

CLASS B – POOL OF QUESTIONS

G1

1. Which of the following would disqualify a third party from participating in stating a message over an amateur station?

G1

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

G1

3. What types of messages for a third party in another country may be transmitted by an amateur station?

G1

4. Which of the following applies in the event of interference between a coordinated repeater and an uncoordinated repeater?

G1

5. With which foreign countries is third party traffic prohibited, except for messages directly involving emergencies or disaster relief communications?

G1

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

G1

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

SUBELEMENT G2 - OPERATING PROCEDURES

G2A - Phone operating procedures; USB/LSB conventions; procedural signals; breaking into a contact; VOX operation

G2

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

G2

2. Which of the following modes is most commonly used for voice communications on the 160-meter, 75-meter, and 40-meter bands?

G2

3. Which of the following is most commonly used for SSB voice communications in the VHF and UHF bands?

G2

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

G2

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

G2

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

G2

7. Which of the following statements is true of the single sideband voice mode?

G2

8. Which of the following is a recommended way to break into a contact when using phone?

G2

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

G2

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

G2

11. What does the expression "CQ DX" usually indicate?

[G2B - Operating courtesy; band plans; emergencies, including drills and emergency communications](#)

G2

1. Which of the following is true concerning access to frequencies in non-emergency situations?

G2

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

G2

3. If propagation changes during your contact and you notice increasing interference from other activity on the same frequency, what should you do?

G2

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

G2

5. What is the customary minimum frequency separation between SSB signals under normal conditions?

G2

6. What is a practical way to avoid harmful interference on an apparently clear frequency before calling CQ on CW or phone?

G2

7. Which of the following complies with good amateur practice when choosing a frequency on which to initiate a call?

G2

8. When is an amateur station allowed to use any means at its disposal to assist another station in distress?

[G2C - CW operating procedures and procedural signals; Q signals and common abbreviations: full break in](#)

G2

1. Which of the following describes full break-in telegraphy (QSK)?

G2

2. What should you do if a CW station sends "QRS"?

G2

3. What does it mean when a CW operator sends "KN" at the end of a transmission?

G2

4. What does the Q signal "QRL?" mean?

G2

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

G2

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

G2C07 (A)

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

G2

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

G2

9. What does the Q signal "QSL" mean?

G2

10. What does the Q signal "QRN" mean?

G2

11. What does the Q signal "QRV" mean?

G2D - Amateur Auxiliary; minimizing interference; HF operations

G2

1. Which of the following are objectives of the Amateur Auxiliary?

G2

2. Which of the following describes an azimuthal projection map?

G2

3. How is a directional antenna pointed when making a "long-path" contact with another station?

G2

4. What is a reason why many amateurs keep a station log?

G2

5. What information is traditionally contained in a station log?

G2

6. What is QRP operation?

G2

7. Which HF antenna would be the best to use for minimizing interference?

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

G2

1. Which mode is normally used when sending an RTTY signal via AFSK with an SSB transmitter?

G2

2. How can a PACTOR modem or controller be used to determine if the channel is in use by other PACTOR stations?

G2

3. What symptoms may result from other signals interfering with a PACTOR or WINMOR transmission?

G2

4. What segment of the 20-meter band is most often used for digital transmissions?

G2

5. What is the standard sideband used to generate a JT65 or JT9 digital signal when using AFSK in any amateur band?

G2

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

G2

7. What segment of the 80-meter band is most commonly used for digital transmissions?

G2

8. In what segment of the 20-meter band are most PSK31 operations commonly found?

G2

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

G2

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

G2

11. What is indicated on a waterfall display by one or more vertical lines adjacent to a PSK31 signal?

G2

12. Which of the following describes a waterfall display?

G2

13. Which communication system sometimes uses the Internet to transfer messages?

G2

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

SUBELEMENT G3 - RADIO WAVE PROPAGATION

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

G3

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

G3

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

G3

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

G3

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

G3

5. What is the solar flux index?

G3

6. What is a geomagnetic storm?

G3

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

G3

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

G3

9. What effect does a high sunspot number have on radio communications?

G3

10. What causes HF propagation conditions to vary periodically in a 28 day cycle?

G3

11. Approximately how long is the typical sunspot cycle?

G3

12. What does the K-index indicate?

G3

13. What does the A-index indicate?

G3

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

G3

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

G3

16. What is a possible benefit to radio communications resulting from periods of high geomagnetic activity?

G3B - Maximum Usable Frequency; Lowest Usable Frequency; propagation

G3

1. How might a sky-wave signal sound if it arrives at your receiver by both short path and long path propagation?

G3

2. Which of the following is a good indicator of the possibility of sky-wave propagation on the 6-meter band?

G3

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

G3

4. What is a reliable way to determine if the MUF is high enough to support skip propagation between your station and a distant location on frequencies between 14 and 30 MHz?

G3

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

G3

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

G3

7. What does LUF stand for?

G3

8. What does MUF stand for?

G3

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

G3

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

G3

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

G3

12. What factor or factors affect the MUF?

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

G3

1. Which ionospheric layer is closest to the surface of the Earth?

G3

2. Where on the Earth do ionospheric layers reach their maximum height?

G3

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

G3

4. What does the term "critical angle" mean as used in radio wave propagation?

G3

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

G3

6. What is a characteristic of HF scatter signals?

G3

7. What makes HF scatter signals often sound distorted?

G3

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

G3

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

G3

10. Which of the following might be an indication that signals heard on the HF bands are being received via scatter propagation?

G3

11. Which of the following antenna types will be most effective for skip communications on 40-meters during the day?

G3

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

G3

13. What is Near Vertical Incidence Sky-wave (NVIS) propagation?

SUBELEMENT G4 - AMATEUR RADIO PRACTICES

G4A – Station Operation and set up

G4

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

G4

2. What is one advantage of selecting the opposite or "reverse" sideband when receiving CW signals on a typical HF transceiver?

G4

3. What is normally meant by operating a transceiver in "split" mode?

G4

4. What reading on the plate current meter of a vacuum tube RF power amplifier indicates correct adjustment of the plate tuning control?

G4

5. What is a reason to use Automatic Level Control (ALC) with an RF power amplifier?

G4

6. What type of device is often used to match transmitter output impedance to an impedance not equal to 50 ohms?

G4

7. What condition can lead to permanent damage to a solid-state RF power amplifier?

G4

8. What is the correct adjustment for the load or coupling control of a vacuum tube RF power amplifier?

G4

9. Why is a time delay sometimes included in a transmitter keying circuit?

G4

10. What is the purpose of an electronic keyer?

G4

11. Which of the following is a use for the IF shift control on a receiver?

G4

12. Which of the following is a common use for the dual VFO feature on a transceiver?

G4

13. What is one reason to use the attenuator function that is present on many HF transceivers?

G4

14. What is likely to happen if a transceiver's ALC system is not set properly when transmitting AFSK signals with the radio using single sideband mode?

G4

15. Which of the following can be a symptom of transmitted RF being picked up by an audio cable carrying AFSK data signals between a computer and a transceiver?

G4B - Test and monitoring equipment; two-tone test

G4

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

G4

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

G4

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

G4

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

G4

5. Why is high input impedance desirable for a voltmeter?

G4

6. What is an advantage of a digital voltmeter as compared to an analog voltmeter?

G4

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

G4

8. Which of the following instruments may be used to monitor relative RF output when making antenna and transmitter adjustments?

G4

9. Which of the following can be determined with a field strength meter?

G4

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

G4

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

G4

12. What problem can occur when making measurements on an antenna system with an antenna analyzer?

G4

13. What is a use for an antenna analyzer other than measuring the SWR of an antenna system?

G4

14. What is an instance in which the use of an instrument with analog readout may be preferred over an instrument with a digital readout?

G4

15. What type of transmitter performance does a two-tone test analyze?

G4C - Interference with consumer electronics; grounding; DSP

G4

1. Which of the following might be useful in reducing RF interference to audio frequency devices?

G4

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

G4

3. What sound is heard from an audio device or telephone if there is interference from a nearby single sideband phone transmitter?

G4

4. What is the effect on an audio device or telephone system if there is interference from a nearby CW transmitter?

G4

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

G4

6. What effect can be caused by a resonant ground connection?

G4

7. What is one good way to avoid unwanted effects of stray RF energy in an amateur

G4

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

G4

9. How can a ground loop be avoided?

G4

10. What could be a symptom of a ground loop somewhere in your station?

G4

11. Which of the following is a function of a digital signal processor?

12. Which of the following is an advantage of a receiver DSP IF filter as compared to an analog filter?

G4

13. Which of the following can perform automatic notching of interfering carriers?

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

G4

1. What is the purpose of a speech processor as used in a modern transceiver?

G4

2. Which of the following describes how a speech processor affects a transmitted single sideband phone signal?

G4

3. Which of the following can be the result of an incorrectly adjusted speech processor?

G4

4. What does an S meter measure?

G4

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

G4

6. Where is an S meter found?

G4

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

G4

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

G4

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

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

G4

11. How close to the upper edge of the 20-meter Cass B band should your displayed carrier frequency be when using 3 kHz wide USB?

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

G4

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

G4

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

G4

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

G4

4. Why is it best NOT to draw the DC power for a 100 watt HF transceiver from a vehicle's auxiliary power socket?

G4

5. Which of the following most limits the effectiveness of an HF mobile transceiver operating in the 75-meter band?

G4

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

G4

7. Which of the following may cause interference to be heard in the receiver of an HF radio installed in a recent model vehicle?

G4

8. What is the name of the process by which sunlight is changed directly into electricity?

G4

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

G4

10. What is the reason that a series diode is connected between a solar panel and a storage battery that is being charged by the panel?

G4

11. Which of the following is a disadvantage of using wind as the primary source of power for an emergency station?

SUBELEMENT G5 – ELECTRICAL PRINCIPLES

G5A – Reactance; inductance; capacitance; impedance; impedance matching

G4

10. What is the reason that a series diode is connected between a solar panel and a storage battery that is being charged by the panel?

G4

11. Which of the following is a disadvantage of using wind as the primary source of power for an emergency station?

; inductance; capacitance; impedance; impedance matching

G5

1. What is impedance?

G5

2. What is reactance?

G5

3. Which of the following causes opposition to the flow of alternating current in an inductor?

G5

4. Which of the following causes opposition to the flow of alternating current in a capacitor?

G5

5. How does an inductor react to AC?

G5

6. How does a capacitor react to AC?

G5

7. What happens when the impedance of an electrical load is equal to the output impedance of a power source, assuming both impedances are resistive?

G5

8. Why is impedance matching important?

G5

9. What unit is used to measure reactance?

G5

10. What unit is used to measure impedance?

G5

11. Which of the following describes one method of impedance matching between two AC circuits?

G5

12. What is one reason to use an impedance matching transformer?

G5

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

G5

9. What unit is used to measure reactance?

G5

10. What unit is used to measure impedance?

G5

11. Which of the following describes one method of impedance matching between two AC circuits?

G5

12. What is one reason to use an impedance matching transformer?

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

G5

1. What dB change represents a two-times increase or decrease in power?

G5

2. How does the total current relate to the individual currents in each branch of a purely resistive parallel circuit?

G5

3. How many watts of electrical power are used if 400 VDC is supplied to an 800 ohm load?

G5

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

G5

5. How many watts are dissipated when a current of 7.0 milliamperes flows through 1.25 kilohms resistance?

G5

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

G5

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

G5

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

G5

9. What percentage of power loss would result from a transmission line loss of 1 dB?

G5

10. What is the ratio of peak envelope power to average power for an unmodulated carrier?

G5

11. What would be the RMS voltage across a 50 ohm dummy load dissipating 1200 watts?

G5

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

G5

13. What is the output PEP from a transmitter if an oscilloscope measures 500 volts peak-to-peak across a 50 ohm resistive load connected to the transmitter output?

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

G5

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

G5

2. What happens if you reverse the primary and secondary windings of a 4:1 voltage step down transformer?

G5

3. Which of the following components should be added to an existing resistor to increase the resistance?

G5

4. What is the total resistance of three 100 ohm resistors in parallel?

G5

5. If three equal value resistors in series produce 450 ohms, what is the value of each resistor?

G5

6. What is the RMS voltage across a 500-turn secondary winding in a transformer if the 2250-turn primary is connected to 120 VAC?

G5

7. What is the turns ratio of a transformer used to match an audio amplifier having 600 ohm output impedance to a speaker having 4 ohm impedance?

G5

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

G5

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

G5

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

G5

2. What happens if you reverse the primary and secondary windings of a 4:1 voltage step down transformer?

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G5

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

G5

11. What is the inductance of a 20 millihenry inductor connected in series with a 50 millihenry inductor?

G5

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

G5

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

G5

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

G5

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

G5

16. Why is the conductor of the primary winding of many voltage step up transformers larger in diameter than the conductor of the secondary winding?

G5

17. What is the value in nanofarads (nF) of a 22,000 pF capacitor?

G5

18. What is the value in microfarads of a 4700 nanofarad (nF) capacitor?

SUBELEMENT G6 – CIRCUIT COMPONENTS

G6A – Resistors; Capacitors; Inductors; Rectifiers; solid state diodes and transistors; vacuum tubes; batteries

G6

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

G6

2. What is an advantage of the low internal resistance of nickel-cadmium batteries?

G6

3. What is the approximate junction threshold voltage of a germanium diode?

G6

4. When is it acceptable to recharge a carbon-zinc primary cell?

G6

5. What is the approximate junction threshold voltage of a conventional silicon diode?

G6

6. Which of the following is an advantage of using a Schottky diode in an RF switching circuit rather than a standard silicon diode?

G6

7. What are the stable operating points for a bipolar transistor used as a switch in a logic circuit?

G6

8. Why must the cases of some large power transistors be insulated from ground?

G6

9. Which of the following describes the construction of a MOSFET?

G6

10. Which element of a triode vacuum tube is used to regulate the flow of electrons between cathode and plate?

G6

11. Which of the following solid state devices is most like a vacuum tube in its general operating characteristics?

G6

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

G6

13. Why is the polarity of applied voltages important for polarized capacitors?

G6

14. Which of the following is an advantage of ceramic capacitors as compared to other types of capacitors?

G6

15. Which of the following is an advantage of an electrolytic capacitor?

G6

16. What will happen to the resistance if the temperature of a resistor is increased?

G6

17. Which of the following is a reason not to use wire-wound resistors in an RF circuit?

G6

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

G6

19. How should the winding axes of two solenoid inductors be oriented to minimize their mutual inductance?

G6B - Analog and digital integrated circuits (ICs); microprocessors; memory; I/O devices; microwave ICs (MMICs); display devices

G6

1. Which of the following is an analog integrated circuit?

G6

2. What is meant by the term MMIC?

G6

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

G6

4. What is meant by the term ROM?

G6

5. What is meant when memory is characterized as non-volatile?

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6. What kind of device is an integrated circuit operational amplifier?

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6. What kind of device is an integrated circuit operational amplifier?

G6

7. Which of the following is an advantage of an LED indicator compared to an incandescent indicator?

G6

8. How is an LED biased when emitting light?

G6

9. Which of the following is a characteristic of a liquid crystal display?

G6B10 (A)

10. What two devices in an Amateur Radio station might be connected using a USB interface?

G6

11. What is a microprocessor?

G6

12. Which of the following connectors would be a good choice for a serial data port?

G6

13. Which of these connector types is commonly used for RF connections at frequencies up to 150 MHz?

G6

14. Which of these connector types is commonly used for audio signals in Amateur Radio stations?

G6

15. What is the main reason to use keyed connectors instead of non-keyed types?

G6

16. Which of the following describes a type N connector?

G6

17. What is the general description of a DIN type connector?

G6

18. What is a type SMA connector?

G7 – PRACTICAL CIRCUITS

G7A Power supplies; and schematic symbols

G7

1. What useful feature does a power supply bleeder resistor provide?

G7

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

G7

3. What is the peak-inverse-voltage across the rectifiers in a full-wave bridge power supply?

G7

4. What is the peak-inverse-voltage across the rectifier in a half-wave power supply?

G7

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

G7

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

G7

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

G7

8. Which of the following is an advantage of a switchmode power supply as compared to a linear power supply?

G7

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

G7

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

G7

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

G7

12. Which symbol in Figure G7-1 represents a multiple-winding transformer?

G7

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

G7B - Digital circuits; amplifiers and oscillators

G7

1. Complex digital circuitry can often be replaced by what type of integrated circuit?

G7

2. Which of the following is an advantage of using the binary system when processing digital signals?

G7

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

G7

4. Which of the following describes the function of a two input NOR gate?

G7

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

G7

6. What is a shift register?

G7

7. What are the basic components of virtually all sine wave oscillators?

G7

8. How is the efficiency of an RF power amplifier determined?

G7

9. What determines the frequency of an LC oscillator?

G7

10. Which of the following is a characteristic of a Class A amplifier?

G7

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

G7

12. Which of these classes of amplifiers has the highest efficiency?

G7

13. What is the reason for neutralizing the final amplifier stage of a transmitter?

G7

14. Which of the following describes a linear amplifier?

G7C - Receivers and transmitters; filters, oscillators

G7

1. Which of the following is used to process signals from the balanced modulator then send them to the mixer in some single sideband phone transmitters?

G7

2. Which circuit is used to combine signals from the carrier oscillator and speech amplifier then send the result to the filter in some single sideband phone transmitters?

G7

3. What circuit is used to process signals from the RF amplifier and local oscillator then send the result to the IF filter in a superheterodyne receiver?

G7

4. What circuit is used to combine signals from the IF amplifier and BFO and send the result to the AF amplifier in some single sideband receivers?

G7

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

G7

6. What should be the impedance of a low-pass filter as compared to the impedance of the transmission line into which it is inserted?

G7

7. What is the simplest combination of stages that implement a superheterodyne receiver?

G7

8. What type of circuit is used in many FM receivers to convert signals coming from the IF amplifier to audio?

G7

9. Which of the following is needed for a Digital Signal Processor IF filter?

G7

10. How is Digital Signal Processor filtering accomplished?

G7

11. What is meant by the term "software defined radio" (SDR)?

SUBELEMENT G8 – SIGNALS AND EMISSIONS

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

G8

1. How is an FSK signal generated?

G8

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

G8

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

G8

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

G8

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

G8

6. What is one advantage of carrier suppression in a single sideband phone transmission versus full carrier amplitude modulation?

G8

7. Which of the following phone emissions uses the narrowest bandwidth?

G8

8. Which of the following is an effect of overmodulation?

G8

9. What control is typically adjusted for proper ALC setting on an amateur single sideband transceiver?

G8

10. What is meant by the term flat-topping when referring to a single sideband phone transmission?

G8

12. What is the modulation envelope of an AM signal?

G8B - Frequency mixing; multiplication; bandwidths of various modes; deviation; duty cycle

G8

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

G8

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

G8

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

G8

4. What is the stage in a VHF FM transmitter that generates a harmonic of a lower frequency signal to reach the desired operating frequency?
G8
5. What is the approximate bandwidth of a PACTOR3 signal at maximum data rate?
G8
6. What is the total bandwidth of an FM phone transmission having 5 kHz deviation and 3 kHz modulating frequency?
G8
7. What is the frequency deviation for a 12.21 MHz reactance modulated oscillator in a 5 kHz deviation, 146.52 MHz FM phone transmitter?
G8
8. Why is it important to know the duty cycle of the mode you are using when transmitting?
G8
9. Why is it good to match receiver bandwidth to the bandwidth of the operating mode?
G8
10. What is the relationship between transmitted symbol rate and bandwidth?

G8C – Digital emission modes

- G8
1. Which of the following digital modes is designed to operate at extremely low signal strength on the HF bands?
G8
 2. How many data bits are sent in a single PSK31 character?
G8
 3. What part of a data packet contains the routing and handling information?
G8
 4. Which of the following describes Baudot code?
G8
 5. In the PACTOR protocol, what is meant by an NAK response to a transmitted packet?
G8
 6. What action results from a failure to exchange information due to excessive transmission attempts when using PACTOR or WINMOR?
G8
 7. How does the receiving station respond to an ARQ data mode packet containing errors?
G8
 8. Which of the following statements is true about PSK31?
G8
 9. What does the number 31 represent in "PSK31"?
G8
 10. How does forward error correction (FEC) allow the receiver to correct errors in received data packets?
G8
 11. How are the two separate frequencies of a Frequency Shift Keyed (FSK) signal identified?

G8

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

SUBELEMENT G9 – ANTENNAS AND FEED LINES

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

G9

1. Which of the following factors determine the characteristic impedance of a parallel conductor antenna feed line?

G9

2. What are the typical characteristic impedances of coaxial cables used for antenna feed lines at amateur stations?

G9

3. What is the characteristic impedance of flat ribbon TV type twinlead?

G9

4. What might cause reflected power at the point where a feed line connects to an antenna?

G9

5. How does the attenuation of coaxial cable change as the frequency of the signal it is carrying increases?

G9

6. In what units is RF feed line loss usually expressed?

G9

7. What must be done to prevent standing waves on an antenna feed line?

G9

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

G9

9. What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 200 ohm impedance?

G9

10. What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 10 ohm impedance?

G9

11. What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 50 ohm impedance?

G9

12. What standing wave ratio will result when connecting a 50 ohm feed line to a non-reactive load having 25 ohm impedance?

G9

13. What standing wave ratio will result when connecting a 50 ohm feed line to an antenna that has a purely resistive 300 ohm feed point impedance?

G9

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

G9

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

G9B - Basic antennas

G9

1. What is one disadvantage of a directly fed random-wire HF antenna?

G9

2. Which of the following is a common way to adjust the feed point impedance of a quarter wave ground plane vertical antenna to be approximately 50 ohms?

G9

3. What happens to the feed point impedance of a ground plane antenna when its radials are changed from horizontal to sloping downward?

G9

4. What is the radiation pattern of a dipole antenna in free space in the plane of the conductor?

G9

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

G9

6. Where should the radial wires of a ground-mounted vertical antenna system be placed?

G9

7. How does the feed point impedance of a 1/2 wave dipole antenna change as the antenna is lowered below 1/4 wave above ground?

G9

8. How does the feed point impedance of a 1/2 wave dipole change as the feed point is moved from the center toward the ends?

G9

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

G9

10. What is the approximate length for a 1/2 wave dipole antenna cut for 14.250 MHz?

G9

11. What is the approximate length for a 1/2 wave dipole antenna cut for 3.550 MHz?

G9

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

G9C - Directional antennas

G9

1. Which of the following would increase the bandwidth of a Yagi antenna?

G9

2. What is the approximate length of the driven element of a Yagi antenna?

G9

3. Which statement about a three-element, single-band Yagi antenna is true?

G9

4. Which statement about a three-element, single-band Yagi antenna is true?
G9
 5. How does increasing boom length and adding directors affect a Yagi antenna?
G9
 6. What configuration of the loops of a two-element quad antenna must be used for the antenna to operate as a beam antenna, assuming one of the elements is used as a reflector?
G9
 7. What does "front-to-back ratio" mean in reference to a Yagi antenna?
G9
 8. What is meant by the "main lobe" of a directive antenna?
G9
 9. How does the gain of two 3-element horizontally polarized Yagi antennas spaced vertically $1/2$ wavelength apart typically compare to the gain of a single 3-element Yagi?
G9
 10. Which of the following is a Yagi antenna design variable that could be adjusted to optimize forward gain, front-to-back ratio, or SWR bandwidth?
G9
 11. What is the purpose of a gamma match used with Yagi antennas?
G9
 12. Which of the following is an advantage of using a gamma match for impedance matching of a Yagi antenna to 50 ohm coax feed line?
G9
 13. Approximately how long is each side of the driven element of a quad antenna?
G9
 14. How does the forward gain of a two-element quad antenna compare to the forward gain of a three-element Yagi antenna?
G9
 15. Approximately how long is each side of the reflector element of a quad antenna?
G9
 16. How does the gain of a two-element delta-loop beam compare to the gain of a two-element quad antenna?
G9
 17. Approximately how long is each leg of a symmetrical delta-loop antenna?
G9
 18. What happens when the feed point of a quad antenna of any shape is moved from the midpoint of the top or bottom to the midpoint of either side?
G9
 19. How does antenna gain stated in dBi compare to gain stated in dBd for the same antenna?
G9
- What is meant by the terms dBi and dBd when referring to antenna gain?

G9D - Specialized antennas

G9

1. What does the term NVIS mean as related to antennas?

G9

2. Which of the following is an advantage of an NVIS antenna?

G9

3. At what height above ground is an NVIS antenna typically installed?

G9

4. What is the primary purpose of antenna traps?

G9

5. What is an advantage of vertical stacking of horizontally polarized Yagi antennas?

G9

6. Which of the following is an advantage of a log periodic antenna?

G9

7. Which of the following describes a log periodic antenna?

G9

8. Why is a Beverage antenna not used for transmitting?

G9

9. Which of the following is an application for a Beverage antenna?

G9

10. Which of the following describes a Beverage antenna?

G9

11. Which of the following is a disadvantage of multiband antennas?

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SUBELEMENT G0 – ELECTRICAL AND RF SAFETY

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

G0

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

G0

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

G0

3. What does "time averaging" mean in reference to RF radiation exposure?

G0

4. What precaution should be taken when installing a ground-mounted antenna?

G0

5. What effect does transmitter duty cycle have when evaluating RF exposure?

G0

6. What type of instrument can be used to accurately measure an RF field?

G0

7. What is one thing that can be done if evaluation shows that a neighbor might receive more than the allowable limit of RF exposure from the main lobe of a directional antenna?

G0

8. What precaution should you take if you install an indoor transmitting antenna?

G0

9. What precaution should you take whenever you make adjustments or repairs to an antenna?

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

G0

1. Which wire or wires in a four-conductor connection should be attached to fuses or circuit breakers in a device operated from a 240 VAC single phase source?

G0

2. What is the minimum wire size that may be safely used for a circuit that draws up to 20 amperes of continuous current?

G0

3. Which size of fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring?

G0

4. Which of the following is a primary reason for not placing a gasoline-fueled generator inside an occupied area?

G0

5. Which of the following conditions will cause a Ground Fault Circuit Interrupter (GFCI) to disconnect the 120 or 240 Volt AC line power to a device?

G0

6. Why must the metal enclosure of every item of station equipment be grounded?

G0

7. Which of these choices should be observed when climbing a tower using a safety belt or harness?

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G0

8. What should be done by any person preparing to climb a tower that supports electrically powered devices?

G0

9. Why should soldered joints not be used with the wires that connect the base of a tower to a system of ground rods?

G0

10. Which of the following is a danger from lead-tin solder?

G0

11. Which of the following is good practice for lightning protection grounds?

G0

12. What is the purpose of a power supply interlock?

G0

13. What must you do when powering your house from an emergency generator?

G0

14. Which of the following is covered by the National Electrical Code?

G0

15. Which of the following is true of an emergency generator installation?

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