No HF radio frequency will support ordinary skywave communications over the path. All of these choices are correct** factors that affect the Maximum Usable Frequency (MUF): Path distance and location, Time of day and season, Solar radiation and ionospheric disturbances.

Because it is the highest ionospheric region the F2 region is mainly responsible for the longest distance radio wave propagation. **2,500 miles** is the approximate maximum distance along the Earth's surface normally covered in one hop using the F2 region. **1,200 miles** is the approximate maximum distance along the Earth's surface normally covered in one hop using the E region.

The D layer is closest ionospheric layer to the surface of the Earth. **The D layer absorbs signals at these frequencies during daylight hours** making long distance communication on the 40, 60, 80 and 160 meter bands more difficult during the day. **The D layer** is the most absorbent of long skip signals during daylight hours on frequencies below 10 MHz.

Where the Sun is overhead on the Earth is where ionospheric layers reach their maximum height.

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

A characteristic of HF scatter signals is **They have a wavering sound**. The distortion heard is because **Energy is scattered into the skip zone through several different radio wave paths**. HF scatter signals in the skip zone are weak because **Only a small part of the signal energy is scattered into the skip zone**. Radio wave **Scatter** propagation allows a signal to be detected at a distance too far for ground wave propagation but too near for normal sky-wave propagation. An indication that signals heard on the HF bands are being received via scatter propagation is **The signal is heard on a frequency above the Maximum Usable Frequency**.

Antenna types most effective for skip communications on 40 meters during the day are **Horizontal dipoles placed between 1/8 and 1/4 wavelength above the ground**. Near Vertical Incidence Sky-wave (NVIS) propagation is **Short distance HF propagation using high elevation angles**.

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

The "notch filter" on HF transceivers is used **To reduce interference from carriers in the receiver passband.**

An advantage of selecting the opposite or "reverse" sideband when receiving CW signals on a typical HF transceiver is **It may be possible to reduce or eliminate interference from other signals.**

Operating a transceiver in "split" mode means **The transceiver is set to different transmit and receive frequencies.**

A pronounced dip on the plate current meter of a vacuum tube RF power amplifier indicates correct adjustment of the plate tuning control **Maximum power output without exceeding maximum allowable plate current** is the correct adjustment for the load or coupling control of a vacuum tube RF power amplifier. The Automatic Level Control (ALC) is used with a RF power amplifier **To reduce distortion due to excessive drive. Excessive drive power** can lead to permanent damage when using a solid-state RF power amplifier.

The **Antenna coupler** is a device often used to enable matching the transmitter output to an impedance other than 50 ohms.

A time delay sometimes included in a transmitter keying circuit **To allow time for transmit-receive changeover operations to complete properly before RF output is allowed**

The purpose of an electronic keyer is **Automatic generation of strings of dots and dashes for CW operation**

A use for the IF shift control on a receiver is **To avoid interference from stations very close to the receive frequency**

The dual VFO feature on a transceiver is **To permit ease of monitoring the transmit and receive frequencies when they are not the same**

One reason to use the attenuator function is **To reduce signal overload due to strong incoming signals**

In transmitting PSK31 data signals, transceiver audio input should be adjusted **So that the transceiver ALC system does not activate**

Test equipment that contains horizontal and vertical channel amplifiers is **An oscilloscope.** An advantage of an oscilloscope versus a digital voltmeter is **Complex waveforms can be measured.** To check the keying waveform of a CW transmitter **An oscilloscope** is the best instrument to use. To check A RF envelope pattern of a transmitted signal source **The attenuated RF output of the transmitter** is connected to the vertical input of an oscilloscope

High input impedance is desirable for a voltmeter because **It decreases the loading on circuits being measured.** An advantage of digital voltmeter compared to analog voltmeter is **Better precision for most uses**

An instrument used to monitor relative RF output when making antenna and transmitter adjustments is **A field-strength meter.** It can also be used for **Close-in radio direction-finding.** You can determine **The radiation pattern of an antenna** with a field strength meter.

The **Standing wave ratio** can be determined with a directional wattmeter.

The **Antenna and feed line** must be connected to an antenna analyzer being used for SWR measurements. **Strong signals from nearby transmitters can affect the accuracy of measurements** on an antenna system when using an

antenna analyzer. The antenna analyzer can be used to **Determining the impedance of an unknown or unmarked coaxial cable.**

An instance where the use of an instrument with analog readout is preferred over an instrument with a numerical digital readout is **When adjusting tuned circuits.**

A two-tone test is used to analyze transmitter **Linearity** performance. **Two non-harmonically related audio signals** are used to conduct a two-tone test.

The **Bypass capacitor** might be useful in reducing RF interference to audio-frequency devices.

Arcing at a poor electrical connection can cause of interference covering a wide range of frequencies. **Placing a ferrite bead around the cable** would reduce RF interference caused by common-mode current on an audio cable.

Distorted speech can be heard from an audio device or telephone if there is interference from a nearby single-sideband phone transmitter. An effect on audio device or telephone system if there is interference from a nearby CW transmitter is **On-and-off humming or clicking.**

High RF voltages on the enclosures of station equipment can be caused by a resonant ground connection thus assuming the equipment is connected to a ground rod if you receive an RF burn when touching your equipment while transmitting on an HF band **The ground wire has high impedance on that frequency.** One good way to avoid unwanted effects of stray RF energy in an amateur station is **Connect all equipment grounds together.**

A ground loop can be avoided by **Connect all ground conductors to a single point** A symptom of a ground loop somewhere in your station could be **You receive reports of "hum" on your station's transmitted signal**

A Digital Signal Processor (DSP) filter can perform automatic notching of interfering carriers. A Digital Signal Processor in an amateur station is used **To remove noise from received signals** an advantage of a receiver Digital Signal Processor IF filter as compared to an analog filter is **A wide range of filter bandwidths and shapes can be created**

A speech processor is used in a modern transceiver to **Increase the intelligibility of transmitted phone signals during poor conditions.** To describe how a speech processor affects a transmitted single sideband phone signal by **It increases average power.**

All of these choices are correct can be the result of an incorrectly adjusted speech processor: Distorted speech, Splatter, Excessive background pickup

An S meter measures **Received signal strength.** An S meter is found **In a receiver.** An S meter reading of 20 dB over S-9 **It is 100 times stronger** than an S-9 signal, assuming a properly calibrated S meter. 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.

A 3 kHz LSB signal occupies **7.175 to 7.178 MHz** when the displayed carrier frequency is set to 7.178 MHz. Thus on the lower edge of the 40 meter General Class phone segment your displayed carrier frequency should be **3 kHz above the edge of the segment** when using 3 kHz wide LSB.

A 3 kHz USB signal occupies **14.347 to 14.350 MHz** when the displayed carrier frequency set to 14.347 MHz. Thus on the upper edge of the 20 meter General Class band your displayed carrier frequency should be **3 kHz below the edge of the band** when using 3 kHz wide USB.

A device to electrically lengthen a physically short antenna when referring to a mobile antenna is a "capacitance hat."

A purpose of the "corona ball" on a HF mobile antenna is **To reduce high voltage discharge from the tip of the antenna.**

Fused power connections direct **To the battery using heavy gauge wire** would be the best for a 100-watt HF mobile installation. It's Not ok to draw the DC power for a 100-watt HF transceiver from an automobile's auxiliary power socket because **The socket's wiring may be inadequate for the current being drawn by the transceiver.**

The antenna system limits the effectiveness of an HF mobile transceiver operating in the 75 meter band.

A disadvantage of using a shortened mobile antenna as opposed to a full size antenna is **Operating bandwidth may be very limited.**

The vehicle control computer is the most likely to cause interfering signals to be heard in the receiver of an HF mobile installation in a recent model vehicle.

The process by which sunlight is changed directly into electricity is **Photovoltaic conversion.** There is approximately **0.5 VDC** open-circuit voltage from a modern, well-illuminated photovoltaic cell. A series diode is connected between a solar panel and a storage battery that is being charged by the panel because **The diode prevents self discharge of the battery though the panel during times of low or no illumination.**

A disadvantage of using wind as the primary source of power for an emergency station is **A large energy storage system is needed to supply power when the wind is not blowing.**

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

Impedance is **The opposition to the flow of current in an AC circuit**. The unit **Ohm** is used to measure impedance. It is also used to measure reactance. A **Reactance** causes opposition to the flow of alternating current in an inductor, & A **Reactance** causes opposition to the flow of alternating current in a capacitor. Thus Reactance is the **Opposition to the flow of alternating current caused by capacitance or inductance**.

As the frequency of the applied AC increases, the reactance increases in inductors. **As the frequency of the applied AC increases, the reactance decreases** in capacitors.

When the impedance of an electrical load is equal to the internal impedance of the power source **The source can deliver maximum power to the load**. Thus impedance matching is important **So the source can deliver maximum power to the load**. A reason to use an impedance matching transformer is **To maximize the transfer of power**. To **Insert an LC network between the two circuits** describes one method of impedance matching between two AC circuits. **All of these choices are correct** devices that can be used for impedance matching at radio frequencies: A transformer, A Pi-network, A length of transmission line.

A two-times increase or decrease in power results in a change **Approximately 3 dB**.

The total current relates to the individual currents in each branch of a parallel circuit by **It equals the sum of the currents through each branch**.

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

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

Approximately 61 milliwatts are dissipated when a current of 7.0 milliamperes flows through 1.25 kilohms.

100 watts 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.

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

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

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

20.5% of power loss would result from a transmission line loss of 1 dB.

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

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

1060 watts is the output PEP of an unmodulated carrier if an average reading wattmeter connected to the transmitter output indicates 1060 watts.

625 watts 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. **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.

The primary of a transformer is normally connected to the incoming source of energy. **A resistor in series** should be added to an existing resistor to increase the resistance

33.3 ohms is the total resistance of three 100-ohm resistors in parallel.

Three equal value resistors in parallel produce 50 ohms of resistance, and the same three resistors in series produce 450 ohms, **150 ohms** is the value of each resistor.

26.7 volts is the RMS voltage across a 500-turn transformer secondary winding if the 2250-turn primary is connected to 120 VAC.

12.2 to 1 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.

10750 picofarads is the equivalent capacitance of two 5000 picofarad capacitors and one 750 picofarad capacitor connected in parallel.

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

3.3 millihenrys is the inductance of three 10 millihenry inductors connected in parallel.

70 millihenrys is the inductance of a 20 millihenry inductor in series with a 50 millihenry inductor.

14.3 microfarads is the capacitance of a 20 microfarad capacitor in series with a 50 microfarad capacitor.

A capacitor in parallel should be added to a capacitor to increase the capacitance. **An inductor in series** should be added to an inductor to increase the inductance.

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

G6 - CIRCUIT COMPONENTS [3 exam question - 3 groups]

Electrolytic capacitors are often used in power supply circuits to filter the rectified AC. **Low equivalent series resistance** is an important characteristic for capacitors used to filter the DC output of a switching power supply. An advantage of an electrolytic capacitor is **High capacitance for given volume**. An advantage of ceramic capacitors compared to other types of capacitors is **Comparatively low cost**. One effect of lead inductance in a capacitor used at VHF and above is **Effective capacitance may be reduced**

A device having a specific change in resistance with temperature variations is a thermistor. The resistance of a resistor changes if the temperature is increased. **It will change depending on the resistor's temperature coefficient**. A reason not to use wire-wound resistors in an RF circuit is **The resistor's inductance could make circuit performance unpredictable**.

All of these choices are correct advantages of using a ferrite core toroidal inductor: Large values of inductance may be obtained, The magnetic properties of the core may be optimized for a specific range of frequencies, Most of the magnetic field is contained in the core.

A **Filter choke** is an inductor used to help smooth the DC output from the rectifier in a conventional power supply. The winding axes of solenoid inductors should be placed **At right angles** to minimize their mutual inductance. It's important to minimize the mutual inductance between two inductors **To reduce unwanted coupling between circuits**. An effect of inter-turn capacitance in an inductor is **The inductor may become self resonant at some frequencies**

The maximum voltage the rectifier will handle in the non-conducting direction is the peak-inverse-voltage rating of a rectifier. Two major ratings that must not be exceeded for silicon diode rectifiers are **Peak inverse voltage; average forward current** The approximate junction threshold voltage of a germanium diode is **0.3 volts** while for silicon diodes it is **0.7 volts**. When connecting two or more diodes in parallel to increase current handling capacity, the purpose of the resistors connected in series with each diode is **To ensure that one diode doesn't carry most of the current**. An advantage of using a Schottky diode in an RF switching circuit as compared to a standard silicon diode is **Lower capacitance**

The **Control grid** element of a triode vacuum tube is used to regulate the flow of electrons between cathode and plate. A purpose of screen grid in a vacuum tube is **To reduce grid--to-plate capacitance**.

The stable operating points of a bipolar transistor used as a switch in a logic circuit are **Its saturation and cut-off regions**. The cases of some large power transistors be insulated from ground **To avoid shorting the collector or drain voltage to ground**. The solid state device most like a vacuum tube in its general operating characteristics is **A Field Effect Transistor**. In the construction of a MOSFET **The gate is separated from the channel with a thin insulating layer**.

Regarding batteries, It is **Never** acceptable to recharge a carbon-zinc primary cell. An advantage of nickel-cadmium batteries is it allows **High discharge current** due to low internal resistance. A minimum discharge voltage for maximum life of standard 12 volt lead acid battery is **10.5 volts**.

Linear voltage regulator is an analog integrated circuit. The operational amplifier is also an **Analog** integrated circuit. The term MMIC stands for **Monolithic Microwave Integrated Circuit**.

An advantage of CMOS integrated circuits compared to TTL integrated circuits is **Low power consumption**. A microprocessor is **A computer on a single integrated circuit**. The term ROM stands for **Read Only Memory**. A characteristic of "non-volatile" memory is **The stored information is maintained even if power is removed**.

A disadvantage of an incandescent indicator compared to an LED is **High power consumption**. A LED **Forward Biased** when emitting light. A characteristic of a liquid crystal display is **It requires ambient or back lighting**.

The **PL-259** connector is used for RF service at frequencies up to 150 MHz. An SMA connector is **A small threaded connector suitable for signals up to several GHz**. A type-N connector is **A moisture-resistant RF connector useful to 10 GHz**

While The **RCA Phono** connector is used for audio signals in Amateur Radio stations. The main reason to use keyed connectors instead of non-keyed types is **Reduced chance of incorrect mating**. A DIN type connector is described as **A family of multiple circuit connectors suitable for audio and control signals**. The **DB-9** connector would be a good choice for a serial data port. A **Computer and transceiver are** two devices in an Amateur Radio station that can be connected using a USB interface.

G7 - PRACTICAL CIRCUITS [3 exam questions - 3 groups]

An advantage of a switch-mode power supply as compared to a linear power supply is **High frequency operation allows the use of smaller components**. The components **Capacitors and inductors** are used in a power-supply filter network. For safety we use power-supply bleeder resistor(s) because **It discharges the filter capacitors**.

In a full-wave rectifier **360 degrees** of the AC cycle is converted to DC. The peak-inverse-voltage across the rectifiers in a full-wave bridge power supply is **Double the normal peak output voltage of the power supply**. An unfiltered full-wave rectifier connected to a resistive load has an output waveform of **A series of DC pulses at twice the frequency of the AC input**.

In a half-wave rectifier **180 degrees** portion of the AC cycle is converted to DC. While the peak-inverse-voltage across the rectifier in a half-wave power supply is **Equal to the normal output voltage of the power supply**.

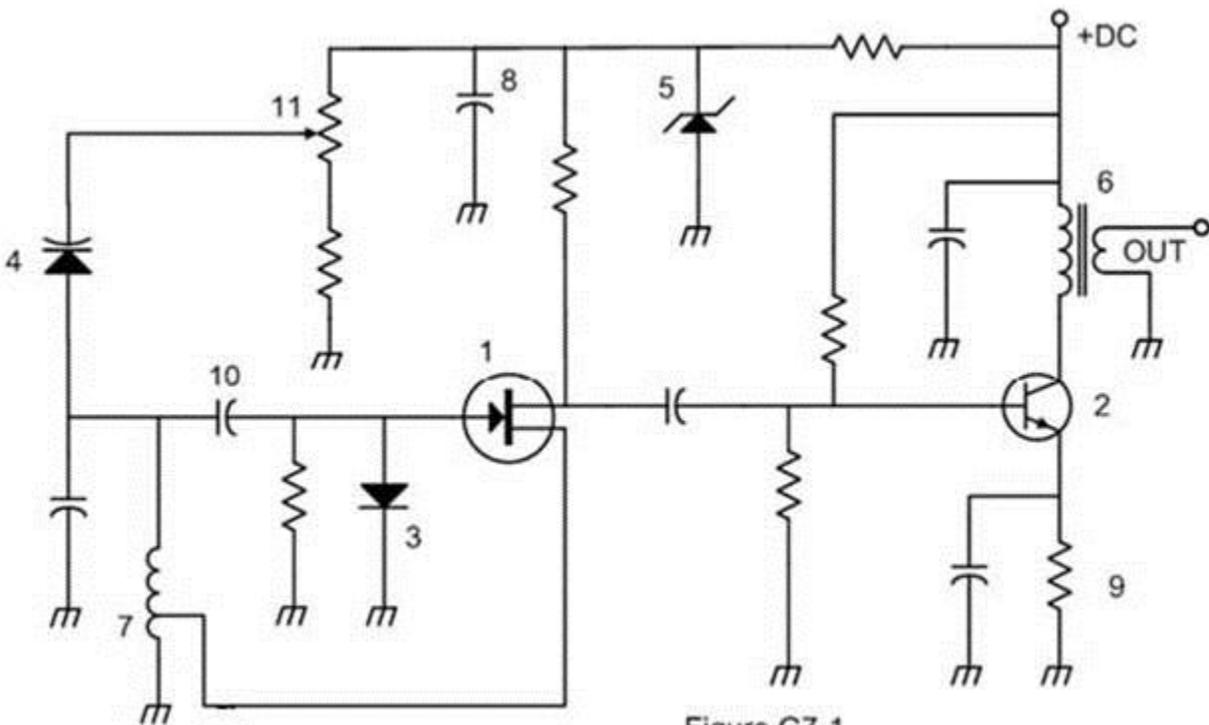


Figure G7-1

Symbol 1 in figure G7-1 represents a field effect transistor. **Symbol 2** in figure G7-1 represents an NPN junction transistor. **Symbol 5** in figure G7-1 represents a Zener diode. **Symbol 6** in Figure G7-1 represents a multiple-winding transformer. **Symbol 7** in Figure G7-1 represents a tapped inductor.

An advantage of using the binary system when processing digital signals is **Binary "ones" and "zeros" are easy to represent with an "on" (high) or "off" (low) state**. The function of a two input AND gate is the **Output is high only when both inputs are high**. The function of a two input NOR gate is the **Output is low when either or both inputs are high**.

A shift register is **A clocked array of circuits that passes data in steps along the array**. A 3-bit binary counter has 8 states. Complex digital circuitry can often be replaced by a **Microcontroller** type of integrated circuit.

The basic components of virtually all sine wave oscillators are **A filter and an amplifier operating in a feedback loop**. In an LC oscillator **The inductance and capacitance in the tank circuit** determines the frequency.

A linear amplifier is **An amplifier in which the output preserves the input waveform**. A characteristic of a Class A amplifier is **Low distortion**. The reason for neutralizing the final amplifier stage of a transmitter is **To eliminate self-oscillations**. To determine the efficiency of an RF power amplifier **Divide the RF output power by the DC input power**. The **Class C** amplifier has the highest efficiency. A Class C power stage is appropriate for amplifying A modulated **CW** signal.

The **Balanced modulator** 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. The **Filter** is used to process signals from the balanced modulator and send them to the mixer in a single-sideband phone transmitter.

The **Mixer** 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. The **Product detector** 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.

An advantage of a transceiver controlled by a direct digital synthesizer (DDS) is **Variable frequency with the stability of a crystal oscillator**.

The impedance of a low-pass filter as compared to the impedance of the transmission line into which it is inserted should be **About the same**.

The simplest combinations of stages that implement a superheterodyne receiver are **HF oscillator, mixer, detector**.

A **Discriminator** circuit is used in many FM receivers to convert signals coming from the IF amplifier to audio.

Digital Signal Processor filtering is accomplished **By converting the signal from analog to digital and using digital processing**. Regarding an IF DSP, **All of these choices are correct**- what is needed in a Digital Signal Processor IF filter is An analog to digital converter, A digital processor chip, and A digital to analog converter.

The "software defined radio" (SDR) is **A radio in which most major signal processing functions are performed by software**.

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

Phase modulation is the process that changes the phase angle of an RF wave to convey information. **Phase modulation** emission is produced by a reactance modulator connected to an RF power amplifier.

Frequency modulation is the process which changes the frequency of an RF wave to convey information. In observing an FM RF carrier signal **The carrier frequency changes proportionally to the instantaneous amplitude of the modulating signal** when a modulating audio signal is applied to an FM transmitter. Frequency modulated (FM) phone isn't used below 29.5 MHz because **The wide bandwidth is prohibited by FCC rules**. The **Multiplier** stage in a VHF FM transmitter is used to generate a harmonic of a lower frequency signal to reach the operating frequency

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

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

Amplitude modulation is the process that changes the envelope of an RF wave to carry information. **Amplitude modulation** varies the instantaneous power level of the RF signal.

Both upper and lower sidebands signal(s) would be found at the output of a properly adjusted balanced modulator. One advantage of carrier suppression in a single-sideband phone transmission is **The available transmitter power can be used more effectively**. The **Transmit audio or microphone gain** control is typically adjusted for proper ALC setting on an amateur single sideband transceiver. **Single sideband** phone emissions use the narrowest frequency bandwidth. Flat-topping of a single-sideband phone transmission is

Signal distortion is caused by excessive drive. Excessive bandwidth is an effect of over-modulation.

The relationship between transmitted symbol rate and bandwidth is **Higher symbol rates require higher bandwidth**. The number 31 represents **The approximate transmitted symbol rate** in PSK31. It is good to match receiver bandwidth to the bandwidth of the operating mode So **It results in the best signal to noise ratio**. Forward error correction allows the receiver to correct errors in received data packets **By transmitting redundant information with the data**. It's important to know the duty cycle of the data mode you are using when transmitting because **Some modes have high duty cycles which could exceed the transmitter's average power rating**.

In a receiver the **Mixer** stage combines a 14.250 MHz input signal with a 13.795 MHz oscillator signal to produce a 455 kHz intermediate frequency (IF) signal. 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, A 13.345 MHz signal will produce **Image response** type of interference in the receiver. **Heterodyning** is another term for the mixing of two RF signals.

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

Factors to determine the characteristic impedance of a parallel conductor antenna feed line are **The distance between the centers of the conductors and the radius of the conductors**. Typical characteristic impedances of coaxial cables used for antenna feed lines at amateur stations are **50 and 75 ohms**. While **300 ohms** is the characteristic impedance of flat ribbon TV type twinlead. Attenuation of coaxial cable **It increases** as the frequency of the signal it is carrying increases. RF feed line losses are usually expressed in **dB per 100 ft**.

A reason for the occurrence of reflected power at the point where a feed line connects to an antenna is **A difference between feed-line impedance and antenna feed-point impedance**. To prevent standing waves on an antenna feed line **The antenna feed-point impedance must be matched to the characteristic impedance of the feed line**.

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, **5 to 1** is the resulting SWR on the feed line.

A **1:1** standing wave ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 50-ohm impedance. Feed a vertical antenna that has a 25-ohm feed-point impedance with 50-ohm coaxial cable, the SWR would be **2:1**. A **4:1** 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 **5:1** standing wave ratio will result from the connection of a 50-ohm feed line to a non-reactive load having a 10-ohm impedance. Feed an antenna that has a 300-ohm feed-point impedance with 50-ohm coaxial cable, the SWR would be **6:1**.

A disadvantage of directly fed random-wire antenna is **You may experience RF burns when touching metal objects in your station**

An advantage of downward sloping radials on a quarter wave ground-plane antenna is **They bring the feed-point impedance closer to 50 ohms**.

The feed-point impedance of a ground-plane antenna **It increases** when radials are changed from horizontal to downward-sloping.

For horizontal dipole HF antenna height affects the horizontal (azimuthal) radiation pattern

If the antenna is less than 1/2 wavelength high, the azimuthal pattern is almost omnidirectional. An ideal half-wavelength dipole antenna installed 1/2 wavelength high and parallel to the Earth **It is a figure-eight at right angles to the antenna**.

Radial wires of a ground-mounted vertical antenna system should be placed **On the surface or buried a few inches below the ground**.

The feed-point impedance of a 1/2 wave dipole antenna **It steadily decreases** as the antenna is lowered from 1/4 wave above ground.

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

An advantage of a horizontally polarized as compared to vertically polarized HF antenna is **Lower ground reflection losses**.

8 feet is the approximate length for a 1/4-wave vertical antenna cut for 28.5 MHz. **32 feet** is the approximate length for a 1/2-wave dipole antenna cut for 14.250 MHz. **131 feet** is the approximate length for a 1/2-wave dipole antenna cut for 3.550 MHz.

In Yagi antenna design **All of these choices are correct.** Variables that could be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth are: The physical length of the boom, The number of elements on the boom, The spacing of each element along the boom.

Larger diameter elements increase the bandwidth of a Yagi antenna. Regarding three-element, single-band Yagi antenna the following is true. **The director is normally the shortest parasitic element and the reflector is normally the longest parasitic element.** The driven element of a Yagi antenna is **1/2 wavelength**. Yagi antenna **Gain increases** by adding directors and increasing boom length. The theoretical max forward gain of a three element, single-band Yagi antenna is **9.7 dBi** The "main lobe" of a directive antenna is **The direction of maximum radiated field strength from the antenna.** A Yagi antenna "front-to-back ratio" refers to **The power radiated in the major radiation lobe compared to the power radiated in exactly the opposite direction.** The purpose of a gamma match used on Yagi antennas is **To match the relatively low feed-point impedance to 50 ohms.** An advantage of using a gamma match for impedance matching of a Yagi antenna to 50-ohm coax feed line is **It does not require that the elements be insulated from the boom.** An advantage of vertical stacking of horizontally polarized Yagi antennas is it **Narrows the main lobe in elevation.** The gain of two 3-element horizontally polarized Yagi antennas spaced vertically 1/2 wavelength apart is **Approximately 3 dB higher** than the gain of a single 3-element Yagi. A reason why a Yagi antenna is often used for radio communications on the 20 meter band is **It helps reduce interference from other stations to the side or behind the antenna.**

The forward gain of a two-element quad antenna is **About the same as** the forward gain of a three-element Yagi antenna. For the loops of a two-element quad antenna to operate as a beam antenna **The reflector element must be approximately 5% longer than the driven element.** Each side of a quad antenna driven element is **1/4 wavelength** long. Each side of a quad antenna reflector element is **Slightly more than 1/4 wavelength** long. When the feed point of a quad antenna is changed from the center of either horizontal wire to the center of either vertical wire **The polarization of the radiated signal changes from horizontal to vertical.**

Each leg of a symmetrical delta-loop antenna is **1/3 wavelength** long. The gain of a two-element delta-loop beam is **About the same** as the gain of a two-element quad antenna.

Regarding antennas the term "NVIS" means **Near Vertical Incidence Sky wave.** An advantage of an NVIS antenna is **High vertical angle radiation for working stations within a radius of a few hundred kilometers.** NVIS antennas typically installed at heights above ground **Between 1/10 and 1/4 wavelength.**

The primary purpose of antenna traps is **To permit multiband operation.** A disadvantage of multiband antennas is **They have poor harmonic rejection.** A advantage of a log periodic antenna is **Wide bandwidth.** The following describes a log periodic antenna. **Length and spacing of the elements increases logarithmically from one end of the boom to the other.**

A Beverage antenna described as **A very long and low directional receiving antenna.** An application for a Beverage antenna is **Directional receiving for low HF bands.** It's not used for transmitting because **Its impedance is too low for effective matching.**

GO - ELECTRICAL AND RF SAFETY [2 exam Questions - 2 groups]

A step an amateur operator must take to ensure compliance with RF safety regulations when transmitter power exceeds levels specified in part 97.13 is **Perform a routine RF exposure evaluation**. If an evaluation of your station shows RF energy radiated from your station exceeds permissible limits you must **Take action to prevent human exposure to the excessive RF fields**. An effect transmitter duty cycle has when evaluating RF exposure is **A lower transmitter duty cycle permits greater short-term exposure levels**.

To accurately measure an RF field **A calibrated field-strength meter with a calibrated antenna** can be used. You should **Make sure that MPE limits are not exceeded in occupied areas** if you install an indoor transmitting antenna. One way that RF energy can affect human body tissue is **It heats body tissue**. If evaluation shows that a neighbor might receive more than the allowable limit of RF exposure from the main lobe of a directional antenna **Take precautions to ensure that the antenna cannot be pointed in their direction**. As a precaution when installing a ground-mounted antenna **It should be installed so no one can be exposed to RF radiation in excess of maximum permissible limits**.

Regarding MPE **All of these choices are correct**. Important properties in estimating whether an RF signal exceeds the maximum permissible exposure (MPE) are Its duty cycle, Its frequency, Its power density.

All of these choices are correct. 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, By measurement of field strength using calibrated equipment. Referring to RF radiation exposure "time averaging" is **The total RF exposure averaged over a certain time**.

A precaution should you take when you make adjustments or repairs to an antenna is **Turn off the transmitter and disconnect the feed line**. Any person preparing to climb a tower that supports electrically powered devices should **Make sure all circuits that supply power to the tower are locked out and tagged**. You should observe the following safety tip when climbing on a tower using a safety belt or harness. **Always attach the belt safety hook to the belt D-ring with the hook opening away from the tower**.

Electrical safety inside the ham shack is covered by the National Electrical Code. A minimum wire size of **AWG number 12** may be safely used for a circuit that draws up to 20 amperes of continuous current. A **15 amperes** fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring. **Only the hot 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 condition that can cause a Ground Fault Circuit Interrupter (GFCI) to disconnect the 120 or 240 Volt AC line power to a device is **Current flowing from one or more of the hot wires directly to ground**. The metal enclosure of every item of station equipment should be grounded so **It ensures that hazardous voltages cannot appear on the chassis**. The purpose of a transmitter power supply interlock is **To ensure that dangerous voltages are removed if the cabinet is opened**.

You must **Disconnect the incoming utility power feed** when powering your house from an emergency generator. With emergency generator installation it's true **The generator should be located in a well ventilated area**. A primary reason for not placing a gasoline-fueled generator inside an occupied area is **Danger of carbon monoxide poisoning**.

Its good engineering practice for lightning protection grounds that **They must be bonded together with all other grounds**. Soldered joints should not be used with the wires that connect the base of a tower to a system of ground rods because **a soldered joint will likely be destroyed by the heat of a lightning strike**. A danger from lead-tin solder is **Lead can contaminate food if hands are not washed carefully after handling**. A lead acid storage battery **When being charged** gives off explosive hydrogen gas.