

SUBELEMENT T1

COMMISSION'S RULES

[6 Exam Questions - 6 Groups]

T1A - Purpose and permissible use of the Amateur Radio Service; Operator/primary station license grant; Meanings of basic terms used in FCC rules; Interference; RACES rules; Phonetics; Frequency Coordinator

Points of Discussion

Part 97.1 (c): Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communications and technical phases of the art.

The FCC (Federal Communications Commission) is the body that makes and enforces the rules for Amateur Radio service in the United States.

The FCC recommends the use of phonetics when you identify by voice -- that avoids confusing letters that sound alike.

The operator license gives you permission to operate an amateur station according to the rules of the amateur service. The station license authorizes you to have an amateur station. The combined license is an amateur operator/primary station license. Each person can have only one such license.

Points of Discussion

Once you pass your exam, your forms are filed with the FCC by the VEC responsible for your exam session. You can't begin operating, though, until you are notified of your call sign. Once your information shows up in the FCC ULS consolidated database, that's proof you have been granted an operator/station license and are fully authorized to go on the air.

Beacons are another type of station restricted to certain sub-bands. These stations make transmissions for the purpose of observing propagation or other experiments.

Space Station: Defined by the FCC as an amateur station located more than 50 km above the Earth's surface.

To keep order (among amateur repeater stations), a committee of volunteers known as a frequency coordinator recommends transmit and receive frequencies.

The frequency coordinator representatives are selected by the local or regional amateurs whose stations are eligible to be auxiliary or repeater stations.

Points of Discussion

RACES (Radio Amateur Civil Emergency Service) is a special part of the FCC Part 97 Amateur service to provide civil defense communications to local, state, or federal government emergency management agencies during national emergencies.

Intentionally creating harmful interference is called willful interference and is never allowed.

Questions?

T1A01 [97.1]

Which of the following is part of the Basis and Purpose of the Amateur Radio Service?

- A. Providing personal radio communications for as many citizens as possible
- B. Providing communications for international non-profit organizations
- C. Advancing skills in the technical and communication phases of the radio art
- D. All these choices are correct

T1A01 [97.1]

Which of the following is part of the Basis and Purpose of the Amateur Radio Service?

C. Advancing skills in the technical and communication phases of the radio art

T1A02 [97.1]

Which agency regulates and enforces the rules for the Amateur Radio Service in the United States?

- A. FEMA
- B. Homeland Security
- C. The FCC
- D. All these choices are correct

T1A02 [97.1]

Which agency regulates and enforces the rules for the Amateur Radio Service in the United States?

C. The FCC

T1A03 [97.119(b)(2)]

What do the FCC rules state regarding the use of a phonetic alphabet for station identification in the Amateur Radio Service?

- A. It is required when transmitting emergency messages
- B. It is encouraged
- C. It is required when in contact with foreign stations
- D. All these choices are correct

T1A03 [97.119(b)(2)]

What do the FCC rules state regarding the use of a phonetic alphabet for station identification in the Amateur Radio Service?

B. It is encouraged

T1A04 [97.5(b)(1)]

How many operator/primary station license grants may be held by any one person?

- A. One
- B. No more than two
- C. One for each band on which the person plans to operate
- D. One for each permanent station location from which the person plans to operate

T1A04 [97.5(b)(1)]

How many operator/primary station license grants may be held by any one person?

A. One

T1A05 [97.7]

What proves that the FCC has issued an operator/primary license grant?

- A. A printed copy of the certificate of successful completion of examination
- B. An email notification from the NCVVEC granting the license
- C. The license appears in the FCC ULS database
- D. All these choices are correct

T1A05 [97.7]

What proves that the FCC has issued an operator/primary license grant?

C. The license appears in the FCC ULS database

T1A06 [97.3(a)(9)]

What is the FCC Part 97 definition of a beacon?

- A. A government transmitter marking the amateur radio band edges
- B. A bulletin sent by the FCC to announce a national emergency
- C. A continuous transmission of weather information authorized in the amateur bands by the National Weather Service
- D. An amateur station transmitting communications for the purposes of observing propagation or related experimental activities

T1A06 [97.3(a)(9)]

What is the FCC Part 97 definition of a beacon?

- D. An amateur station transmitting communications for the purposes of observing propagation or related experimental activities**

T1A07 [97.3(a)(41)]

What is the FCC Part 97 definition of a space station?

- A. Any satellite orbiting Earth
- B. A manned satellite orbiting Earth
- C. An amateur station located more than 50 km above Earth's surface
- D. An amateur station using amateur radio satellites for relay of signals

T1A07 [97.3(a)(41)]

What is the FCC Part 97 definition of a space station?

C. An amateur station located more than 50 km above Earth's surface

T1A08 [97.3(a)(22)]

Which of the following entities recommends transmit/receive channels and other parameters for auxiliary and repeater stations?

- A. Frequency Spectrum Manager appointed by the FCC
- B. Volunteer Frequency Coordinator recognized by local amateurs
- C. FCC Regional Field Office
- D. International Telecommunication Union

T1A08 [97.3(a)(22)]

Which of the following entities recommends transmit/receive channels and other parameters for auxiliary and repeater stations?

B. Volunteer Frequency Coordinator recognized by local amateurs

T1A09 [97.3(a)(22)]

Who selects a Frequency Coordinator?

- A. The FCC Office of Spectrum Management and Coordination Policy
- B. The local chapter of the Office of National Council of Independent Frequency Coordinators
- C. Amateur operators in a local or regional area whose stations are eligible to be repeater or auxiliary stations
- D. FCC Regional Field Office

T1A09 [97.3(a)(22)]

Who selects a Frequency Coordinator?

- C. Amateur operators in a local or regional area whose stations are eligible to be repeater or auxiliary stations

T1A10 [97.3(a)(38), 97.407]

What is the Radio Amateur Civil Emergency Service (RACES)?

- A. A radio service using amateur frequencies for emergency management or civil defense communications
- B. A radio service using amateur stations for emergency management or civil defense communications
- C. An emergency service using amateur operators certified by a civil defense organization as being enrolled in that organization
- D. All these choices are correct

T1A10 [97.3(a)(38), 97.407]

What is the Radio Amateur Civil Emergency Service (RACES)?

D. All these choices are correct

T1A11 [97.101]

When is willful interference to other amateur radio stations permitted?

- A. To stop another amateur station that is breaking the FCC rules
- B. At no time
- C. When making short test transmissions
- D. At any time, stations in the Amateur Radio Service are not protected from willful interference

T1A11 [97.101]

When is willful interference to other amateur radio stations permitted?

B. At no time

T1B - Frequency allocations; Emission modes; Spectrum sharing; Transmissions near band edges; Contacting the International Space Station; Power output

Points of Discussion

Technician class hams have access to part of the 10 meter band, ranging from 28.000 MHz to 28.500 MHz.

Any amateur licensed to use the 2 meter and 70 cm bands can join the fun of communicating with the International Space Station.

6 meter band ranges from 50 MHz to 54 MHz.

2 meter band ranges from 144 MHz to 148 MHz.

The segment of the 1.25-meter band from 219 MHz to 220 MHz is restricted to digital message forwarding by fixed stations and systems.

Technician class hams have HF phone (voice) privileges only on the 10 meter band.

There is a small CW-only sub-band occupying the bottom 100 kHz of the 6- and 2-meter bands.

Amateurs have a secondary allocation on the 70 cm band and must avoid interfering with radiolocation stations that have primary status.

Points of Discussion

Amateurs are allowed to use any frequency in a band, but you have to be careful when operating near the edge of a band. You must keep all of your signal inside the band. Since your radio displays the carrier frequency, you have to remember to leave room for the signal's sidebands.

Every amateur band from 50 MHz on up has frequencies available for CW and SSB (phone) operation.

Below 30 MHz, Novice and Technician licenses are limited to 200 watts PEP on FH bands.

With a few specific restrictions, amateurs are allowed the full legal limit of 1500 watts PEP output. This applies to Technician operators above 30 MHz.

Questions?

T1B01 [97.301 (e)]

Which of the following frequency ranges are available for phone operation by Technician licensees?

- A. 28.050 MHz to 28.150 MHz
- B. 28.100 MHz to 28.300 MHz
- C. 28.300 MHz to 28.500 MHz
- D. 28.500 MHz to 28.600 MHz

T1B01 [97.301 (e)]

Which of the following frequency ranges are available for phone operation by Technician licensees?

C. 28.300 MHz to 28.500 MHz

T1B02 [97.301, 97.207(c)]

Which amateurs may contact the International Space Station (ISS) on VHF bands?

- A. Any amateur holding a General class or higher license
- B. Any amateur holding a Technician class or higher license
- C. Any amateur holding a General class or higher license who has applied for and received approval from NASA
- D. Any amateur holding a Technician class or higher license who has applied for and received approval from NASA

T1B02 [97.301, 97.207(c)]

Which amateurs may contact the International Space Station (ISS) on VHF bands?

B. Any amateur holding a Technician class or higher license

T1B03 [97.301(a)]

Which frequency is in the 6 meter amateur band?

- A. 49.00 MHz
- B. 52.525 MHz
- C. 28.50 MHz
- D. 222.15 MHz

T1B03 [97.301(a)]

Which frequency is in the 6 meter amateur band?

B. 52.525 MHz

T1B04 [97.301(a)]

Which amateur band includes 146.52 MHz?

- A. 6 meters
- B. 20 meters
- C. 70 centimeters
- D. 2 meters

T1B04 [97.301(a)]

Which amateur band includes 146.52 MHz?

D. 2 meters

T1B05 [97.305(c)]

How many amateurs use the 219 to 220 MHz segment of 1.25 meter band?

- A. Spread spectrum only
- B. Fast-scan television only
- C. Emergency traffic only
- D. Fixed digital message forwarding systems only

T1B05 [97.305(c)]

How many amateurs use the 219 to 220 MHz segment of 1.25 meter band?

D. Fixed digital message forwarding systems only

T1B06 [97.301(e), 97.305]

On which HF bands does a Technician class operator have phone privileges?

- A. None
- B. 10 meter band only
- C. 80 meter, 40 meter, 15 meter, and 10 meter bands
- D. 30 meter band only

T1B06 [97.301(e), 97.305]

On which HF bands does a Technician class operator have phone privileges?

B. 10 meter band only

T1B07 [97.305(a),]

Which of the following VHF/UHF band segments are limited to CW only?

- A. 50.0 MHz to 50.1 MHz and 144.0 MHz to 144.1 MHz
- B. 219 MHz to 220 MHz and 420.0 MHz to 420.1 MHz
- C. 902.0 MHz to 902.1 MHz
- D. All these choices are correct

T1B07 [97.305(a),]

Which of the following VHF/UHF band segments are limited to CW only?

A. 50.0 MHz to 50.1 MHz and 144.0 MHz to 144.1 MHz

T1B08 [97.303]

How are US amateurs restricted in segments of bands where the Amateur Radio Service is secondary?

- A. U.S. amateurs may find non-amateur stations in those segments, and must avoid interfering with them
- B. U.S. amateurs must give foreign amateur stations priority in those segments
- C. International communications are not permitted in those segments
- D. Digital transmissions are not permitted in those segments

T1B08 [97.303]

How are US amateurs restricted in segments of bands where the Amateur Radio Service is secondary?

A. U.S. amateurs may find non-amateur stations in those segments, and must avoid interfering with them

T1B09 [97.101(a), 97.301(a-e)]

Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?

- A. To allow for calibration error in the transmitter frequency display
- B. So that modulation sidebands do not extend beyond the band edge
- C. To allow for transmitter frequency drift
- D. All these choices are correct

T1B09 [97.101(a), 97.301(a-e)]

Why should you not set your transmit frequency to be exactly at the edge of an amateur band or sub-band?

D. All these choices are correct

T1B10 [97.305(c)]

Where may SSB phone be used in amateur bands above 50 MHz?

- A. Only in sub-bands allocated to General class or higher licensees
- B. Only on repeaters
- C. In at least some segment of all these bands
- D. On any band if the power is limited to 25 watts

T1B10 [97.305(c)]

Where may SSB phone be used in amateur bands above 50 MHz?

C. In at least some segment of all these bands

T1B11 [97.313]

What is the maximum peak envelope power output for Technician class operators in their HF band segments?

- A. 200 watts
- B. 100 watts
- C. 50 watts
- D. 10 watts

T1B11 [97.313]

What is the maximum peak envelope power output for Technician class operators in their HF band segments?

A. 200 watts

T1B12 [97.313(b)]

Except for some specific restrictions, what is the maximum peak envelope power output for Technician class operators using frequencies above 30 MHz?

- A. 50 watts
- B. 100 watts
- C. 500 watts
- D. 1500 watts

T1B12 [97.313(b)]

Except for some specific restrictions, what is the maximum peak envelope power output for Technician class operators using frequencies above 30 MHz?

D. 1500 watts

T1C - Licensing: classes, sequential and vanity call sign systems, places where the Amateur Radio Service is regulated by the FCC, name and address on FCC license database, term, renewal, grace period, maintaining mailing address; International communications

Points of Discussion

There are three classes of Amateur Radio licenses being granted today: Technician, General, and Amateur Extra.

Licensed hams can pick any available call authorized for their license class. There are lots of available calls for Technician licensees to choose from in Group C (1 x 3) and Group D (2 x 3).

Unless specifically prohibited by the government of either country, any ham can talk to any other ham. International communications must be limited to the purposes of the amateur service or remarks of a personal nature.

The FCC requires you to provide and maintain a valid current mailing and email address in their database at all times. This is so you can be contacted by mail and email, if needed. If you move or even change P.O. boxes, be sure to update your information using the FCC ULS online system. If mail or email to you is returned to the FCC as undeliverable, your license can be suspended or revoked and removed from the database.

Points of Discussion

Licensed hams can pick any available call authorized for their license class.

There are lots of available calls for Technician licensees to choose from in Group C (1 x 3) and Group D (2 x 3).

To operate at all (while in a foreign country), the foreign country must permit amateur operation. In addition, you must have permission and when you are inside a country's national boundaries, including territorial waters, you are required to operate according to their rules. You may also operate from any vessel or craft that is documented or registered in the United States.

The FCC requires you to provide and maintain a valid current mailing and email address in their database at all times. This is so you can be contacted by mail and email, if needed. If you move or even change P.O. boxes, be sure to update your information using the FCC ULS online system. If mail or email to you is returned to the FCC as undeliverable, your license can be suspended or revoked and removed from the database.

Amateur licenses are good for a 10-year term.

Points of Discussion

You have a two-year grace period to apply for a new license without taking the exam again.

Once you pass your exam, your forms are filed with the FCC by the VEC responsible for your exam session. You can't begin operating, though, until you are notified of your call sign. Once your information shows up in the FCC ULS consolidated database, that's proof you have been granted an operator/station license and are fully authorized to go on the air.

If your license expires, you are supposed to stop transmitting because your license is not valid after it expires.

Questions?

T1C01 [97.9(a), 97.17(a)]

For which license classes are new licenses currently available from the FCC?

- A. Novice, Technician, General, Amateur Extra
- B. Technician, Technician Plus, General, Amateur Extra
- C. Novice, Technician Plus, General, Advanced
- D. Technician, General, Amateur Extra

T1C01 [97.9(a), 97.17(a)]

For which license classes are new licenses currently available from the FCC?

D. Technician, General, Amateur Extra

T1C02 [97.19]

Who may select a desired call sign under the vanity call sign rules?

- A. Only a licensed amateur with a General or Amateur Extra Class license
- B. Only a licensed amateur with an Amateur Extra Class license
- C. Only a licensed amateur who has been licensed continuously for more than 10 years
- D. Any licensed amateur

T1C02 [97.19]

Who may select a desired call sign under the vanity call sign rules?

D. Any licensed amateur

T1C03 [97.117]

What types of international communications are an FCC-licensed amateur radio station permitted to make?

- A. Communications incidental to the purposes of the Amateur Radio Service and remarks of a personal character
- B. Communications incidental to conducting business or remarks of a personal nature
- C. Only communications incidental to contest exchanges; all other communications are prohibited
- D. Any communications that would be permitted by an international broadcast station

T1C03 [97.117]

What types of international communications are an FCC-licensed amateur radio station permitted to make?

A. Communications incidental to the purposes of the Amateur Radio Service and remarks of a personal character

T1C04 [97.23]

What may happen if the FCC is unable to reach you by email?

- A. Fine and suspension of operator license
- B. Revocation of the station license or suspension of the operator license
- C. Revocation of access to the license record in the FCC system
- D. Nothing; there is no such requirement

T1C04 [97.23]

What may happen if the FCC is unable to reach you by email?

B. Revocation of the station license or suspension of the operator license

T1C05

Which of the following is a valid Technician class call sign format?

- A. KF1XXX
- B. KA1X
- C. W1XX
- D. All these choices are correct

T1C05

Which of the following is a valid Technician class call sign format?

A. KF1XXX

T1C06 [97.5(a)(2)]

From which of the following locations may an FCC-licensed amateur station transmit?

- A. From within any country that belongs to the International Telecommunication Union
- B. From within any country that is a member of the United Nations
- C. From anywhere within International Telecommunication Union (ITU) Regions 2 and 3
- D. From any vessel or craft located in international waters and documented or registered in the United States

T1C06 [97.5(a)(2)]

From which of the following locations may an FCC-licensed amateur station transmit?

D. From any vessel or craft located in international waters and documented or registered in the United States

T1C07 [97.23]

Which of the following can result in revocation of the station license or suspension of the operator license?

- A. Failure to inform the FCC of any changes in the amateur station following performance of an RF safety environmental evaluation
- B. Failure to provide and maintain a correct email address with the FCC
- C. Failure to obtain FCC type acceptance prior to using a home-built transmitter
- D. Failure to have a copy of your license available at your station

T1C07 [97.23]

Which of the following can result in revocation of the station license or suspension of the operator license?

B. Failure to provide and maintain a correct email address with the FCC

T1C08 [97.25]

What is the normal term for an FCC-issued amateur radio license?

- A. Five years
- B. Life
- C. Ten years
- D. Eight years

T1C08 [97.25]

What is the normal term for an FCC-issued amateur radio license?

C. Ten years

T1C09 [97.21(a)(b)]

What is the grace period for renewal if an amateur license expires?

- A. Two years
- B. Three years
- C. Five years
- D. Ten years

T1C09 [97.21(a)(b)]

What is the grace period for renewal if an amateur license expires?

A. Two years

T1C10 [97.5a]

How soon after passing the examination for your first amateur radio license may you transmit on the amateur radio bands?

- A. Immediately on receiving your Certificate of Successful Completion of Examination (CSCE)
- B. As soon as your operator/station license grant appears on the ARRL website
- C. As soon as your operator/station license grant appears in the FCC's license database
- D. As soon as you receive your license in the mail from the FCC

T1C10 [97.5a]

How soon after passing the examination for your first amateur radio license may you transmit on the amateur radio bands?

- C. As soon as your operator/station license grant appears in the FCC's license database**

T1C11 [97.21(b)]

If your license has expired and is still within the allowable grace period, may you continue to transmit on the amateur radio bands?

- A. Yes, for up to two years
- B. Yes, as soon as you apply for renewal
- C. Yes, for up to one year
- D. No, you must wait until the license has been renewed

T1C11 [97.21(b)]

If your license has expired and is still within the allowable grace period, may you continue to transmit on the amateur radio bands?

D. No, you must wait until the license has been renewed

T1D - Authorized and prohibited transmissions: communications with other countries, music, exchange of information with other services, indecent language, compensation for operating, retransmission of other amateur signals, encryption, sale of equipment, unidentified transmissions, one-way transmission

Points of Discussion

The FCC can prohibit contacts between US citizens and those of specific other countries by notifying the ITU (International Telecommunication Union) of its objections.

Hams are not allowed to broadcast except for the purpose of transmitting code practice, information bulletins for other amateurs, or when necessary for emergency communications.

Amateurs may not use encryption techniques except for radio control and control transmissions to space stations where interception or unauthorized transmissions could have serious consequences.

The prohibition against transmission of music (and other entertainment-type material in video and image transmissions) extends to incidental retransmission of music from a nearby radio. Music can only be rebroadcast as part of an authorized rebroadcast of space station transmissions. [This basically means the International Space Station.]

Points of Discussion

You can order things over the air, as long as you don't do it regularly or as part of your normal income-making activities. It is also okay to advertise equipment for sale as long as it pertains to Amateur Radio and it's not your regular business.

Obscene or indecent speech are prohibited during transmissions. Avoid controversial topics and expletives.

Retransmitting the signals of another station is also generally prohibited, except when you are relaying messages or digital data from another station. Some types of stations (repeaters, auxiliary stations, and space stations) are allowed to automatically retransmit signals on different frequencies or channels.

One exception to the profession or business prohibition is that teachers may use ham radio as part of their classroom instruction. In that case, they can be a control operator of a ham station, but it must be incidental to their job and can't be the majority of their duties.

Points of Discussion

The prohibition on broadcasting includes repeating and relaying transmissions from other communications services. Hams are also specifically prohibited from assisting and participating in news gathering by broadcasting organizations.

Non-hams often refer to ham transmissions as “broadcasting” but that is inaccurate. Broadcasting consists of one-way transmissions intended for reception by the general public.

The first rule of identification is that unidentified transmissions are not allowed. Unidentified means that no call sign was associated with the transmission. The only exception is when your signals are controlling a model craft.

Questions?

T1D01 [97.111(a)(1)]

With which countries are FCC-licensed amateur radio stations prohibited from exchanging communications?

- A. Any country whose administration has notified the International Telecommunication Union (ITU) that it objects to such communications
- B. Any country whose administration has notified the American Radio Relay League (ARRL) that it objects to such communications
- C. Any country banned from such communications by the International Amateur Radio Union (IARU)
- D. Any country banned from making such communications by the American Radio Relay League (ARRL)

T1D01 [97.111(a)(1)]

With which countries are FCC-licensed amateur radio stations prohibited from exchanging communications?

A. Any country whose administration has notified the International Telecommunication Union (ITU) that it objects to such communications

T1D02 [97.113(b), 97.111(b)]

Under which of the following circumstances are one-way transmissions by an amateur station prohibited?

- A. In all circumstances
- B. Broadcasting
- C. International Morse Code Practice
- D. Telecommand or transmissions of telemetry

T1D02 [97.113(b), 97.111(b)]

Under which of the following circumstances are one-way transmissions by an amateur station prohibited?

B. Broadcasting

T1D03 [97.211(b), 97.215(b), 97.113(a)(4)]

When is it permissible to transmit messages encoded to obscure their meaning?

- A. Only during contests
- B. Only when transmitting certain approved digital codes
- C. Only when transmitting control commands to space stations or radio control craft
- D. Never

T1D03 [97.211(b), 97.215(b), 97.113(a)(4)]

When is it permissible to transmit messages encoded to obscure their meaning?

C. Only when transmitting control commands to space stations or radio control craft

T1D04 [97.113(a)(4), 97.113(c)]

Under what conditions is an amateur station authorized to transmit music using a phone emission?

- A. When incidental to an authorized retransmission of manned spacecraft communications
- B. When the music produces no spurious emissions
- C. When transmissions are limited to less than three minutes per hour
- D. When the music is transmitted above 1280 MHz

T1D04 [97.113(a)(4), 97.113(c)]

Under what conditions is an amateur station authorized to transmit music using a phone emission?

A. When incidental to an authorized retransmission of manned spacecraft communications

T1D05 [97.113(a)(3)(ii)]

When may amateur radio operators use their stations to notify other amateurs of the availability of equipment for sale or trade?

- A. Never
- B. When the equipment is not the personal property of either the station licensee, or the control operator, or their close relatives
- C. When no profit is made on the sale
- D. When selling amateur radio equipment and not on a regular basis

T1D05 [97.113(a)(3)(ii)]

When may amateur radio operators use their stations to notify other amateurs of the availability of equipment for sale or trade?

D. When selling amateur radio equipment and not on a regular basis

T1D06 [97.113(a)(4)]

What, if any, are the restrictions concerning transmission of language that may be considered indecent or obscene?

- A. The FCC maintains a list of words that are not permitted to be used on amateur frequencies
- B. Any such language is prohibited
- C. The ITU maintains a list of words that are not permitted to be used on amateur frequencies
- D. There is no such prohibition

T1D06 [97.113(a)(4)]

What, if any, are the restrictions concerning transmission of language that may be considered indecent or obscene?

B. Any such language is prohibited

T1D07 [97.113(d)]

What types of amateur stations can automatically retransmit the signals of other amateur stations?

- A. Auxiliary, beacon, or Earth stations
- B. Earth, repeater, or space stations
- C. Beacon, repeater, or space stations
- D. Repeater, auxiliary, or space stations

T1D07 [97.113(d)]

What types of amateur stations can automatically retransmit the signals of other amateur stations?

D. Repeater, auxiliary, or space stations

T1D08 [97.113(a)(3)(iii)]

In which of the following circumstances may the control operator of an amateur station receive compensation for operating that station?

- A. When the communication is related to the sale of amateur equipment by the control operator's employer
- B. When the communication is incidental to classroom instruction at an educational institution
- C. When the communication is made to obtain emergency information for a local broadcast station
- D. All these choices are correct

T1D08 [97.113(a)(3)(iii)]

In which of the following circumstances may the control operator of an amateur station receive compensation for operating that station?

B. When the communication is incidental to classroom instruction at an educational institution

T1D09 [97.113(5)(b)]

When may amateur stations transmit information in support of broadcasting, program production, or news gathering, assuming no other means is available?

- A. When such communications are directly related to the immediate safety of human life or protection of property
- B. When broadcasting communications to or from the space shuttle
- C. Where noncommercial programming is gathered and supplied exclusively to the National Public Radio network
- D. Never

T1D09 [97.113(5)(b)]

When may amateur stations transmit information in support of broadcasting, program production, or news gathering, assuming no other means is available?

- A. When such communications are directly related to the immediate safety of human life or protection of property**

T1D10 [97.3(a)(10)]

How does the FCC define broadcasting for the Amateur Radio Service?

- A. Two-way transmissions by amateur stations
- B. Any transmission made by the licensed station
- C. Transmission of messages directed only to amateur operators
- D. Transmissions intended for reception by the general public

T1D10 [97.3(a)(10)]

How does the FCC define broadcasting for the Amateur Radio Service?

D. Transmissions intended for reception by the general public

T1D11 [97.119(a)]

When may an amateur station transmit without identifying on the air?

- A. When the transmissions are of a brief nature to make station adjustments
- B. When the transmissions are unmodulated
- C. When the transmitted power level is below 1 watt
- D. When transmitting signals to control model craft

T1D11 [97.119(a)]

When may an amateur station transmit without identifying on the air?

D. When transmitting signals to control model craft

T1E - Control operator: eligibility, designating, privileges, duties, location, required; Control point; Control types: automatic, remote

Points of Discussion

All transmissions must be made under the supervision of a control operator.

Satellite contacts, including contacts with the amateur station on the International Space Station, can be made by any amateur licensed to transmit on the uplink frequency.

A control operator is the licensed operator designated to be responsible for making sure that transmissions comply with FCC rules. That doesn't have to be the same person as the station owner. The station licensee is responsible for designating the control operator.

As the control operator, you may operate the station in any way permitted by the privileges of your license class.

The control point is where the station's control function is performed. Usually, the control point is at the transmitter and the control operator physically manipulates the controls of the transmitter. The control point can be remotely located and connected by phone lines, the internet, or a radio link.

Points of Discussion

At no time can a Technician class licensee be the control operator of a station operating in an Amateur Extra class band segment.

Regardless of operator class, both the guest operator and station owner are responsible for the proper operation of the station.

Automatic operation: the station operates completely under the control of devices and procedures that ensure compliance with FCC rules. A control operator is still required, but need not be at the control point when the station is transmitting. Repeaters, beacons, and space stations are allowed to be automatically controlled. Digipeaters that relay messages, such as for the APRS network, are also automatically controlled.

Remote operation: the control point is located away from the transmitter and the control operator adjusts or operates the transmitter indirectly using some kind of control link. The control operator must be present at the control point during all transmission. Many stations operate under remote control over an internet link.

Points of Discussion

Remote operation: the control point is located away from the transmitter and the control operator adjusts or operates the transmitter indirectly using some kind of control link. The control operator must be present at the control point during all transmission. Many stations operate under remote control over an internet link.

The station owner is responsible for limiting access to the station only to responsible licensees who will follow the FCC rules. The FCC will presume the station licensee to be the control operator unless there is a written record to the contrary.

Questions?

T1E01 [97.7(a)]

When may an amateur station transmit without a control operator?

- A. When using automatic control, such as in the case of a repeater
- B. When the station licensee is away and another licensed amateur is using the station
- C. When the transmitting station is an auxiliary station
- D. Never

T1E01 [97.7(a)]

When may an amateur station transmit without a control operator?

D. Never

T1E02 [97.301, 97.207(c)]

Who may be the control operator of a station communicating through an amateur satellite or space station?

- A. Only an Amateur Extra Class operator
- B. A General class or higher licensee with a satellite operator certification
- C. Only an Amateur Extra Class operator who is also an AMSAT member
- D. Any amateur allowed to transmit on the satellite uplink frequency

T1E02 [97.301, 97.207(c)]

Who may be the control operator of a station communicating through an amateur satellite or space station?

D. Any amateur allowed to transmit on the satellite uplink frequency

T1E03 [97.103(b)]

Who must designate the station control operator?

- A. The station licensee
- B. The FCC
- C. The frequency coordinator
- D. Any licensed operator

T1E03 [97.103(b)]

Who must designate the station control operator?

A. The station licensee

T1E04 [97.103(b)]

What determines the transmitting frequency privileges of an amateur station?

- A. The frequency authorized by the frequency coordinator
- B. The frequencies printed on the license grant
- C. The highest class of operator license held by anyone on the premises
- D. The class of operator license held by the control operator

T1E04 [97.103(b)]

What determines the transmitting frequency privileges of an amateur station?

D. The class of operator license held by the control operator

T1E05 [97.3(a)(14)]

What is an amateur station's control point?

- A. The location of the station's transmitting antenna
- B. The location of the station's transmitting apparatus
- C. The location at which the control operator function is performed
- D. The mailing address of the station licensee

T1E05 [97.3(a)(14)]

What is an amateur station's control point?

C. The location at which the control operator function is performed

T1E06 [97.301]

When, under normal circumstances, may a Technician class licensee be the control operator of a station operating in an Amateur Extra Class band segment?

- A. At no time
- B. When designated as the control operator by an Amateur Extra Class licensee
- C. As part of a multi-operator contest team
- D. When using a club station whose trustee holds an Amateur Extra Class license

T1E06 [97.301]

When, under normal circumstances, may a Technician class licensee be the control operator of a station operating in an Amateur Extra Class band segment?

A. At no time

T1E07 [97.103(a)]

When the control operator is not the station licensee, who is responsible for the proper operation of the station?

- A. All licensed amateurs who are present at the operation
- B. Only the station licensee
- C. Only the control operator
- D. The control operator and the station licensee

T1E07 [97.103(a)]

When the control operator is not the station licensee, who is responsible for the proper operation of the station?

D. The control operator and the station licensee

T1E08 [97.3(a)(6), 97.205(d)]

Which of the following is an example of automatic control?

- A. Repeater operation
- B. Controlling a station over the internet
- C. Using a computer or other device to send CW automatically
- D. Using a computer or other device to identify automatically

T1E08 [97.3(a)(6), 97.205(d)]

Which of the following is an example of automatic control?

A. Repeater operation

T1E09 [97.109(c)]

Which of the following are required for remote control operation?

- A. The control operator must be at the control point
- B. A control operator is required at all times
- C. The control operator must indirectly manipulate the controls
- D. All these choices are correct

T1E09 [97.109(c)]

Which of the following are required for remote control operation?

D. All these choices are correct

T1E10 [97.3(a)(39)]

Which of the following is an example of remote control as defined in Part 97?

- A. Repeater operation
- B. Operating the station over the internet
- C. Controlling a model aircraft, boat, or car by amateur radio
- D. All these choices are correct

T1E10 [97.3(a)(39)]

Which of the following is an example of remote control as defined in Part 97?

B. Operating the station over the internet

T1E11 [97.103(a)]

Who does the FCC presume to be the control operator of an amateur station, unless documentation to the contrary is in the station records?

- A. The station custodian
- B. The third party participant
- C. The person operating the station equipment
- D. The station licensee

T1E11 [97.103(a)]

Who does the FCC presume to be the control operator of an amateur station, unless documentation to the contrary is in the station records?

D. The station licensee

T1F - Station identification; Repeaters; Third party communications; Club stations; FCC inspection

Points of Discussion

By accepting the FCC rules and regulations for the amateur service, you agree that your station could be inspected any time. These visits are very rare and only occur when there is reason to believe that your station has been operated improperly.

Tactical calls don't replace regular call signs and the regular identification rules apply -- give your FCC-assigned call sign every 10 minutes and at the end of the communication.

The identification rules are simple: give your call sign at least once every 10 minutes during a contact and when the communication is finished.

If you are using phone, you are required to identify in English, even if you are communicating in a language other than English.

The standard phonetics are words in the English language, as well. You may also identify by CW even if using phone.

When using a self-assigned indicator, you can add the indicator to either the beginning or end of your call sign using “stroke,” “slash,” or “portable” between the indicator and the call sign.

Points of Discussion

When signals cross borders, the rules change. International third-party communications are restricted to those countries that specifically allow third-party communications with US hams. If the other country is not on the list of countries with which the US has third-party agreements, third-party communications with that country is not permitted.

The exact definition of third-party communication is a message from an amateur station control operator to another amateur station control operator on behalf of another person. That “other person” is the “third party.”

Repeaters consist of a receiver and transmitter that re-transmit the information from a received signal simultaneously on another frequency or channel.

Repeater users are responsible for proper operation via the repeater.

Points of Discussion

Clubs can also be license holders. Each club must have a licensed trustee who actually holds the club license and is designated by a club officer. Clubs must have at least four members and be organized as in rule 97.5 (b).

Questions?

T1F01 [97.103(c)]

When must the station and its records be available for FCC inspection?

- A. At any time ten days after notification by the FCC of such an inspection
- B. At any time upon request by an FCC representative
- C. At any time after written notification by the FCC of such inspection
- D. Only when presented with a valid warrant by an FCC official or government agent

T1F01 [97.103(c)]

When must the station and its records be available for FCC inspection?

B. At any time upon request by an FCC representative

T1F02 [97.119 (a)]

How often must you identify with your FCC-assigned call sign when using tactical call signs such as “Race Headquarters”?

- A. Never, the tactical call is sufficient
- B. Once during every hour
- C. At the end of each communication and every ten minutes during a communication
- D. At the end of every transmission

T1F02 [97.119 (a)]

How often must you identify with your FCC-assigned call sign when using tactical call signs such as “Race Headquarters”?

C. At the end of each communication and every ten minutes during a communication

T1F03 [97.119(a)]

When are you required to transmit your assigned call sign?

- A. At the beginning of each contact, and every 10 minutes thereafter
- B. At least once during each transmission
- C. At least every 15 minutes during and at the end of a communication
- D. At least every 10 minutes during and at the end of a communication

T1F03 [97.119(a)]

When are you required to transmit your assigned call sign?

D. At least every 10 minutes during and at the end of a communication

T1F04 [97.119(b)(2)]

What language may you use for identification when operating in a phone sub-band?

- A. Any language recognized by the United Nations
- B. Any language recognized by the ITU
- C. English
- D. English, French, or Spanish

T1F04 [97.119(b)(2)]

What language may you use for identification when operating in a phone sub-band?

C. English

T1F05 [97.119(b)(2)]

What method of call sign identification is required for a station transmitting phone signals?

- A. Send the call sign followed by the indicator RPT
- B. Send the call sign using a CW or phone emission
- C. Send the call sign followed by the indicator R
- D. Send the call sign using only a phone emission

T1F05 [97.119(b)(2)]

What method of call sign identification is required for a station transmitting phone signals?

B. Send the call sign using a CW or phone emission

T1F06 [97.119(c)]

Which of the following self-assigned indicators are acceptable when using a phone transmission?

- A. KL7CC stroke W3
- B. KL7CC slant W3
- C. KL7CC slash W3
- D. All these choices are correct

T1F06 [97.119(c)]

Which of the following self-assigned indicators are acceptable when using a phone transmission?

D. All these choices are correct

T1F07 [97.115(a)(2)]

Which of the following restrictions apply when a non-licensed person is allowed to speak to a foreign station using a station under the control of a licensed amateur operator?

- A. The person must be a U.S. citizen
- B. The foreign station must be in a country with which the U.S. has a third party agreement
- C. The licensed control operator must do the station identification
- D. All these choices are correct

T1F07 [97.115(a)(2)]

Which of the following restrictions apply when a non-licensed person is allowed to speak to a foreign station using a station under the control of a licensed amateur operator?

- B. The foreign station must be in a country with which the U.S. has a third party agreement**

T1F08 [97.3(a)(47)]

What is the definition of third party communications?

- A. A message from a control operator to another amateur station control operator on behalf of another person
- B. Amateur radio communications where three stations are in communications with one another
- C. Operation when the transmitting equipment is licensed to a person other than the control operator
- D. Temporary authorization for an unlicensed person to transmit on the amateur bands for technical experiments

T1F08 [97.3(a)(47)]

What is the definition of third party communications?

- A. A message from a control operator to another amateur station control operator on behalf of another person

T1F09 [97.3(a)(40)]

What type of amateur station simultaneously retransmits the signal of another amateur station on a different channel or channels?

- A. Beacon station
- B. Earth station
- C. Repeater station
- D. Message forwarding station

T1F09 [97.3(a)(40)]

What type of amateur station simultaneously retransmits the signal of another amateur station on a different channel or channels?

C. Repeater station

T1F10 [97.205(g)]

Who is accountable if a repeater inadvertently retransmits communications that violate the FCC rules?

- A. The control operator of the originating station
- B. The control operator of the repeater
- C. The owner of the repeater
- D. Both the originating station and the repeater owner

T1F10 [97.205(g)]

Who is accountable if a repeater inadvertently retransmits communications that violate the FCC rules?

A. The control operator of the originating station

T1F11 [97.5(b)(2)]

Which of the following is a requirement for the issuance of a club station license grant?

- A. The trustee must have an Amateur Extra Class operator license grant
- B. The club must have at least four members
- C. The club must be registered with the American Radio Relay League
- D. All these choices are correct

T1F11 [97.5(b)(2)]

Which of the following is a requirement for the issuance of a club station license grant?

B. The club must have at least four members

SUBELEMENT T2

OPERATING PROCEDURES

[3 Exam Questions - 3 Groups]

T2A - Station operation: choosing an operating frequency, calling another station, test transmissions; Band plans: calling frequencies, repeater offsets

Points of Discussion

The common repeater frequency offset in the 2 meter band is +/- 600 kHz.

The National Simplex calling frequency on 2 meters is 146.52 MHz and on 70 cm it is 446.00 MHz.

The common repeater frequency offset in the 70 cm band is plus or minus +/- 5 MHz.

If you want to respond to a station asking for a call or want to contact a station whose call sign you already know, take advantage of the repeater's strong signal and keep it short. Just say the other station's call sign once followed by "this is" or "from," then give your call sign.

If you hear a station calling CQ and want to respond, give the CQing station's call once then yours once. Give your call clearly and distinctly so that they can understand it if there is noise or interference.

Points of Discussion

Identification rules apply to on-the-air test transmission, as well, no matter how brief. The call sign must be given once every 10 minutes and at the end of transmissions.

The difference between repeater input and output frequencies is called the repeater's offset or shift.

“CQ” is a procedural signal that means “I am calling any station.”

When operating on a repeater, the easiest way to announce you are listening and available for contact is to just give your call sign followed by “monitoring.”

It's important to keep in mind that band plans are voluntary agreements designed for normal conditions.

Simplex operation is transmitting and receiving on the same frequency.

Before calling CQ you should do three things: be sure the frequency is one your license privileges authorize you to use, listen to be sure the frequency is not already in use, make a short transmission asking if the frequency is in use.

Questions?

T2A01

What is a common repeater frequency offset in the 2 meter band?

- A. Plus or minus 5 MHz
- B. Plus or minus 600 kHz
- C. Plus or minus 500 kHz
- D. Plus or minus 1 MHz

T2A01

What is a common repeater frequency offset in the 2 meter band?

B. Plus or minus 600 kHz

T2A02

What is the national calling frequency for FM simplex operations in the 2 meter band?

- A. 146.520 MHz
- B. 145.000 MHz
- C. 432.100 MHz
- D. 446.000 MHz

T2A02

What is the national calling frequency for FM simplex operations in the 2 meter band?

A. 146.520 MHz

T2A03

What is a common repeater frequency offset in the 70 cm band?

- A. Plus or minus 5 MHz
- B. Plus or minus 600 kHz
- C. Plus or minus 500 kHz
- D. Plus or minus 1 MHz

T2A03

What is a common repeater frequency offset in the 70 cm band?

A. Plus or minus 5 MHz

T2A04

What is an appropriate way to call another station on a repeater if you know the other station's call sign?

- A. Say "break, break," then say the station's call sign
- B. Say the station's call sign, then identify with your call sign
- C. Say "CQ" three times, then the other station's call sign
- D. Wait for the station to call CQ, then answer

T2A04

What is an appropriate way to call another station on a repeater if you know the other station's call sign?

B. Say the station's call sign, then identify with your call sign

T2A05

How should you respond to a station calling CQ?

- A. Transmit "CQ" followed by the other station's call sign
- B. Transmit your call sign followed by the other station's call sign
- C. Transmit the other station's call sign followed by your call sign
- D. Transmit a signal report followed by your call sign

T2A05

How should you respond to a station calling CQ?

C. Transmit the other station's call sign followed by your call sign

T2A06

Which of the following is required when making on-the-air test transmissions?

- A. Identify the transmitting station
- B. Conduct tests only between 10 p.m. and 6 a.m. local time
- C. Notify the FCC of the transmissions
- D. All these choices are correct

T2A06

Which of the following is required when making on-the-air test transmissions?

A. Identify the transmitting station

T2A07

What is meant by "repeater offset"?

- A. The difference between a repeater's transmit and receive frequencies
- B. The repeater has a time delay to prevent interference
- C. The repeater station identification is done on a separate frequency
- D. The number of simultaneous transmit frequencies used by a repeater

T2A07

What is meant by "repeater offset"?

A. The difference between a repeater's transmit and receive frequencies

T2A08

What is the meaning of the procedural signal “CQ”?

- A. Call on the quarter hour
- B. Test transmission, no reply expected
- C. Only the called station should transmit
- D. Calling any station

T2A08

What is the meaning of the procedural signal “CQ”?

D. Calling any station

T2A09

Which of the following indicates that a station is listening on a repeater and looking for a contact?

- A. “CQ CQ” followed by the station’s call sign
- B. The station’s call sign followed by the word “monitoring”
- C. The repeater call sign followed by the station’s call sign
- D. “QSY” followed by your call sign

T2A09

Which of the following indicates that a station is listening on a repeater and looking for a contact?

B. The station's call sign followed by the word "monitoring"

T2A10

What is a band plan, beyond the privileges established by the FCC?

- A. A voluntary guideline for using different modes or activities within an amateur band
- B. A list of operating schedules
- C. A list of available net frequencies
- D. A plan devised by a club to indicate frequency band usage

T2A10

What is a band plan, beyond the privileges established by the FCC?

A. A voluntary guideline for using different modes or activities within an amateur band

T2A11

What term describes an amateur station that is transmitting and receiving on the same frequency?

- A. Full duplex
- B. Diplex
- C. Simplex
- D. Multiplex

T2A11

What term describes an amateur station that is transmitting and receiving on the same frequency?

C. Simplex

T2A12

What should you do before calling CQ?

- A. Listen first to be sure that no one else is using the frequency
- B. Ask if the frequency is in use
- C. Make sure you are authorized to use that frequency
- D. All these choices are correct

T2A12

What should you do before calling CQ?

D. All these choices are correct

T2B – VHF/UHF operating practices: FM repeater, simplex, reverse splits; Access tones: CTCSS, DTMF; DMR operation; Resolving operational problems; Q signals

Points of Discussion

Many radios have a reverse split function that swaps your transmit and receive frequencies. This enables you to listen for the other station on the repeater's input frequency.

Repeater access tones were invented by Motorola to allow different commercial users to share a repeater without having to listen to each other's conversations. These tones are known by various names: Continuous Tone Coded Squelch System (CTCSS), PL (or Private Line, the Motorola trade name), or sub-audible. FRS/GMRS radio users know these tones as privacy codes or privacy tones.

Repeaters can be linked to other repeaters. That is, they share the signals that each receives and retransmits them.

If you can hear a repeater's signal and you're sure you are using the right offset, but you can't access the repeater, then you probably don't have your radio set up to use the right type or frequency of access tone.

Points of Discussion

An overmodulated FM signal has excessive deviation and is said to be overdeviating. Overdeviation is usually caused by speaking too loudly into the microphone and may cause interference on adjacent channels. It often generates noise or distortion on voice peaks, called “breaking up.” To reduce overdeviation, speak more softly or move the microphone farther from your mouth.

To initiate a contact via IRLP or EchoLink, the initiating station must know the repeater control code to request an IRLP connection. The code is a sequence of DTMF (Dual-tone Multi-Frequency) tones, like dialing a phone number.

The controller organizes users of the DMR network into talk groups. Each talk group has an ID or code. By programming your radio with those IDs and codes, you can join the group and your audio will be shared with all other members of the group.

If a transmission seriously degrades, obstructs, or repeatedly interrupts the communications of a regulated service, that's considered harmful interference. In such a case, common courtesy should prevail but remember that no one has an absolute right to any frequency.

Points of Discussion

If you and the station you've contacted are within range of each other, why not give simplex a try? This avoids occupying or “tying up” a repeater.

QRM is a Q-code that indicates that there is interference

QSY is a Q-code that indicates a request or instruction to change to a different frequency.

Your digital voice is routed by a central network controller to other DMR repeaters through the internet. Digital codes called color codes are used to access a specific repeater, similarly to CTCSS or PL access tones on an analog FM repeater.

To keep from having to listen to continuous noise when no signal is present, the squelch circuit was invented. The squelch circuit (sometimes called carrier squelch) mutes the receiver's audio output when no signal is present.

Questions?

T2B01

How is a VHF/UHF transceiver's "reverse" function used?

- A. To reduce power output
- B. To increase power output
- C. To listen on a repeater's input frequency
- D. To listen on a repeater's output frequency

T2B01

How is a VHF/UHF transceiver's "reverse" function used?

C. To listen on a repeater's input frequency

T2B02

What term describes the use of a sub-audible tone transmitted along with normal voice audio to open the squelch of a receiver?

- A. Carrier squelch
- B. Tone burst
- C. DTMF
- D. CTCSS

T2B02

What term describes the use of a sub-audible tone transmitted along with normal voice audio to open the squelch of a receiver?

D. CTCSS

T2B03

Which of the following describes a linked repeater network?

- A. A network of repeaters in which signals received by one repeater are transmitted by all the repeaters in the network
- B. A single repeater with more than one receiver
- C. Multiple repeaters with the same control operator
- D. A system of repeaters linked by APRS

T2B03

Which of the following describes a linked repeater network?

- A. A network of repeaters in which signals received by one repeater are transmitted by all the repeaters in the network

T2B04

Which of the following could be the reason you are unable to access a repeater whose output you can hear?

- A. Improper transceiver offset
- B. You are using the wrong CTCSS tone
- C. You are using the wrong DCS code
- D. All these choices are correct

T2B04

Which of the following could be the reason you are unable to access a repeater whose output you can hear?

D. All these choices are correct

T2B05

What would cause your FM transmission audio to be distorted on voice peaks?

- A. Your repeater offset is inverted
- B. You need to talk louder
- C. You are talking too loudly
- D. Your transmit power is too high

T2B05

What would cause your FM transmission audio to be distorted on voice peaks?

C. You are talking too loudly

T2B06

What type of signaling uses pairs of audio tones?

- A. DTMF
- B. CTCSS
- C. GPRS
- D. D-STAR

T2B06

What type of signaling uses pairs of audio tones?

A. DTMF

T2B07

How can you join a digital repeater's "talkgroup"?

- A. Register your radio with the local FCC office
- B. Join the repeater owner's club
- C. Program your radio with the group's ID or code
- D. Sign your call after the courtesy tone

T2B07

How can you join a digital repeater's "talkgroup"?

C. Program your radio with the group's ID or code

T2B08

Which of the following applies when two stations transmitting on the same frequency interfere with each other?

- A. The stations should negotiate continued use of the frequency
- B. Both stations should choose another frequency to avoid conflict
- C. Interference is inevitable, so no action is required
- D. Use subaudible tones so both stations can share the frequency

T2B08

Which of the following applies when two stations transmitting on the same frequency interfere with each other?

A. The stations should negotiate continued use of the frequency

T2B09

Why are simplex channels designated in the VHF/UHF band plans?

- A. So stations within range of each other can communicate without tying up a repeater
- B. For contest operation
- C. For working DX only
- D. So stations with simple transmitters can access the repeater without automated offset

T2B09

Why are simplex channels designated in the VHF/UHF band plans?

A. So stations within range of each other can communicate without tying up a repeater

T2B10

Which Q signal indicates that you are receiving interference from other stations?

- A. QRM
- B. QRN
- C. QTH
- D. QSB

T2B10

Which Q signal indicates that you are receiving interference from other stations?

A. QRM

T2B11

Which Q signal indicates that you are changing frequency?

- A. QRU
- B. QSY
- C. QSL
- D. QRZ

T2B11

Which Q signal indicates that you are changing frequency?

B. QSY

T2B12

What is the purpose of the color code used on DMR repeater systems?

- A. Establishes groups of users
- B. Defines the frequency pair to use
- C. Identifies the codec used
- D. Defines the minimum signal level required for access

T2B12

What is the purpose of the color code used on DMR repeater systems?

A. Establishes groups of users

T2B13

What is the purpose of a squelch function?

- A. Reduce a CW transmitter's key clicks
- B. Mute the receiver audio when a signal is not present
- C. Eliminate parasitic oscillations in an RF amplifier
- D. Reduce interference from impulse noise

T2B13

What is the purpose of a squelch function?

B. Mute the receiver audio when a signal is not present

T2C – Public service: emergency operations, applicability of FCC rules, RACES and ARES, net and traffic procedures, operating restrictions during emergencies, use of phonetics in message handling

Points of Discussion

Once the threat has receded or normal communications become available, you must return to normal rules, even in support of public safety agencies. You are bound by FCC rules at all times, even if using your radio in support of a public safety agency.

A Net Control Station (NCS) directs the net by calling it to order and directing communications between stations checking into the net.

Take extra care to be sure the receiving station copies the message exactly. For example, proper names (such as “John Doe”) and unusual words (such as material names or model identifiers) are spelled out using standard phonetics.

RACES (Radio Amateur Civil Emergency Service) is a special part of the FCC Part 97 Amateur service to provide civil defense communications to local, state, or federal government emergency management agencies during national emergencies.

Emergency Response Nets usually have two purposes: they pass emergency messages and coordinate reporting and response activities. Messages following a set, formal structure are called traffic.

Points of Discussion

ARES (Amateur Radio Emergency Service) consists of licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service.

Once you have checked into a formal net under the direction of a NCS, it is important to not disrupt the net. Do not transmit unless you are specifically requested or authorized to do so, or a request is made for capabilities or information that you can provide

The most important job during emergency or disaster net operation is the ability to accurately relay or “pass” messages exactly as written, spoken, or received.

In an emergency situation where there is immediate risk to life or property and normal forms of communication are unavailable, you may use any means possible to address that risk, including operating outside the frequency privileges of your license.

Points of Discussion

The preamble of a radiogram is made up of several bits of information about the message. These establish a unique identity for each message so that it can be handled and tracked appropriately as it moves through the Amateur Radio traffic handling system.

Check (radiogram preamble): the number of words and word equivalents in the radiogram text.

Questions?

T2C01 [97.103(a)]

When do FCC rules NOT apply to the operation of an amateur station?

- A. When operating a RACES station
- B. When operating under special FEMA rules
- C. When operating under special ARES rules
- D. FCC rules always apply

T2C01 [97.103(a)]

When do FCC rules NOT apply to the operation of an amateur station?

D. FCC rules always apply

T2C02

Which of the following are typical duties of a Net Control Station?

- A. Choose the regular net meeting time and frequency
- B. Ensure that all stations checking into the net are properly licensed for operation on the net frequency
- C. Call the net to order and direct communications between stations checking in
- D. All these choices are correct

T2C02

Which of the following are typical duties of a Net Control Station?

C. Call the net to order and direct communications between stations checking in

T2C03

What technique is used to ensure that voice messages containing unusual words are received correctly?

- A. Send the words by voice and Morse code
- B. Speak very loudly into the microphone
- C. Spell the words using a standard phonetic alphabet
- D. All these choices are correct

T2C03

What technique is used to ensure that voice messages containing unusual words are received correctly?

C. Spell the words using a standard phonetic alphabet

T2C04

What is RACES?

- A. An emergency organization combining amateur radio and citizens band operators and frequencies
- B. An international radio experimentation society
- C. A radio contest held in a short period, sometimes called a “sprint”
- D. An FCC part 97 amateur radio service for civil defense communications during national emergencies

T2C04

What is RACES?

- D. An FCC part 97 amateur radio service for civil defense communications during national emergencies

T2C05

What does the term “traffic” refer to in net operation?

- A. Messages exchanged by net stations
- B. The number of stations checking in and out of a net
- C. Operation by mobile or portable stations
- D. Requests to activate the net by a served agency

T2C05

What does the term “traffic” refer to in net operation?

A. Messages exchanged by net stations

T2C06

What is the Amateur Radio Emergency Service (ARES)?

- A. A group of licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service
- B. A group of licensed amateurs who are members of the military and who voluntarily agreed to provide message handling services in the case of an emergency
- C. A training program that provides licensing courses for those interested in obtaining an amateur license to use during emergencies
- D. A training program that certifies amateur operators for membership in the Radio Amateur Civil Emergency Service

T2C06

What is the Amateur Radio Emergency Service (ARES)?

A. A group of licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service

T2C07

Which of the following is standard practice when you participate in a net?

- A. When first responding to the net control station, transmit your call sign, name, and address as in the FCC database
- B. Record the time of each of your transmissions
- C. Unless you are reporting an emergency, transmit only when directed by the net control station
- D. All these choices are correct

T2C07

Which of the following is standard practice when you participate in a net?

- C. Unless you are reporting an emergency, transmit only when directed by the net control station

T2C08

Which of the following is a characteristic of good traffic handling?

- A. Passing messages exactly as received
- B. Making decisions as to whether messages are worthy of relay or delivery
- C. Ensuring that any newsworthy messages are relayed to the news media
- D. All these choices are correct

T2C08

Which of the following is a characteristic of good traffic handling?

A. Passing messages exactly as received

T2C09

Are amateur station control operators ever permitted to operate outside the frequency privileges of their license class?

- A. No
- B. Yes, but only when part of a FEMA emergency plan
- C. Yes, but only when part of a RACES emergency plan
- D. Yes, but only in situations involving the immediate safety of human life or protection of property

T2C09

Are amateur station control operators ever permitted to operate outside the frequency privileges of their license class?

D. Yes, but only in situations involving the immediate safety of human life or protection of property

T2C10

What information is contained in the preamble of a formal traffic message?

- A. The email address of the originating station
- B. The address of the intended recipient
- C. The telephone number of the addressee
- D. Information needed to track the message

T2C10

What information is contained in the preamble of a formal traffic message?

D. Information needed to track the message

T2C11

What is meant by “check” in a radiogram header?

- A. The number of words or word equivalents in the text portion of the message
- B. The call sign of the originating station
- C. A list of stations that have relayed the message
- D. A box on the message form that indicates that the message was received and/or relayed

T2C11

What is meant by “check” in a radiogram header?

A. The number of words or word equivalents in the text portion of the message

SUBELEMENT T3

RADIO WAVE PROPAGATION

[3 Exam Questions - 3 Groups]

T3A - Radio wave characteristics: how a radio signal travels, fading, multipath, polarization, wavelength vs absorption; Antenna orientation

Points of Discussion

Radio signals arriving at a receiver after taking different paths from the transmitter can interfere with each other if they are out of phase, even canceling completely! This phenomenon is known as multipath and can cause a signal to become weak and distorted.

Obstructions such as buildings and hills also create radio shadowing, especially at VHF/UHF and microwave frequencies. Vegetation can also absorb VHF and UHF radio waves.

Horizontally-polarized Yagis are usually used for long-distance communications, especially for weak signal SSB and CW contacts on the VHF and UHF bands. Horizontal polarization is preferred because it results in lower ground losses when the wave reflects from or travels along the ground.

When the polarizations of transmit and receive antennas aren't aligned the same, the received signal can be dramatically reduced. Because the polarization of the radio wave doesn't match that of the receiving antenna, less current is created in the antenna.

Points of Discussion

On VHF and UHF, if a direct signal path is blocked by a building or other obstruction, a beam antenna can be used to aim the signal at a reflecting surface to bypass the obstruction.

Because “dead spots” from multipath are usually spaced about 1/2-wavelength apart, VHF or UHF signals from a station in motion can take on a rapid variation in strength known as mobile flutter or picket-fencing due to multipath propagation.

Precipitation such as fog and rain can absorb microwave and UHF radio waves although it has little effect at HF and on the lower VHF bands.

Multipath propagation of signals from distant stations results in irregular fading, even when reception is generally good.

As a radio wave travels through the ionosphere its polarization changes from vertical or horizontal to a combination of the two, called elliptical polarization. As a result, the receiving antenna of any polarization will respond to the incoming wave at least partially. This means both vertical and horizontal antennas are effective for receiving and transmitting on the HF bands where skip propagation is common.

Points of Discussion

Distortion caused by multipath can also cause VHF and UHF digital data signals to be received with a higher error rate, even though the signal may be strong.

Each reflection from the ionosphere is called a hop. Reflections from the ionosphere allow radio waves to be received hundreds or thousands of miles away.

Precipitation such as fog and rain can absorb microwave and UHF radio waves although it has little effect at HF and on the lower VHF bands.

Questions?

T3A01

Why do VHF signal strengths sometimes vary greatly when the antenna is moved only a few feet?

- A. The signal path encounters different concentrations of water vapor
- B. VHF ionospheric propagation is very sensitive to path length
- C. Multipath propagation cancels or reinforces signals
- D. All these choices are correct

T3A01

Why do VHF signal strengths sometimes vary greatly when the antenna is moved only a few feet?

C. Multipath propagation cancels or reinforces signals

T3A02

What is the effect of vegetation on UHF and microwave signals?

- A. Knife-edge diffraction
- B. Absorption
- C. Amplification
- D. Polarization rotation

T3A02

What is the effect of vegetation on UHF and microwave signals?

B. Absorption

T3A03

What antenna polarization is normally used for long-distance CW and SSB contacts on the VHF and UHF bands?

- A. Right-hand circular
- B. Left-hand circular
- C. Horizontal
- D. Vertical

T3A03

What antenna polarization is normally used for long-distance CW and SSB contacts on the VHF and UHF bands?

C. Horizontal

T3A04

What happens when antennas at opposite ends of a VHF or UHF line of sight radio link are not using the same polarization?

- A. The modulation sidebands might become inverted
- B. Received signal strength is reduced
- C. Signals have an echo effect
- D. Nothing significant will happen

T3A04

What happens when antennas at opposite ends of a VHF or UHF line of sight radio link are not using the same polarization?

B. Received signal strength is reduced

T3A05

When using a directional antenna, how might your station be able to communicate with a distant repeater if buildings or obstructions are blocking the direct line of sight path?

- A. Change from vertical to horizontal polarization
- B. Try to find a path that reflects signals to the repeater
- C. Try the long path
- D. Increase the antenna SWR

T3A05

When using a directional antenna, how might your station be able to communicate with a distant repeater if buildings or obstructions are blocking the direct line of sight path?

B. Try to find a path that reflects signals to the repeater

T3A06

What is the meaning of the term “picket fencing”?

- A. Alternating transmissions during a net operation
- B. Rapid flutter on mobile signals due to multipath propagation
- C. A type of ground system used with vertical antennas
- D. Local vs long-distance communications

T3A06

What is the meaning of the term “picket fencing”?

B. Rapid flutter on mobile signals due to multipath propagation

T3A07

What weather condition might decrease range at microwave frequencies?

- A. High winds
- B. Low barometric pressure
- C. Precipitation
- D. Colder temperatures

T3A07

What weather condition might decrease range at microwave frequencies?

C. Precipitation

T3A08

What is a likely cause of irregular fading of signals propagated by the ionosphere?

- A. Frequency shift due to Faraday rotation
- B. Interference from thunderstorms
- C. Intermodulation distortion
- D. Random combining of signals arriving via different paths

T3A08

What is a likely cause of irregular fading of signals propagated by the ionosphere?

D. Random combining of signals arriving via different paths

T3A09

Which of the following results from the fact that signals propagated by the ionosphere are elliptically polarized?

- A. Digital modes are unusable
- B. Either vertically or horizontally polarized antennas may be used for transmission or reception
- C. FM voice is unusable
- D. Both the transmitting and receiving antennas must be of the same polarization

T3A09

Which of the following results from the fact that signals propagated by the ionosphere are elliptically polarized?

B. Either vertically or horizontally polarized antennas may be used for transmission or reception

T3A10

What effect does multi-path propagation have on data transmissions?

- A. Transmission rates must be increased by a factor equal to the number of separate paths observed
- B. Transmission rates must be decreased by a factor equal to the number of separate paths observed
- C. No significant changes will occur if the signals are transmitted using FM
- D. Error rates are likely to increase

T3A10

What effect does multi-path propagation have on data transmissions?

D. Error rates are likely to increase

T3A11

Which region of the atmosphere can refract or bend HF and VHF radio waves?

- A. The stratosphere
- B. The troposphere
- C. The ionosphere
- D. The mesosphere

T3A11

Which region of the atmosphere can refract or bend HF and VHF radio waves?

C. The ionosphere

T3A12

What is the effect of fog and rain on signals in the 10 meter and 6 meter bands?

- A. Absorption
- B. There is little effect
- C. Deflection
- D. Range increase

T3A12

What is the effect of fog and rain on signals in the 10 meter and 6 meter bands?

B. There is little effect

T3B - Electromagnetic wave properties: wavelength vs frequency, nature and velocity of electromagnetic waves, relationship of wavelength and frequency; Electromagnetic spectrum definitions: UHF, VHF, HF

Points of Discussion

The radio wave is an electromagnetic wave that contains both electric and magnetic energy or fields created by the RF current. The electric and magnetic fields are at right angles to each other and oscillate at the same frequency as the RF current in the antenna.

Polarization refers to the orientation of the radio wave's electric field.

The radio wave is an electromagnetic wave that contains both electric and magnetic energy or fields created by the RF current. The electric and magnetic fields are at right angles to each other and oscillate at the same frequency as the RF current in the antenna.

All radio waves travel at the speed of light (represented by a lower-case 'c') in whatever medium they are traveling, such as air.

Because radio waves travel at a constant speed, one wavelength = speed of light / frequency. This means that as frequency increases, wavelength decreases, and vice versa.

Frequency (meters) = 300,000,000 meters per second / frequency in MHz

Points of Discussion

Because of the relationship between frequency and wavelength, amateur bands are often referred to by wavelength.

Very High Frequency (VHF) range = 30 MHz - 300 MHz

Ultra-High Frequency (UHF) range = 300 MHz - 3 GHz

High Frequency (HF) range = 3 MHz - 30 MHz

The speed of light in space and air is very close to 300 million meters per second (300,000,000 or 3×10^8 meters per second)

Questions?

T3B01

What is the relationship between the electric and magnetic fields of an electromagnetic wave?

- A. They travel at different speeds
- B. They are in parallel
- C. They revolve in opposite directions
- D. They are at right angles

T3B01

What is the relationship between the electric and magnetic fields of an electromagnetic wave?

D. They are at right angles

T3B02

What property of a radio wave defines its polarization?

- A. The orientation of the electric field
- B. The orientation of the magnetic field
- C. The ratio of the energy in the magnetic field to the energy in the electric field
- D. The ratio of the velocity to the wavelength

T3B02

What property of a radio wave defines its polarization?

A. The orientation of the electric field

T3B03

What are the two components of a radio wave?

- A. Impedance and reactance
- B. Voltage and current
- C. Electric and magnetic fields
- D. Ionizing and non-ionizing radiation

T3B03

What are the two components of a radio wave?

C. Electric and magnetic fields

T3B04

What is the velocity of a radio wave traveling through free space?

- A. Speed of light
- B. Speed of sound
- C. Speed inversely proportional to its wavelength
- D. Speed that increases as the frequency increases

T3B04

What is the velocity of a radio wave traveling through free space?

A. Speed of light

T3B05

What is the relationship between wavelength and frequency?

- A. Wavelength gets longer as frequency increases
- B. Wavelength gets shorter as frequency increases
- C. Wavelength and frequency are unrelated
- D. Wavelength and frequency increase as path length increases

T3B05

What is the relationship between wavelength and frequency?

B. Wavelength gets shorter as frequency increases

T3B06

What is the formula for converting frequency to approximate wavelength in meters?

- A. Wavelength in meters equals frequency in hertz multiplied by 300
- B. Wavelength in meters equals frequency in hertz divided by 300
- C. Wavelength in meters equals frequency in megahertz divided by 300
- D. Wavelength in meters equals 300 divided by frequency in megahertz

T3B06

What is the formula for converting frequency to approximate wavelength in meters?

D. Wavelength in meters equals 300 divided by frequency in megahertz

T3B07

In addition to frequency, which of the following is used to identify amateur radio bands?

- A. The approximate wavelength in meters
- B. Traditional letter/number designators
- C. Channel numbers
- D. All these choices are correct

T3B07

In addition to frequency, which of the following is used to identify amateur radio bands?

A. The approximate wavelength in meters

T3B08

What frequency range is referred to as VHF?

- A. 30 kHz to 300 kHz
- B. 30 MHz to 300 MHz
- C. 300 kHz to 3000 kHz
- D. 300 MHz to 3000 MHz

T3B08

What frequency range is referred to as VHF?

B. 30 MHz to 300 MHz

T3B09

What frequency range is referred to as UHF?

- A. 30 to 300 kHz
- B. 30 to 300 MHz
- C. 300 to 3000 kHz
- D. 300 to 3000 MHz

T3B09

What frequency range is referred to as UHF?

D. 300 to 3000 MHz

T3B10

What frequency range is referred to as HF?

- A. 300 to 3000 MHz
- B. 30 to 300 MHz
- C. 3 to 30 MHz
- D. 300 to 3000 kHz

T3B10

What frequency range is referred to as HF?

C. 3 to 30 MHz

T3B11

What is the approximate velocity of a radio wave in free space?

- A. 150,000 meters per second
- B. 300,000,000 meters per second
- C. 300,000,000 miles per hour
- D. 150,000 miles per hour

T3B11

What is the approximate velocity of a radio wave in free space?

B. 300,000,000 meters per second

T3C - Propagation modes: sporadic E, meteor scatter, auroral propagation, tropospheric ducting; F region skip; Line of sight and radio horizon

Points of Discussion

UHF signals passing through the ionosphere with only a little bending is why UHF signals from stations beyond the radio horizon are rarely heard without being relayed by a repeater.

Long-distance ionospheric propagation is the most common way for hams to make long-distance contacts on the HF bands. At VHF and higher frequencies, the waves usually pass through the ionosphere with only a little bending and are lost to space.

The aurora (northern lights) is the glow from thin sheets of charged particles flowing down through the lower layers of the ionosphere. Those thin sheets 50 miles or more above the Earth's surface reflect VHF signals. Because the aurora is constantly changing, the reflected signals change strength quickly and are often distorted.

At all points of the solar cycle, patches of the ionosphere's E layer can become sufficiently ionized to reflect VHF and UHF signals back to Earth. This is called sporadic E or E-skip propagation and it is most common during early summer and mid-winter months on 10, 6, and occasionally 2 meters.

Points of Discussion

Radio waves can also be diffracted as they travel past sharp edges of large objects. This type of propagation is called knife-edge diffraction.

Tropo contacts over 300-mile paths are not uncommon.

A meteoroid burning up in the upper atmosphere results in a meteor with a meteor trail of ionized gas lasting up to several seconds that can reflect radio signals. Bouncing signals off of these ionized trails is called meteor scatter propagation. The best band for meteor scatter is 6 meters, and contact can be made at distances up to 1200 to 1500 miles.

Propagation at and above VHF frequencies assisted by variations in the atmosphere is called tropospheric propagation or just “tropo.” Variations such as weather fronts or temperature inversions create layers of air next to each other that have different characteristics. The layers form structures called ducts that can guide even microwave signals for long distances.

Points of Discussion

As sunspot activity increases, solar UV rays become more intense. This increases the peak level of ionization in the ionosphere, raising the highest frequency for signals to be returned to Earth along the path between stations. During the years of maximum solar activity, the upper HF bands, such as 10 meters, are likely to be open from dawn until shortly after sunset. Occasionally, the F layers can even reflect 6 meter (50 MHz) signals at the sunspot cycle's peak.

As sunspot activity increases, solar UV rays become more intense. This increases the peak level of ionization in the ionosphere, raising the highest frequency for signals to be returned to Earth along the path between stations. During the years of maximum solar activity, the upper HF bands, such as 10 meters, are likely to be open from dawn until shortly after sunset. Occasionally, the F layers can even reflect 6 meter (50 MHz) signals at the sunspot cycle's peak.

Points of Discussion

Refraction is another type of propagation -- a gradual bending of VHF and UHF radio waves in the atmosphere. By bending signals slightly back towards the ground, refraction counteracts the curvature of the Earth and allows signals at these frequencies to be received at distances somewhat beyond the visual horizon.

Questions?

T3C01

Why are simplex UHF signals rarely heard beyond their radio horizon?

- A. They are too weak to go very far
- B. FCC regulations prohibit them from going more than 50 miles
- C. UHF signals are usually not propagated by the ionosphere
- D. UHF signals are absorbed by the ionospheric D region

T3C01

Why are simplex UHF signals rarely heard beyond their radio horizon?

C. UHF signals are usually not propagated by the ionosphere

T3C02

What is a characteristic of HF communication compared with communications on VHF and higher frequencies?

- A. HF antennas are generally smaller
- B. HF accommodates wider bandwidth signals
- C. Long-distance ionospheric propagation is far more common on HF
- D. There is less atmospheric interference (static) on HF

T3C02

What is a characteristic of HF communication compared with communications on VHF and higher frequencies?

C. Long-distance ionospheric propagation is far more common on HF

T3C03

What is a characteristic of VHF signals received via auroral backscatter?

- A. They are often received from 10,000 miles or more
- B. They are distorted and signal strength varies considerably
- C. They occur only during winter nighttime hours
- D. They are generally strongest when your antenna is aimed west

T3C03

What is a characteristic of VHF signals received via auroral backscatter?

B. They are distorted and signal strength varies considerably

T3C04

Which of the following types of propagation is most commonly associated with occasional strong signals on the 10, 6, and 2 meter bands from beyond the radio horizon?

- A. Backscatter
- B. Sporadic E
- C. D region absorption
- D. Gray-line propagation

T3C04

Which of the following types of propagation is most commonly associated with occasional strong signals on the 10, 6, and 2 meter bands from beyond the radio horizon?

B. Sporadic E

T3C05

Which of the following effects may allow radio signals to travel beyond obstructions between the transmitting and receiving stations?

- A. Knife-edge diffraction
- B. Faraday rotation
- C. Quantum tunneling
- D. Doppler shift

T3C05

Which of the following effects may allow radio signals to travel beyond obstructions between the transmitting and receiving stations?

A. Knife-edge diffraction

T3C06

What type of propagation is responsible for allowing over-the-horizon VHF and UHF communications to ranges of approximately 300 miles on a regular basis?

- A. Tropospheric ducting
- B. D region refraction
- C. F2 region refraction
- D. Faraday rotation

T3C06

What type of propagation is responsible for allowing over-the-horizon VHF and UHF communications to ranges of approximately 300 miles on a regular basis?

A. Tropospheric ducting

T3C07

What band is best suited for communicating via meteor scatter?

- A. 33 centimeters
- B. 6 meters
- C. 2 meters
- D. 70 centimeters

T3C07

What band is best suited for communicating via meteor scatter?

B. 6 meters

T3C08

What causes tropospheric ducting?

- A. Discharges of lightning during electrical storms
- B. Sunspots and solar flares
- C. Updrafts from hurricanes and tornadoes
- D. Temperature inversions in the atmosphere

T3C08

What causes tropospheric ducting?

D. Temperature inversions in the atmosphere

T3C09

What is generally the best time for long-distance 10 meter band propagation via the F region?

- A. From dawn to shortly after sunset during periods of high sunspot activity
- B. From shortly after sunset to dawn during periods of high sunspot activity
- C. From dawn to shortly after sunset during periods of low sunspot activity
- D. From shortly after sunset to dawn during periods of low sunspot activity

T3C09

What is generally the best time for long-distance 10 meter band propagation via the F region?

A. From dawn to shortly after sunset during periods of high sunspot activity

T3C10

Which of the following bands may provide long-distance communications via the ionosphere's F region during the peak of the sunspot cycle?

- A. 6 and 10 meters
- B. 23 centimeters
- C. 70 centimeters and 1.25 meters
- D. All these choices are correct

T3C10

Which of the following bands may provide long-distance communications via the ionosphere's F region during the peak of the sunspot cycle?

A. 6 and 10 meters

T3C11

Why is the radio horizon for VHF and UHF signals more distant than the visual horizon?

- A. Radio signals move somewhat faster than the speed of light
- B. Radio waves are not blocked by dust particles
- C. The atmosphere refracts radio waves slightly
- D. Radio waves are blocked by dust particles

T3C11

Why is the radio horizon for VHF and UHF signals more distant than the visual horizon?

C. The atmosphere refracts radio waves slightly

SUBELEMENT T4

AMATEUR RADIO PRACTICES

[2 Exam Questions - 2 Groups]

T4A – Station setup: connecting a microphone, a power source, a computer, digital equipment, an SWR meter; bonding; Mobile radio installation

Points of Discussion

A typical mobile 50-watt FM radio requires at least $50 \text{ W} / 13.8 \text{ V} = 3.6 \text{ A}$. Doubling that value is 7.2 A, rounded up to 8 A. Any power supply current rating above 8 A, such as 12 or 20 A, will work well.

If an external or standalone SWR (standing wave ratio) meter is used, be sure it is specified for the frequency range in use so that it will make accurate measurements.

Radio equipment can draw large currents when transmitting. This means you must use heavy wire to the power source. If the wire is too thin, its resistance ('R') will create a voltage drop, $V = I * R$. Longer wire lengths also increase resistance. The resulting lower voltage at the radio can cause it to operate improperly, possibly distorting your output signal, or creating interference.

If a sound card is used, its output is connected to the radio's microphone input and the radio's speaker or headphone output is connected to the computer's audio input, which may be the sound card's microphone or line input. A very popular example of a "sound card mode" is FT8 which is part of the WSJT-X software package.

Points of Discussion

To measure the SWR in a feed line the 'SWR meter' is used. The meter is placed in series with the feed line, usually right at the output of the radio.

During digital mode operation, the computer-radio interface uses receive audio, transmit audio, and transmitter keying signals.

When using computer software during digital mode operation, a connection between the computer and transceiver is required. Generally, this a computer "line in" to transceiver speaker connector.

Use short, wide conductors such as copper flashing or strap or heavy sold wire (#8 AWG or larger) to help manage potential RF problems.

You can find out how long a fully-charged battery will power your equipment from the battery's energy rating. Divide the energy rating in ampere-hours (Ah) by the total current needs of the equipment. Remember to use the average current draw for transceivers since you won't be transmitting all the time.

Points of Discussion

By using the appropriate software and an internet connection, you can use your digital mode transceiver to make contacts on all of the popular digital voice systems in use today.

Connect the radio's negative lead to the negative battery terminal or where the battery ground lead is connected to the vehicle body.

When using a straight key (in CW), the operator generates the dots and dashes manually. This is called hand keying. You can get some assistance in manually sending by using an electronic keyer.

Questions?

T4A01

Which of the following is an appropriate power supply rating for a typical 50 watt output mobile FM transceiver?

- A. 24.0 volts at 4 amperes
- B. 13.8 volts at 4 amperes
- C. 24.0 volts at 12 amperes
- D. 13.8 volts at 12 amperes

T4A01

Which of the following is an appropriate power supply rating for a typical 50 watt output mobile FM transceiver?

D. 13.8 volts at 12 amperes

T4A02

Which of the following should be considered when selecting an accessory SWR meter?

- A. The frequency and power level at which the measurements will be made
- B. The distance that the meter will be located from the antenna
- C. The types of modulation being used at the station
- D. All these choices are correct

T4A02

Which of the following should be considered when selecting an accessory SWR meter?

A. The frequency and power level at which the measurements will be made

T4A03

Why are short, heavy-gauge wires used for a transceiver's DC power connection?

- A. To minimize voltage drop when transmitting
- B. To provide a good counterpoise for the antenna
- C. To avoid RF interference
- D. All these choices are correct

T4A03

Why are short, heavy-gauge wires used for a transceiver's DC power connection?

A. To minimize voltage drop when transmitting

T4A04

How are the transceiver audio input and output connected in a station configured to operate using FT8?

- A. To a computer running a terminal program and connected to a terminal node controller unit
- B. To the audio input and output of a computer running WSJT-X software
- C. To an FT8 conversion unit, a keyboard, and a computer monitor
- D. To a computer connected to the FT8converter.com website

T4A04

How are the transceiver audio input and output connected in a station configured to operate using FT8?

B. To the audio input and output of a computer running WSJT-X software

T4A05

Where should an RF power meter be installed?

- A. In the feed line, between the transmitter and antenna
- B. At the power supply output
- C. In parallel with the push-to-talk line and the antenna
- D. In the power supply cable, as close as possible to the radio

T4A05

Where should an RF power meter be installed?

A. In the feed line, between the transmitter and antenna

T4A06

What signals are used in a computer-radio interface for digital mode operation?

- A. Receive and transmit mode, status, and location
- B. Antenna and RF power
- C. Receive audio, transmit audio, and transmitter keying
- D. NMEA GPS location and DC power

T4A06

What signals are used in a computer-radio interface for digital mode operation?

C. Receive audio, transmit audio, and transmitter keying

T4A07

Which of the following connections is made between a computer and a transceiver to use computer software when operating digital modes?

- A. Computer “line out” to transceiver push-to-talk
- B. Computer “line in” to transceiver push-to-talk
- C. Computer “line in” to transceiver speaker connector
- D. Computer “line out” to transceiver speaker connector

T4A07

Which of the following connections is made between a computer and a transceiver to use computer software when operating digital modes?

C. Computer “line in” to transceiver speaker connector

T4A08

Which of the following conductors is preferred for bonding at RF?

- A. Copper braid removed from coaxial cable
- B. Steel wire
- C. Twisted-pair cable
- D. Flat copper strap

T4A08

Which of the following conductors is preferred for bonding at RF?

D. Flat copper strap

T4A09

How can you determine the length of time that equipment can be powered from a battery?

- A. Divide the watt-hour rating of the battery by the peak power consumption of the equipment
- B. Divide the battery ampere-hour rating by the average current draw of the equipment
- C. Multiply the watts per hour consumed by the equipment by the battery power rating
- D. Multiply the square of the current rating of the battery by the input resistance of the equipment

T4A09

How can you determine the length of time that equipment can be powered from a battery?

B. Divide the battery ampere-hour rating by the average current draw of the equipment

T4A10

What function is performed with a transceiver and a digital mode hot spot?

- A. Communication using digital voice or data systems via the internet
- B. FT8 digital communications via AFSK
- C. RTTY encoding and decoding without a computer
- D. High-speed digital communications for meteor scatter

T4A10

What function is performed with a transceiver and a digital mode hot spot?

A. Communication using digital voice or data systems via the internet

T4A11

Where should the negative power return of a mobile transceiver be connected in a vehicle?

- A. At the 12 volt battery chassis ground
- B. At the antenna mount
- C. To any metal part of the vehicle
- D. Through the transceiver's mounting bracket

T4A11

Where should the negative power return of a mobile transceiver be connected in a vehicle?

A. At the 12 volt battery chassis ground

T4A12

What is an electronic keyer?

- A. A device for switching antennas from transmit to receive
- B. A device for voice activated switching from receive to transmit
- C. A device that assists in manual sending of Morse code
- D. An interlock to prevent unauthorized use of a radio

T4A12

What is an electronic keyer?

C. A device that assists in manual sending of Morse code

T4B - Operating controls: frequency tuning, use of filters, squelch function, AGC, memory channels, noise blanker, microphone gain, receiver incremental tuning (RIT), bandwidth selection, digital transceiver configuration

Points of Discussion

Overmodulation of an AM or SSB signal is caused by speaking too loudly or by setting the microphone gain or speech compression too high, possibly resulting in distortion of the transmitted signal.

Some radios also have a keypad that you can use to enter frequencies directly.

Sometimes a signal is too weak to “open the squelch” or unmute the receiver. To hear these signals, adjust the squelch control so that continuous noise is heard. That will allow you to hear any weak signal that is present. Many transceivers have a monitor or MON switch that temporarily opens the squelch for this purpose.

Memories or memory channels are used to store frequencies and modes for later recall. Memories are provided so that you can quickly tune to frequently used or favorite frequencies.

You can use the scanning function of your radio to listen for activity on repeater or simplex channels.

Points of Discussion

Receiver incremental tuning (RIT) is fine-tuning control used for SSB or CW operation. RIT allows the operator to adjust the receiver frequency without changing the transmitter frequency. This allows you to tune in a station that is slightly off frequency or to adjust the pitch of an operator's voice that seems too high or low.

A DMR transceiver must be set up with all of the necessary frequencies and IDs and codes to be used on the air. This information is contained in a computer file called a code plug, an old term from the days when a special component had to be plugged into the radio. Today, software is available to transfer the code plug file to the radio digitally.

Having multiple filters available allows you to reduce noise or interference by selecting a filter with just enough bandwidth to pass the desired signal.

Points of Discussion

Digital repeater systems such as WIRES II/System Fusion, D-STAR, DMR, P25, and NXDN all use talk groups in one form or another. To join a talk group, you'll need to know the groups identification code or number. Enter or select the code on your transceiver and the repeater system connects you to any ongoing communication with that group. Along with the talk group, you'll also have to enter your own identification code into the transceiver so the system knows who you are.

Wide filters (around 2.4 kHz) are used for SSB reception.

Digital repeater systems such as WIRES II/System Fusion, D-STAR, DMR, P25, and NXDN all use talk groups in one form or another. To join a talk group, you'll need to know the groups identification code or number. Enter or select the code on your transceiver and the repeater system connects you to any ongoing communication with that group. Along with the talk group, you'll also have to enter your own identification code into the transceiver so the system knows who you are.

Points of Discussion

When using FM, tuning above or below a signal's frequency does not change its pitch. You will still hear the signal but the audio will be distorted.

Questions?

T4B01

What is the effect of excessive microphone gain on SSB transmissions?

- A. Frequency instability
- B. Distorted transmitted audio
- C. Increased SWR
- D. All these choices are correct

T4B01

What is the effect of excessive microphone gain on SSB transmissions?

B. Distorted transmitted audio

T4B02

Which of the following can be used to enter a transceiver's operating frequency?

- A. The keypad or VFO knob
- B. The CTCSS or DTMF encoder
- C. The Automatic Frequency Control
- D. All these choices are correct

T4B02

Which of the following can be used to enter a transceiver's operating frequency?

A. The keypad or VFO knob

T4B03

How is squelch adjusted so that a weak FM signal can be heard?

- A. Set the squelch threshold so that receiver output audio is on all the time
- B. Turn up the audio level until it overcomes the squelch threshold
- C. Turn on the anti-squelch function
- D. Enable squelch enhancement

T4B03

How is squelch adjusted so that a weak FM signal can be heard?

A. Set the squelch threshold so that receiver output audio is on all the time

T4B04

What is a way to enable quick access to a favorite frequency or channel on your transceiver?

- A. Enable the frequency offset
- B. Store it in a memory channel
- C. Enable the VOX
- D. Use the scan mode to select the desired frequency

T4B04

What is a way to enable quick access to a favorite frequency or channel on your transceiver?

B. Store it in a memory channel

T4B05

What does the scanning function of an FM transceiver do?

- A. Checks incoming signal deviation
- B. Prevents interference to nearby repeaters
- C. Tunes through a range of frequencies to check for activity
- D. Checks for messages left on a digital bulletin board

T4B05

What does the scanning function of an FM transceiver do?

C. Tunes through a range of frequencies to check for activity

T4B06

Which of the following controls could be used if the voice pitch of a single-sideband signal returning to your CQ call seems too high or low?

- A. The AGC or limiter
- B. The bandwidth selection
- C. The tone squelch
- D. The RIT or Clarifier

T4B06

Which of the following controls could be used if the voice pitch of a single-sideband signal returning to your CQ call seems too high or low?

D. The RIT or Clarifier

T4B07

What does a DMR “code plug” contain?

- A. Your call sign in CW for automatic identification
- B. Access information for repeaters and talkgroups
- C. The codec for digitizing audio
- D. The DMR software version

T4B07

What does a DMR “code plug” contain?

B. Access information for repeaters and talkgroups

T4B08

What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

- A. Permits monitoring several modes at once by selecting a separate filter for each mode
- B. Permits noise or interference reduction by selecting a bandwidth matching the mode
- C. Increases the number of frequencies that can be stored in memory
- D. Increases the amount of offset between receive and transmit frequencies

T4B08

What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

B. Permits noise or interference reduction by selecting a bandwidth matching the mode

T4B09

How is a specific group of stations selected on a digital voice transceiver?

- A. By retrieving the frequencies from transceiver memory
- B. By enabling the group's CTCSS tone
- C. By entering the group's identification code
- D. By activating automatic identification

T4B09

How is a specific group of stations selected on a digital voice transceiver?

C. By entering the group's identification code

T4B10

Which of the following receiver filter bandwidths provides the best signal-to-noise ratio for SSB reception?

- A. 500 Hz
- B. 1000 Hz
- C. 2400 Hz
- D. 5000 Hz

T4B10

Which of the following receiver filter bandwidths provides the best signal-to-noise ratio for SSB reception?

C. 2400 Hz

T4B11

Which of the following must be programmed into a D-STAR digital transceiver before transmitting?

- A. Your call sign
- B. Your output power
- C. The codec type being used
- D. All these choices are correct

T4B11

Which of the following must be programmed into a D-STAR digital transceiver before transmitting?

A. Your call sign

T4B12

What is the result of tuning an FM receiver above or below a signal's frequency?

- A. Change in audio pitch
- B. Sideband inversion
- C. Generation of a heterodyne tone
- D. Distortion of the signal's audio

T4B12

What is the result of tuning an FM receiver above or below a signal's frequency?

D. Distortion of the signal's audio

SUBELEMENT T5

ELECTRICAL PRINCIPLES

[4 Exam Questions - 4 Groups]

T5A – Current and voltage: terminology and units, conductors and insulators, alternating and direct current

Points of Discussion

Current is measured in units of amperes, which is abbreviated as A or amps.

A device that consumes or dissipates power, such as a heater or a motor, is often referred to as a load. Power is measured in watts which are abbreviated as 'W.'

Electrical current (represented in equations by the symbol 'I' or 'i') is the flow of electrons.

All materials oppose the flow of electrons through them, whether in the form of direct current (dc) or alternating current (ac) at power frequencies like 60 Hz or RF that we use for our radio signals. This property is called resistance, represented by the symbol 'R.' Resistance is measured in ohms, which are represented by the Greek letter omega. Resistance is measured with an ohmmeter, which must be connected to a component in parallel.

Voltage (represented in equations by the symbol 'E' or 'e') is the electromotive force or electric potential that makes electrons move.

Points of Discussion

The unit of measurement for frequency is hertz, abbreviated 'Hz.'

Materials in which electrons flow easily in response to an applied voltage are conductors. Metals such as copper are good conductors.

Materials that resist or prevent the flow of electrons are insulators, such as glass and ceramics, dry wood and paper, most plastics, and other non-metals.

Current that flows in one direction all the time is direct current, abbreviated dc. Current that regularly reversed direction is alternating current, abbreviated ac.

Power, represented by the symbol 'P,' is the rate at which electrical energy is used.

Points of Discussion

All materials oppose the flow of electrons through them, whether in the form of direct current (dc) or alternating current (ac) at power frequencies like 60 Hz or RF that we use for our radio signals. This property is called resistance, represented by the symbol 'R.' Resistance is measured in ohms, which are represented by the Greek letter omega. Resistance is measured with an ohmmeter, which must be connected to a component in parallel.

As the signal oscillates, each complete up-and-down sequence is called a cycle. The number of cycles per second is the signal's frequency, represented by a lower-case 'f.'

Questions?

T5A01

Electrical current is measured in which of the following units?

- A. Volts
- B. Watts
- C. Ohms
- D. Amperes

T5A01

Electrical current is measured in which of the following units?

D. Amperes

T5A02

Electrical power is measured in which of the following units?

- A. Volts
- B. Watts
- C. Watt-hours
- D. Amperes

T5A02

Electrical power is measured in which of the following units?

B. Watts

T5A03

What is the name for the flow of electrons in an electric circuit?

- A. Voltage
- B. Resistance
- C. Capacitance
- D. Current

T5A03

What is the name for the flow of electrons in an electric circuit?

D. Current

T5A04

What are the units of electrical resistance?

- A. Siemens
- B. Mhos
- C. Ohms
- D. Coulombs

T5A04

What are the units of electrical resistance?

C. Ohms

T5A05

What is the electrical term for the force that causes electron flow?

- A. Voltage
- B. Ampere-hours
- C. Capacitance
- D. Inductance

T5A05

What is the electrical term for the force that causes electron flow?

A. Voltage

T5A06

What is the unit of frequency?

- A. Hertz
- B. Henry
- C. Farad
- D. Tesla

T5A06

What is the unit of frequency?

A. Hertz

T5A07

Why are metals generally good conductors of electricity?

- A. They have relatively high density
- B. They have many free electrons
- C. They have many free protons
- D. All these choices are correct

T5A07

Why are metals generally good conductors of electricity?

B. They have many free electrons

T5A08

Which of the following is a good electrical insulator?

- A. Copper
- B. Glass
- C. Aluminum
- D. Mercury

T5A08

Which of the following is a good electrical insulator?

B. Glass

T5A09

Which of the following describes alternating current?

- A. Current that alternates between a positive direction and zero
- B. Current that alternates between a negative direction and zero
- C. Current that alternates between positive and negative directions
- D. All these answers are correct

T5A09

Which of the following describes alternating current?

C. Current that alternates between positive and negative directions

T5A10

Which term describes the rate at which electrical energy is used?

- A. Resistance
- B. Current
- C. Power
- D. Voltage

T5A10

Which term describes the rate at which electrical energy is used?

C. Power

T5A11

What type of current flow is opposed by resistance?

- A. Direct current
- B. Alternating current
- C. RF current
- D. All these choices are correct

T5A11

What type of current flow is opposed by resistance?

D. All these choices are correct

T5A12

What describes the number of times per second that an alternating current makes a complete cycle?

- A. Pulse rate
- B. Speed
- C. Wavelength
- D. Frequency

T5A12

What describes the number of times per second that an alternating current makes a complete cycle?

D. Frequency

T5B - Math for electronics: conversion of electrical units, decibels

Points of Discussion

1500 mA = 1.5 A (amperes)

1.5 MHz = 1,500,000 Hz (hertz)

1 kV = 1000 V (volts)

1 μ V = one-one-millionth of V (volt)

500 mW = 0.5 W (watt)

3000 mA = 3 A (ampere)

3.525 MHz = 3525 kV

1,000,000 pF = 1 μ F (farad)

A logarithmic function is used to determine a change in a signal's power ratio in units called decibel (dB), and it is $10 \log (\text{final power} / \text{starting power})$. For example: if an amplifier turns a 5-watt signal into a 10-watt signal, that's a change of $10 \log (10/5) = 10 \log 2 = 3 \text{ dB}$

Points of Discussion

A logarithmic function is used to determine a change in a signal's power ratio in units called decibel (dB), and it is $10 \log (\text{final power} / \text{starting power})$. For example: if an amplifier's power is reduced from 12 watts to 3 watts, that's a change of $10 \log (3/12) = 10 \log (0.25) = -6 \text{ dB}$

A logarithmic function is used to determine a change in a signal's power ratio in units called decibel (dB), and it is $10 \log (\text{final power} / \text{starting power})$. For example: if an amplifier turns a 20-watt signal into a 200-watt signal, that's a change of $10 \log (200/20) = 10 \log 10 = 10 \text{ dB}$

28400 kHz = 28.4 MHz (hertz)

2425 MHz = 2.425 GHz (hertz)

Questions?

T5B01

How many milliamperes is 1.5 amperes?

- A. 15 milliamperes
- B. 150 milliamperes
- C. 1500 milliamperes
- D. 15,000 milliamperes

T5B01

How many milliamperes is 1.5 amperes?

C. 1500 milliamperes

T5B02

Which is equal to 1,500,000 hertz?

- A. 1500 kHz
- B. 1500 MHz
- C. 15 GHz
- D. 150 kHz

T5B02

Which is equal to 1,500,000 hertz?

A. 1500 kHz

T5B03

Which is equal to one kilovolt?

- A. One one-thousandth of a volt
- B. One hundred volts
- C. One thousand volts
- D. One million volts

T5B03

Which is equal to one kilovolt?

C. One thousand volts

T5B04

Which is equal to one microvolt?

- A. One one-millionth of a volt
- B. One million volts
- C. One thousand kilovolts
- D. One one-thousandth of a volt

T5B04

Which is equal to one microvolt?

A. One one-millionth of a volt

T5B05

Which is equal to 500 milliwatts?

- A. 0.02 watts
- B. 0.5 watts
- C. 5 watts
- D. 50 watts

T5B05

Which is equal to 500 milliwatts?

B. 0.5 watts

T5B06

Which is equal to 3000 milliamperes?

- A. 0.003 amperes
- B. 0.3 amperes
- C. 3,000,000 amperes
- D. 3 amperes

T5B06

Which is equal to 3000 milliamperes?

D. 3 amperes

T5B07

Which is equal to 3.525 MHz?

- A. 0.003525 kHz
- B. 35.25 kHz
- C. 3525 kHz
- D. 3,525,000 kHz

T5B07

Which is equal to 3.525 MHz?

C. 3525 kHz

T5B08

Which is equal to 1,000,000 picofarads?

- A. 0.001 microfarads
- B. 1 microfarad
- C. 1000 microfarads
- D. 1,000,000,000 microfarads

T5B08

Which is equal to 1,000,000 picofarads?

B. 1 microfarad

T5B09

Which decibel value most closely represents a power increase from 5 watts to 10 watts?

- A. 2 dB
- B. 3 dB
- C. 5 dB
- D. 10 dB

T5B09

Which decibel value most closely represents a power increase from 5 watts to 10 watts?

B. 3 dB

T5B10

Which decibel value most closely represents a power decrease from 12 watts to 3 watts?

- A. -1 dB
- B. -3 dB
- C. -6 dB
- D. -9 dB

T5B10

Which decibel value most closely represents a power decrease from 12 watts to 3 watts?

C. -6 dB

T5B11

Which decibel value represents a power increase from 20 watts to 200 watts?

- A. 10 dB
- B. 12 dB
- C. 18 dB
- D. 28 dB

T5B11

Which decibel value represents a power increase from 20 watts to 200 watts?

A. 10 dB

T5B12

Which is equal to 28400 kHz?

- A. 28.400 kHz
- B. 2.800 MHz
- C. 284.00 MHz
- D. 28.400 MHz

T5B12

Which is equal to 28400 kHz?

D. 28.400 MHz

T5B13

Which is equal to 2425 MHz?

- A. 0.002425 GHz
- B. 24.25 GHz
- C. 2.425 GHz
- D. 2425 GHz

T5B13

Which is equal to 2425 MHz?

C. 2.425 GHz

T5C – Capacitance and inductance terminology and units; Radio frequency definition and units; Impedance definition and units; Calculating power

Points of Discussion

Storing energy in a capacitor is called capacitance, and it is measured in farads ('F').

Inductors store energy in the magnetic field created by current flowing in a wire. This is called inductance and is measured in henrys ('H').

The combination of resistance and reactance is called impedance, represented by the capital letter 'Z,' and is also measured in ohms.

Signals that have a frequency greater than 20,000 Hz (or 20 kHz) are radio frequency or 'RF' signals.

1 kilohertz (kHz) = 1000 hertz (Hz); 1 megahertz (MHz) = 1000 kilohertz = 1,000,000 hertz; 1 gigahertz (GHz) = 1000 MHz = 1,000,000,000 Hz

In a dc circuit, power is calculated as the product of voltage and current. $P = I * E$

How much power is delivered by a voltage of 13.8 volts DC and a current of 10 amperes? $P = I * E$; $P = 10 * 13.8$; $P = 138$ watts

Points of Discussion

How much power is delivered by a voltage of 12 volts DC and a current of 2.5 amperes? $P = I * E$; $P = 2.5 * 12$; $P = 30$ watts

How much current is required to deliver 120 watts at a voltage of 12 volts DC? $I = P / E$; $I = 120 / 12$; $I = 10$ amps

Radio circuits almost always have both resistance and reactance, so impedance is often used as a general term to mean the circuit's opposition to ac current flow.

1 kilohertz (kHz) = 1000 hertz (Hz); 1 megahertz (MHz) = 1000 kilohertz = 1,000,000 hertz; 1 gigahertz (GHz) = 1000 MHz = 1,000,000,000 Hz

Questions?

T5C01

What describes the ability to store energy in an electric field?

- A. Inductance
- B. Resistance
- C. Tolerance
- D. Capacitance

T5C01

What describes the ability to store energy in an electric field?

D. Capacitance

T5C02

What is the unit of capacitance?

- A. The farad
- B. The ohm
- C. The volt
- D. The henry

T5C02

What is the unit of capacitance?

A. The farad

T5C03

What describes the ability to store energy in a magnetic field?

- A. Admittance
- B. Capacitance
- C. Resistance
- D. Inductance

T5C03

What describes the ability to store energy in a magnetic field?

D. Inductance

T5C04

What is the unit of inductance?

- A. The coulomb
- B. The farad
- C. The henry
- D. The ohm

T5C04

What is the unit of inductance?

C. The henry

T5C05

What is the unit of impedance?

- A. The volt
- B. The ampere
- C. The coulomb
- D. The ohm

T5C05

What is the unit of impedance?

D. The ohm

T5C06

What does the abbreviation “RF” mean?

- A. Radio frequency signals of all types
- B. The resonant frequency of a tuned circuit
- C. The real frequency transmitted as opposed to the apparent frequency
- D. Reflective force in antenna transmission lines

T5C06

What does the abbreviation “RF” mean?

A. Radio frequency signals of all types

T5C07

What is the abbreviation for megahertz?

- A. MH
- B. mh
- C. Mhz
- D. MHz

T5C07

What is the abbreviation for megahertz?

D. MHz

T5C08

What is the formula used to calculate electrical power (P) in a DC circuit?

A. $P = E \times I$

B. $P = E / I$

C. $P = E - I$

D. $P = E + I$

T5C08

What is the formula used to calculate electrical power (P) in a DC circuit?

A. $P = E \times I$

T5C09

How much power is delivered by a voltage of 13.8 volts DC and a current of 10 amperes?

- A. 138 watts
- B. 0.7 watts
- C. 23.8 watts
- D. 3.8 watts

T5C09

How much power is delivered by a voltage of 13.8 volts DC and a current of 10 amperes?

A. 138 watts

T5C10

How much power is delivered by a voltage of 12 volts DC and a current of 2.5 amperes?

- A. 4.8 watts
- B. 30 watts
- C. 14.5 watts
- D. 0.208 watts

T5C10

How much power is delivered by a voltage of 12 volts DC and a current of 2.5 amperes?

B. 30 watts

T5C11

How much current is required to deliver 120 watts at a voltage of 12 volts DC?

- A. 0.1 amperes
- B. 10 amperes
- C. 12 amperes
- D. 132 amperes

T5C11

How much current is required to deliver 120 watts at a voltage of 12 volts DC?

B. 10 amperes

T5C12

What is impedance?

- A. The opposition to AC current flow
- B. The inverse of resistance
- C. The Q or Quality Factor of a component
- D. The power handling capability of a component

T5C12

What is impedance?

A. The opposition to AC current flow

T5C13

What is the abbreviation for kilohertz?

- A. KHZ
- B. khz
- C. khZ
- D. kHz

T5C13

What is the abbreviation for kilohertz?

D. kHz

T5D – Ohm's Law; Series and parallel circuits

Points of Discussion

Ohm's Law: $I = E / R$ or Current = Electromotive Force / Resistance

Ohm's Law: $E = I * R$ or Electromotive Force = Current * Resistance

Ohm's Law: $R = E / I$ or Resistance = Electromotive Force / Current

What is the Resistance of a circuit in which a current of 3 amperes flows when connect to 90 volts? $R = E / I$; $R = 90 / 3$; $R = 30$ ohms

What is the Resistance of a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes? $R = E / I$; $R = 12 / 1.5$; $R = 8$ ohms

What is the Resistance of a circuit that draws 4 amperes from a 12-volt source? $R = E / I$; $R = 12 / 4$; $R = 3$ ohms

What is the current in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms? $I = E / R$; $I = 120 / 80$; $I = 1.5$ amps

What is the current through a 100-ohm resistor connected across 200 volts? $I = E / R$; $I = 200 / 100$; $I = 2$ amps

Points of Discussion

What is the current through a 24-ohm resistor connected across 240 volts?

$$I = E / R; I = 240 / 24; I = 10 \text{ amps}$$

What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it? $E = I * R; E = 0.5 * 2; E = 1 \text{ volt}$

What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it? $E = I * R; E = 1 * 10; E = 10 \text{ volts}$

What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it? $E = I * R; E = 2 * 10; E = 20 \text{ volts}$

If two or more components, such as light bulbs, are connected in a circuit so that the same current must flow through all of them, that is a series circuit.

If two or more components are connected so that the same voltage is present across all of them, that is a parallel circuit.

Questions?

T5D01

What formula is used to calculate current in a circuit?

A. $I = E \times R$

B. $I = E / R$

C. $I = E + R$

D. $I = E - R$

T5D01

What formula is used to calculate current in a circuit?

B. $I = E / R$

T5D02

What formula is used to calculate voltage in a circuit?

A. $E = I \times R$

B. $E = I / R$

C. $E = I + R$

D. $E = I - R$

T5D02

What formula is used to calculate voltage in a circuit?

A. $E = I \times R$

T5D03

What formula is used to calculate resistance in a circuit?

A. $R = E \times I$

B. $R = E / I$

C. $R = E + I$

D. $R = E - I$

T5D03

What formula is used to calculate resistance in a circuit?

B. $R = E / I$

T5D04

What is the resistance of a circuit in which a current of 3 amperes flows when connected to 90 volts?

- A. 3 ohms
- B. 30 ohms
- C. 93 ohms
- D. 270 ohms

T5D04

What is the resistance of a circuit in which a current of 3 amperes flows when connected to 90 volts?

B. 30 ohms

T5D05

What is the resistance of a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

- A. 18 ohms
- B. 0.125 ohms
- C. 8 ohms
- D. 13.5 ohms

T5D05

What is the resistance of a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

C. 8 ohms

T5D06

What is the resistance of a circuit that draws 4 amperes from a 12-volt source?

- A. 3 ohms
- B. 16 ohms
- C. 48 ohms
- D. 8 ohms

T5D06

What is the resistance of a circuit that draws 4 amperes from a 12-volt source?

A. 3 ohms

T5D07

What is the current in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?

- A. 9600 amperes
- B. 200 amperes
- C. 0.667 amperes
- D. 1.5 amperes

T5D07

What is the current in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?

D. 1.5 amperes

T5D08

What is the current through a 100-ohm resistor connected across 200 volts?

- A. 20,000 amperes
- B. 0.5 amperes
- C. 2 amperes
- D. 100 amperes

T5D08

What is the current through a 100-ohm resistor connected across 200 volts?

C. 2 amperes

T5D09

What is the current through a 24-ohm resistor connected across 240 volts?

- A. 24,000 amperes
- B. 0.1 amperes
- C. 10 amperes
- D. 216 amperes

T5D09

What is the current through a 24-ohm resistor connected across 240 volts?

C. 10 amperes

T5D10

What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?

- A. 1 volt
- B. 0.25 volts
- C. 2.5 volts
- D. 1.5 volts

T5D10

What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?

A. 1 volt

T5D11

What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?

- A. 1 volt
- B. 10 volts
- C. 11 volts
- D. 9 volts

T5D11

What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?

B. 10 volts

T5D12

What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?

- A. 8 volts
- B. 0.2 volts
- C. 12 volts
- D. 20 volts

T5D12

What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?

D. 20 volts

T5D13

In which type of circuit is DC current the same through all components?

- A. Series
- B. Parallel
- C. Resonant
- D. Branch

T5D13

In which type of circuit is DC current the same through all components?

A. Series

T5D14

In which type of circuit is voltage the same across all components?

- A. Series
- B. Parallel
- C. Resonant
- D. Branch

T5D14

In which type of circuit is voltage the same across all components?

B. Parallel

SUBELEMENT T6

ELECTRONIC AND ELECTRICAL COMPONENTS

[4 Exam Questions - 4 Groups]

*T6A - Fixed and variable resistors; Capacitors;
Inductors; Fuses; Switches; Batteries*

Points of Discussion

The function of a resistor is to oppose the flow of electrical current in an ac or dc circuit, just as a valve in a water pipe restricts the flow through the pipe.

All three types of basic components (resistors, capacitors, inductors) are also available as adjustable or variable models. A variable resistor is called a potentiometer or 'pot' because it is frequently used to adjust voltage or potential, such as for a volume control.

Capacitors store electrical energy in the electric field created by a voltage between two conducting surfaces or electrodes that are separated by an insulator called a dielectric.

Inductors store energy in the magnetic field created by current flowing in a wire. This is called inductance and is measured in henrys ('H').

Inductors are made from wire wound in a coil, sometimes around a core of magnetic material that concentrates the magnetic energy.

Points of Discussion

The combination of poles and throws describes the switch. For example, the simplest switch that opens or closes a single current path is an SPST (single-pole single-throw) switch. An SPDT switch selects one of two paths (double-throw) for one circuit (single-pole). DPST and DPDT are other common configurations.

Fuses are rated by the maximum current they can carry without blowing. They interrupt current overloads by melting a short length of metal.

Rechargeable batteries include: nickle-metal hydride, lithium-ion, and lead-acid.

Non-rechargeable batteries include: carbon-zinc and alkaline.

A double-throw (DT) switch can route current through either of two paths while a single-throw (ST) switch can only open or close a single path.

Questions?

T6A01

What electrical component opposes the flow of current in a DC circuit?

- A. Inductor
- B. Resistor
- C. Inverter
- D. Transformer

T6A01

What electrical component opposes the flow of current in a DC circuit?

B. Resistor

T6A02

What type of component is often used as an adjustable volume control?

- A. Fixed resistor
- B. Power resistor
- C. Potentiometer
- D. Transformer

T6A02

What type of component is often used as an adjustable volume control?

C. Potentiometer

T6A03

What electrical parameter is controlled by a potentiometer?

- A. Inductance
- B. Resistance
- C. Capacitance
- D. Field strength

T6A03

What electrical parameter is controlled by a potentiometer?

B. Resistance

T6A04

What electrical component stores energy in an electric field?

- A. Varistor
- B. Capacitor
- C. Inductor
- D. Diode

T6A04

What electrical component stores energy in an electric field?

B. Capacitor

T6A05

What type of electrical component consists of conductive surfaces separated by an insulator?

- A. Resistor
- B. Potentiometer
- C. Oscillator
- D. Capacitor

T6A05

What type of electrical component consists of conductive surfaces separated by an insulator?

D. Capacitor

T6A06

What type of electrical component stores energy in a magnetic field?

- A. Varistor
- B. Capacitor
- C. Inductor
- D. Diode

T6A06

What type of electrical component stores energy in a magnetic field?

C. Inductor

T6A07

What electrical component is typically constructed as a coil of wire?

- A. Switch
- B. Capacitor
- C. Diode
- D. Inductor

T6A07

What electrical component is typically constructed as a coil of wire?

D. Inductor

T6A08

What is the function of an SPDT switch?

- A. A single circuit is opened or closed
- B. Two circuits are opened or closed
- C. A single circuit is switched between one of two other circuits
- D. Two circuits are each switched between one of two other circuits

T6A08

What is the function of an SPDT switch?

C. A single circuit is switched between one of two other circuits

T6A09

What electrical component is used to protect other circuit components from current overloads?

- A. Fuse
- B. Thyatron
- C. Varactor
- D. All these choices are correct

T6A09

What electrical component is used to protect other circuit components from current overloads?

A. Fuse

T6A10

Which of the following battery chemistries is rechargeable?

- A. Nickel-metal hydride
- B. Lithium-ion
- C. Lead-acid
- D. All these choices are correct

T6A10

Which of the following battery chemistries is rechargeable?

D. All these choices are correct

T6A11

Which of the following battery chemistries is not rechargeable?

- A. Nickel-cadmium
- B. Carbon-zinc
- C. Lead-acid
- D. Lithium-ion

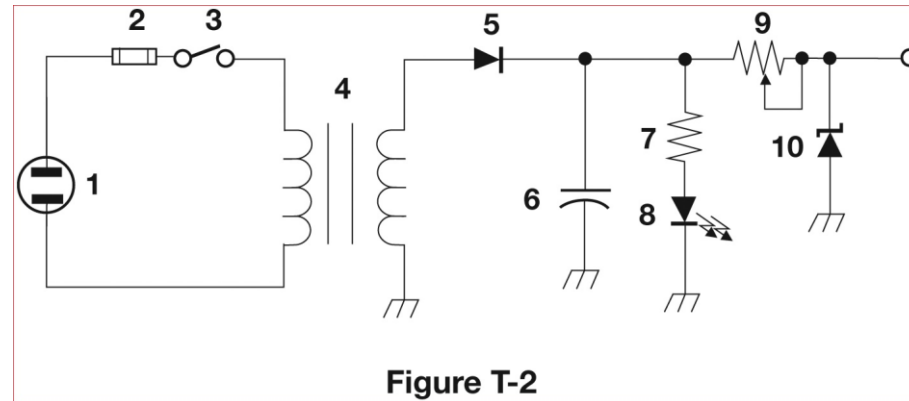
T6A11

Which of the following battery chemistries is not rechargeable?

B. Carbon-zinc

T6A12

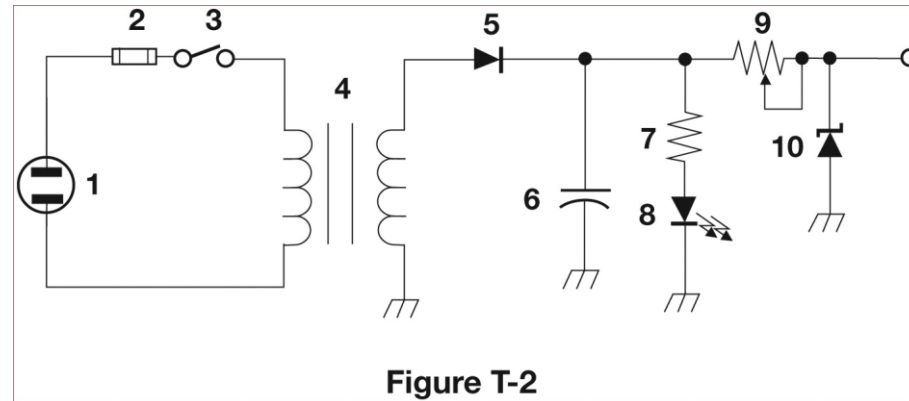
What type of switch is represented by component 3 in figure T-2?



- A. Single-pole single-throw
- B. Single-pole double-throw
- C. Double-pole single-throw
- D. Double-pole double-throw

T6A12

What type of switch is represented by component 3 in figure T-2?



A. Single-pole single-throw

T6B – Semiconductors: basic principles and applications of solid state devices, diodes and transistors

Points of Discussion

When current flows through a diode, a small positive voltage develops from the anode to the cathode. This is called the diode's forward voltage drop and it is usually less than 1 V. The voltage depends on the type of diode and the materials it's made from.

A semiconductor that only allows current to flow in one direction is called a diode.

With the appropriate external circuit and a source of power, transistors can amplify or switch voltages and currents.

Transistors are components made of N- and P- layer patterns, and can have three layers of semiconductor material.

The three electrodes of a BJT are the base, collector, and emitter. The three electrodes of an FET are the gate, drain, and source.

On a diode, the cathode is usually identified by a stripe marked on the component.

Points of Discussion

A special type of diode, the light-emitting diode or LED, give off light when the current flows through it in the forward direction from anode to cathode.

There are two common types of transistors: bipolar junction transistors (BJT) and field-effect transistors (FET)

A diode has two electrodes: an anode and a cathode.

RF power transistors are used as the primary gain-producing component in RF power amplifiers.

Using a small signal to control or amplify larger signals is called gain.

The three electrodes of a BJT are the base, collector, and emitter. The three electrodes of an FET are the gate, drain, and source.

Questions?

T6B01

Which is true about forward voltage drop in a diode?

- A. It is lower in some diode types than in others
- B. It is proportional to peak inverse voltage
- C. It indicates that the diode is defective
- D. It has no impact on the voltage delivered to the load

T6B01

Which is true about forward voltage drop in a diode?

A. It is lower in some diode types than in others

T6B02

What electronic component allows current to flow in only one direction?

- A. Resistor
- B. Fuse
- C. Diode
- D. Driven element

T6B02

What electronic component allows current to flow in only one direction?

C. Diode

T6B03

Which of these components can be used as an electronic switch?

- A. Varistor
- B. Potentiometer
- C. Transistor
- D. Thermistor

T6B03

Which of these components can be used as an electronic switch?

C. Transistor

T6B04

Which of the following components can consist of three regions of semiconductor material?

- A. Alternator
- B. Transistor
- C. Triode
- D. Pentagrid converter

T6B04

Which of the following components can consist of three regions of semiconductor material?

B. Transistor

T6B05

What type of transistor has a gate, drain, and source?

- A. Varistor
- B. Field-effect
- C. Tesla-effect
- D. Bipolar junction

T6B05

What type of transistor has a gate, drain, and source?

B. Field-effect

T6B06

How is the cathode lead of a semiconductor diode often marked on the package?

- A. With the word "cathode"
- B. With a stripe
- C. With the letter C
- D. With the letter K

T6B06

How is the cathode lead of a semiconductor diode often marked on the package?

B. With a stripe

T6B07

What causes a light-emitting diode (LED) to emit light?

- A. Forward DC current
- B. Reverse DC current
- C. Capacitively-coupled RF signal
- D. Inductively-coupled RF signal

T6B07

What causes a light-emitting diode (LED) to emit light?

A. Forward DC current

T6B08

What does the abbreviation FET stand for?

- A. Frequency Emission Transmitter
- B. Fast Electron Transistor
- C. Free Electron Transmitter
- D. Field Effect Transistor

T6B08

What does the abbreviation FET stand for?

D. Field Effect Transistor

T6B09

What are the names for the electrodes of a diode?

- A. Plus and minus
- B. Source and drain
- C. Anode and cathode
- D. Gate and base

T6B09

What are the names for the electrodes of a diode?

C. Anode and cathode

T6B10

Which of the following can provide power gain?

- A. Transformer
- B. Transistor
- C. Reactor
- D. Resistor

T6B10

Which of the following can provide power gain?

B. Transistor

T6B11

What is the term that describes a device's ability to amplify a signal?

- A. Gain
- B. Forward resistance
- C. Forward voltage drop
- D. On resistance

T6B11

What is the term that describes a device's ability to amplify a signal?

A. Gain

T6B12

What are the names of the electrodes of a bipolar junction transistor?

- A. Signal, bias, power
- B. Emitter, base, collector
- C. Input, output, supply
- D. Pole one, pole two, output

T6B12

What are the names of the electrodes of a bipolar junction transistor?

B. Emitter, base, collector

T6C - Circuit diagrams: use of schematics, basic structure; Schematic symbols of basic components

Points of Discussion

Schematics are a visual description of a circuit and its components that uses standardized drawings called circuit symbols.

Resistor

Transistor

Lamp

Battery

Capacitor

Light-emitting diode (LED)

Variable Resistor

Transformer

Variable Inductor

Antenna

Points of Discussion

Each line in a schematic diagram does not necessarily correspond to a physical wire -- it just indicates that an electrical connection exists between whatever is at each end of the line.

Questions?

T6C01

What is the name of an electrical wiring diagram that uses standard component symbols?

- A. Bill of materials
- B. Connector pinout
- C. Schematic
- D. Flow chart

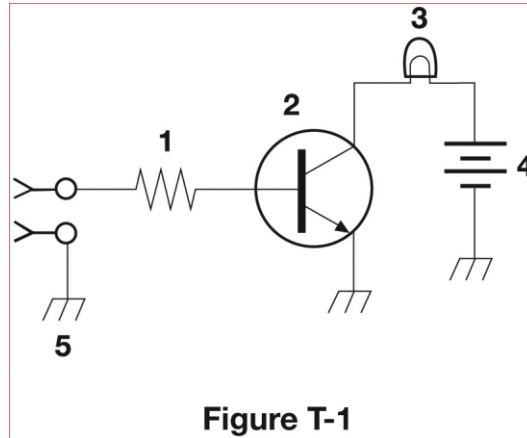
T6C01

What is the name of an electrical wiring diagram that uses standard component symbols?

C. Schematic

T6C02

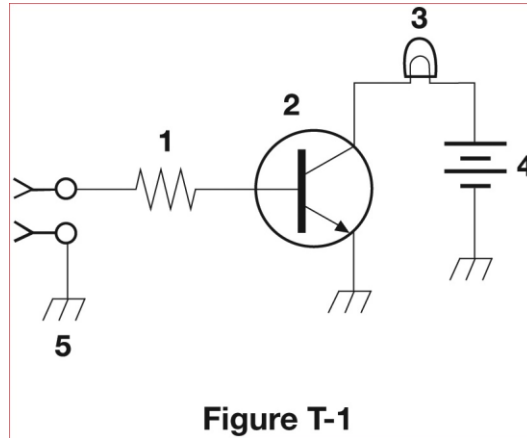
What is component 1 in figure T-1?



- A. Resistor
- B. Transistor
- C. Battery
- D. Connector

T6C02

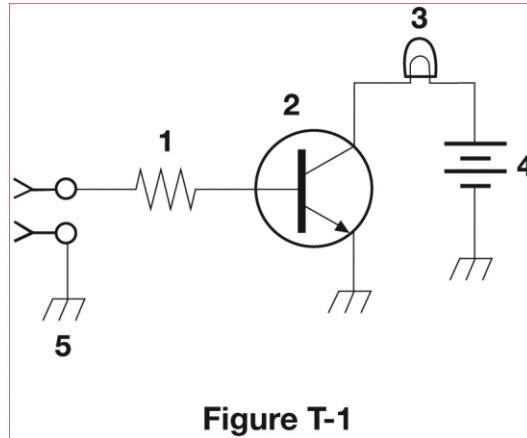
What is component 1 in figure T-1?



A. Resistor

T6C03

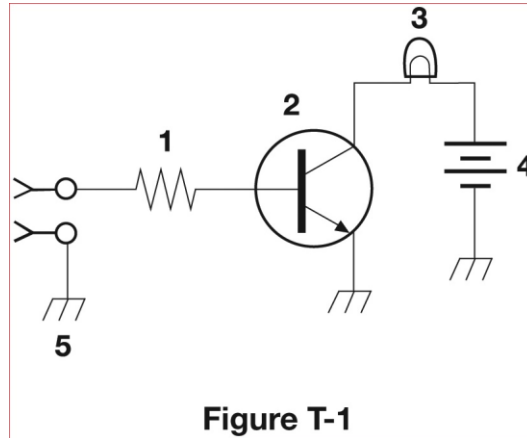
What is component 2 in figure T-1?



- A. Resistor
- B. Transistor
- C. Indicator lamp
- D. Connector

T6C03

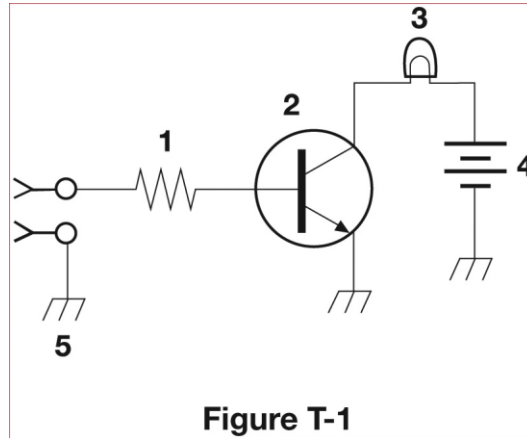
What is component 2 in figure T-1?



B. Transistor

T6C04

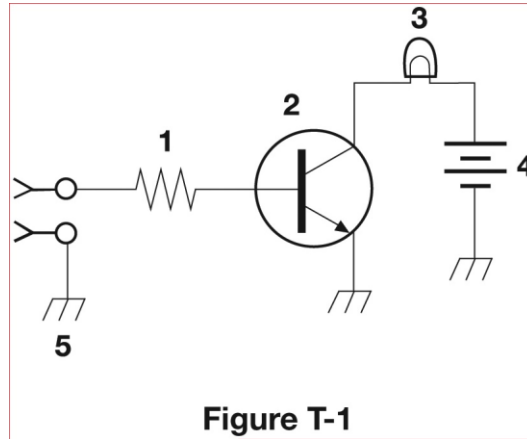
What is component 3 in figure T-1?



- A. Resistor
- B. Transistor
- C. Lamp
- D. Ground symbol

T6C04

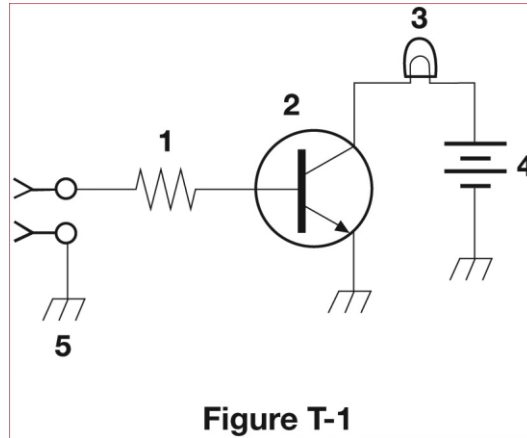
What is component 3 in figure T-1?



C. Lamp

T6C05

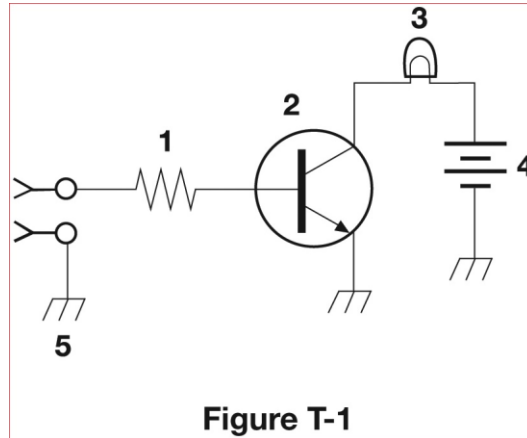
What is component 4 in figure T-1?



- A. Resistor
- B. Transistor
- C. Ground symbol
- D. Battery

T6C05

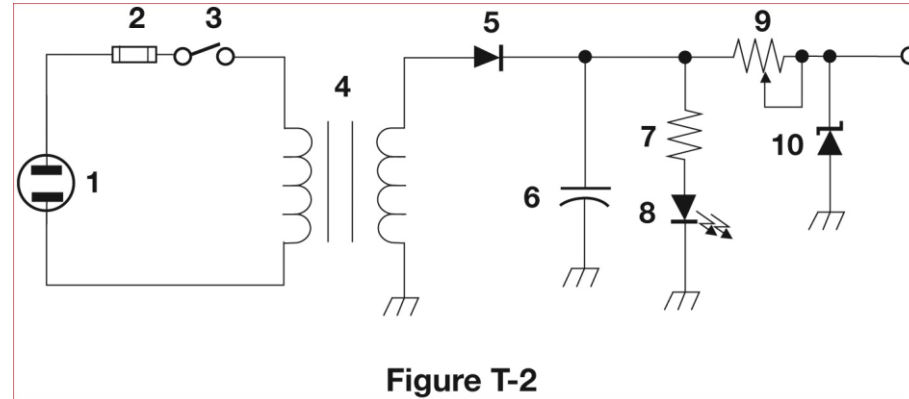
What is component 4 in figure T-1?



D. Battery

T6C06

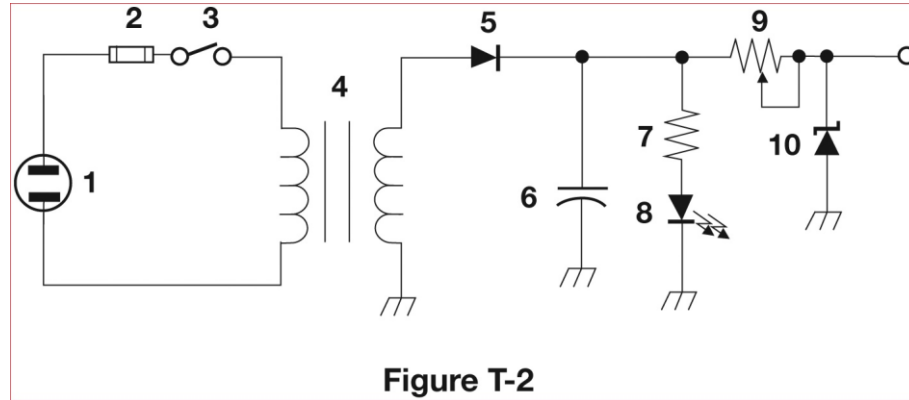
What is component 6 in figure T-2?



- A. Resistor
- B. Capacitor
- C. Regulator IC
- D. Transistor

T6C06

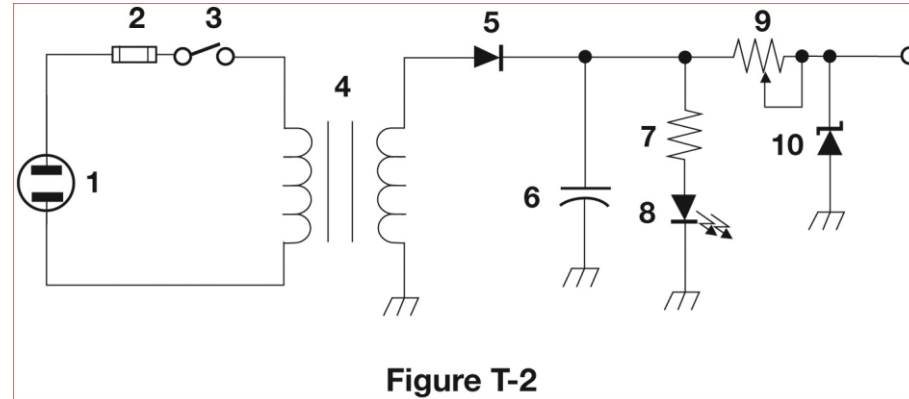
What is component 6 in figure T-2?



B. Capacitor

T6C07

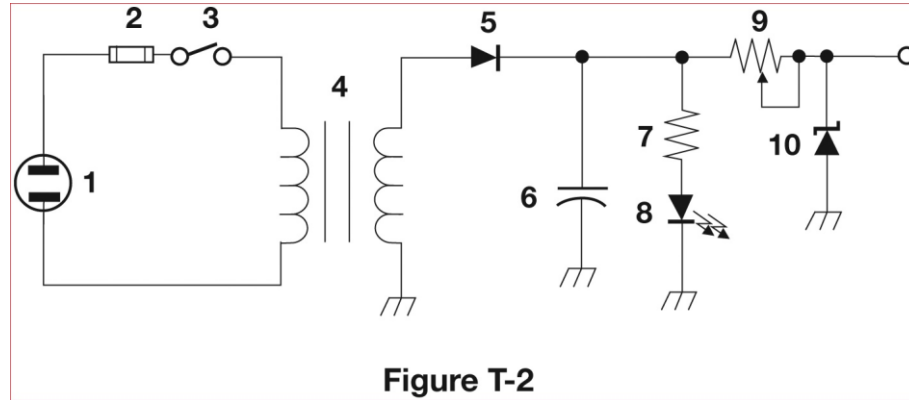
What is component 8 in figure T-2?



- A. Resistor
- B. Inductor
- C. Regulator IC
- D. Light emitting diode

T6C07

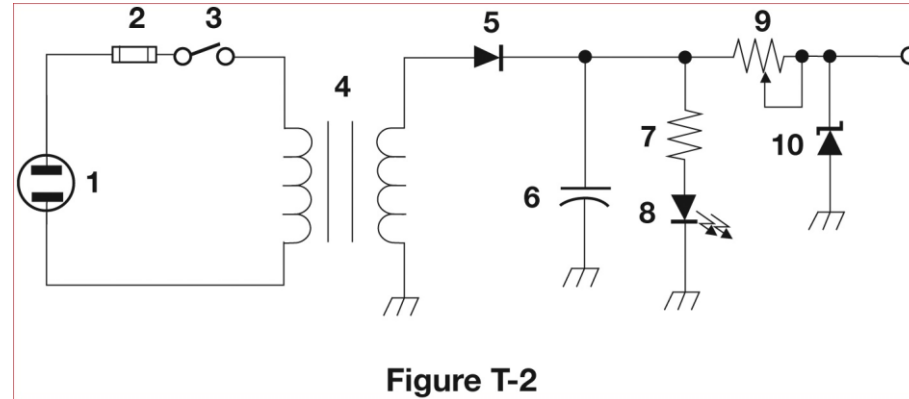
What is component 8 in figure T-2?



D. Light emitting diode

T6C08

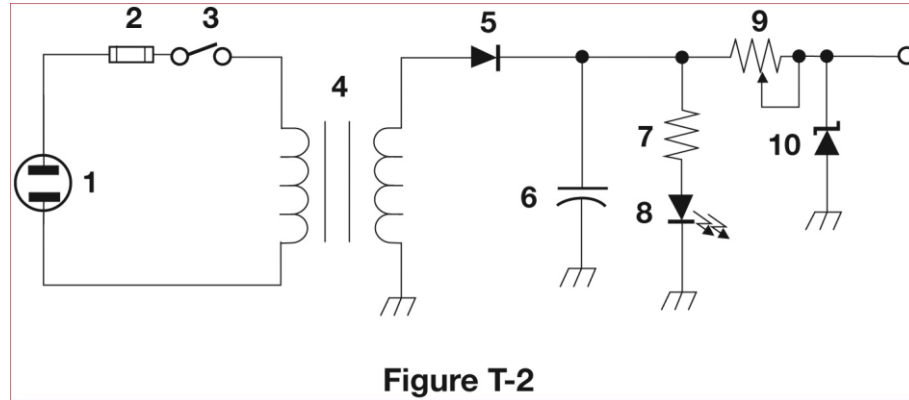
What is component 9 in figure T-2?



- A. Variable capacitor
- B. Variable inductor
- C. Variable resistor
- D. Variable transformer

T6C08

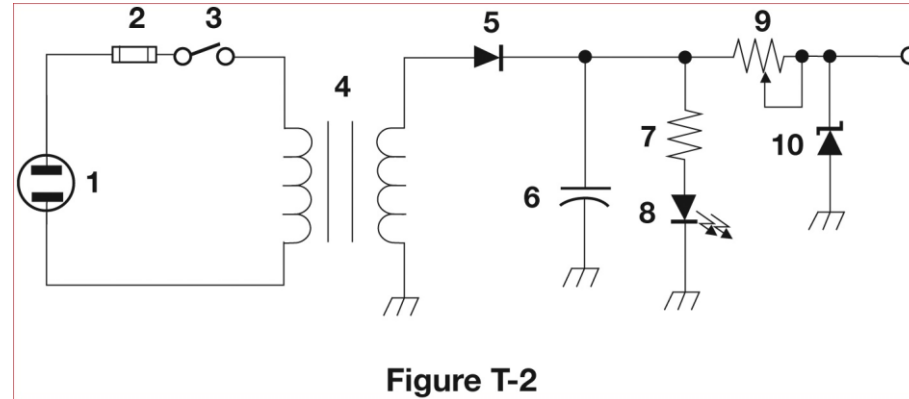
What is component 9 in figure T-2?



C. Variable resistor

T6C09

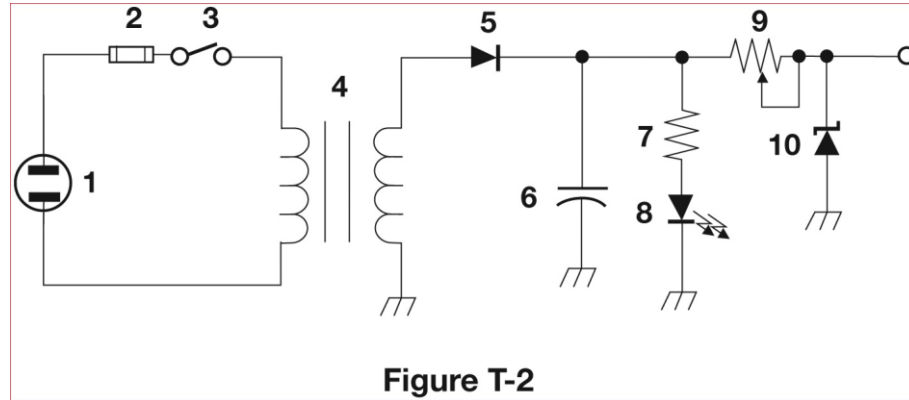
What is component 4 in figure T-2?



- A. Variable inductor
- B. Double-pole switch
- C. Potentiometer
- D. Transformer

T6C09

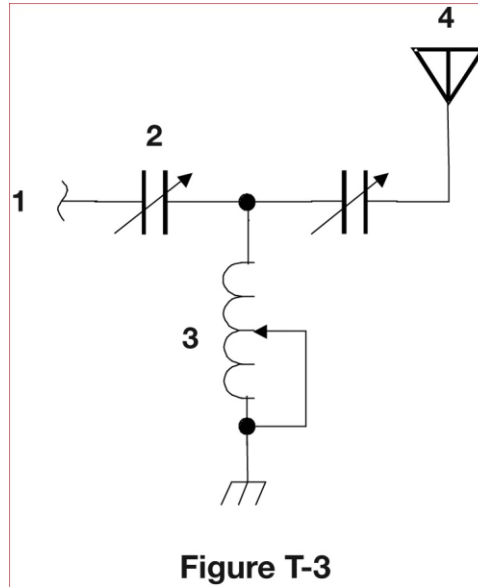
What is component 4 in figure T-2?



D. Transformer

T6C10

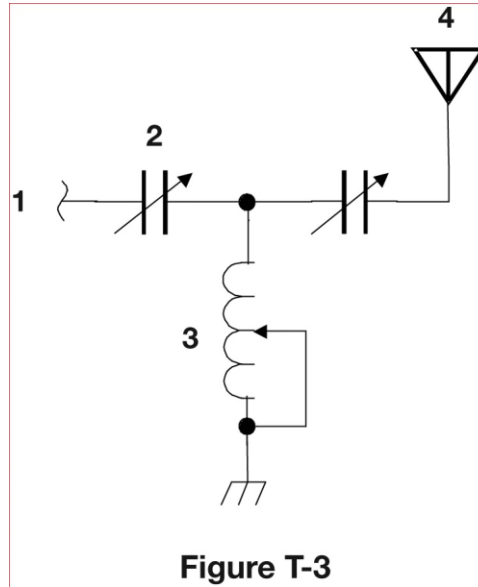
What is component 3 in figure T-3?



- A. Connector
- B. Meter
- C. Variable capacitor
- D. Variable inductor

T6C10

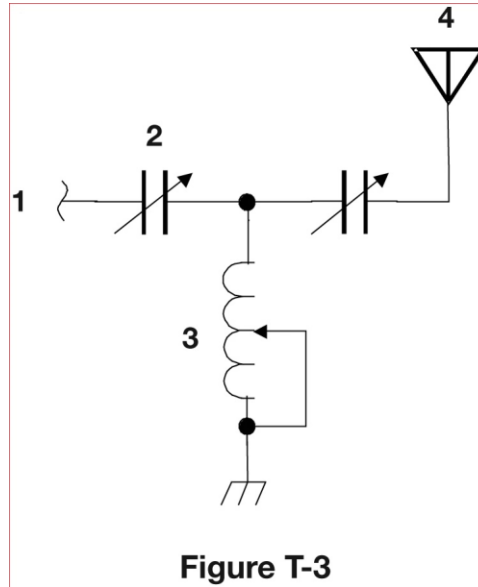
What is component 3 in figure T-3?



D. Variable inductor

T6C11

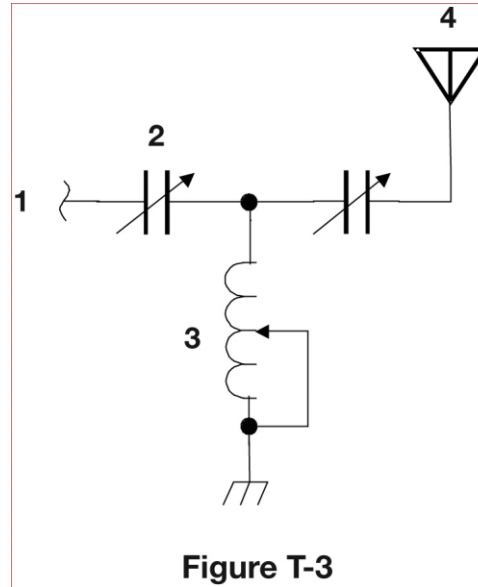
What is component 4 in figure T-3?



- A. Antenna
- B. Transmitter
- C. Dummy load
- D. Ground

T6C11

What is component 4 in figure T-3?



A. Antenna

T6C12

Which of the following is accurately represented in electrical schematics?

- A. Wire lengths
- B. Physical appearance of components
- C. Component connections
- D. All these choices are correct

T6C12

Which of the following is accurately represented in electrical schematics?

C. Component connections

T6D - Component functions: rectifiers, relays, voltage regulators, meters, indicators, integrated circuits, transformers; Resonant circuit; Shielding

Points of Discussion

If an ac voltage is applied to a diode, the result is a pulsing dc current because current is blocked when the voltage tries to push electrons in the “wrong” direction.

Switches and relays control current through a circuit by connecting and disconnecting paths for current to follow. Both can interrupt current -- called opening a circuit -- or allow it to flow -- called closing a circuit. A switch is operated manually while a relay is a switch controlled by an electromagnet.

Use shielded wire and shielded cables to prevent coupling with unwanted signals and undesired radiation.

A meter provides information as a value in the form of numbers or on a numeric scale.

A supply's output voltage changes with the amount of output current. A regulated supply uses a regulator circuit to minimize the amount of voltage change.

Points of Discussion

A transformer is used to transfer energy from household 120 V ac voltage to a lower voltage for other uses such as in electronic equipment.

LEDs are most often used as visual indicators.

Circuits that contain both a capacitor and an inductor are called resonant circuits or tuned circuits.

An integrated circuit (IC or chip) is made of many components connected together as a useful circuit and packaged as a single component.

Transistors use small voltages and currents to control larger ones.

A tuned circuit acts as a filter, passing or rejecting signals at its resonant frequency.

Questions?

T6D01

Which of the following devices or circuits changes an alternating current into a varying direct current signal?

- A. Transformer
- B. Rectifier
- C. Amplifier
- D. Reflector

T6D01

Which of the following devices or circuits changes an alternating current into a varying direct current signal?

B. Rectifier

T6D02

What is a relay?

- A. An electrically-controlled switch
- B. A current controlled amplifier
- C. An inverting amplifier
- D. A pass transistor

T6D02

What is a relay?

A. An electrically-controlled switch

T6D03

Which of the following is a reason to use shielded wire?

- A. To decrease the resistance of DC power connections
- B. To increase the current carrying capability of the wire
- C. To prevent coupling of unwanted signals to or from the wire
- D. To couple the wire to other signals

T6D03

Which of the following is a reason to use shielded wire?

C. To prevent coupling of unwanted signals to or from the wire

T6D04

Which of the following displays an electrical quantity as a numeric value?

- A. Potentiometer
- B. Transistor
- C. Meter
- D. Relay

T6D04

Which of the following displays an electrical quantity as a numeric value?

C. Meter

T6D05

What type of circuit controls the amount of voltage from a power supply?

- A. Regulator
- B. Oscillator
- C. Filter
- D. Phase inverter

T6D05

What type of circuit controls the amount of voltage from a power supply?

A. Regulator

T6D06

What component changes 120 V AC power to a lower AC voltage for other uses?

- A. Variable capacitor
- B. Transformer
- C. Transistor
- D. Diode

T6D06

What component changes 120 V AC power to a lower AC voltage for other uses?

B. Transformer

T6D07

Which of the following is commonly used as a visual indicator?

- A. LED
- B. FET
- C. Zener diode
- D. Bipolar transistor

T6D07

Which of the following is commonly used as a visual indicator?

A. LED

T6D08

Which of the following is combined with an inductor to make a resonant circuit?

- A. Resistor
- B. Zener diode
- C. Potentiometer
- D. Capacitor

T6D08

Which of the following is combined with an inductor to make a resonant circuit?

D. Capacitor

T6D09

What is the name of a device that combines several semiconductors and other components into one package?

- A. Transducer
- B. Multi-pole relay
- C. Integrated circuit
- D. Transformer

T6D09

What is the name of a device that combines several semiconductors and other components into one package?

C. Integrated circuit

T6D10

What is the function of component 2 in figure T-1?

- A. Give off light when current flows through it
- B. Supply electrical energy
- C. Control the flow of current
- D. Convert electrical energy into radio waves

T6D10

What is the function of component 2 in figure T-1?

C. Control the flow of current

T6D11

Which of the following is a resonant or tuned circuit?

- A. An inductor and a capacitor in series or parallel
- B. A linear voltage regulator
- C. A resistor circuit used for reducing standing wave ratio
- D. A circuit designed to provide high-fidelity audio

T6D11

Which of the following is a resonant or tuned circuit?

A. An inductor and a capacitor in series or parallel

SUBELEMENT T7

PRACTICAL CIRCUITS

[4 Exam Questions - 4 Groups]

T7A – Station equipment: receivers, transceivers, transmitter amplifiers, receive amplifiers, transverters; Basic radio circuit concepts and terminology: sensitivity, selectivity, mixers, oscillators, PTT, modulation

Points of Discussion

Receivers are compared on the basis of two primary characteristics: sensitivity and selectivity. A receiver's sensitivity determines its ability to detect signals.

Most amateur equipment combines the transmitter and receiver in to a single piece of equipment called a transceiver (abbreviated XCVR).

A mixer is closely related to a modulator. Mixer combine two RF signals and shift one of them to a third frequency.

Selectivity is the ability of a receiver to discriminate between signals, retrieving only the information from the desired signal in the presence of unwanted signals.

An oscillator produces a steady signal at one frequency.

By using mixers, it is possible to convert an entire transceiver to operate on a different band. The mixers are part of equipment called a 'transverter.' Transverters allow one main transceiver to be used on one or more new bands.

Points of Discussion

Switching between receive and transmit on voice can be performed manually with a push-to-talk (PTT) switch or an automatic voice-operated transmitter control circuit (VOX). Grounding a transceiver's PTT input switches from receive to transmit.

The process of combining data or voice signals with an RF signal is modulation. A circuit that performs the modulation function is called a modulator.

Many UHF/UHF power amplifiers can be used on all modes but need to be set to the right mode to operate properly. On most amplifiers, this is controlled by a CW/SSB switch on the front panel.

Handheld transceivers or handhelds are incredibly popular and offer a variety of useful features. They can only output a few watts, however. If you have difficulty accessing distant repeaters or making simplex contacts, an RF power amplifier can be used to increase the output power by a factor of five or more.

Points of Discussion

Sensitivity is specified as a minimum detectable signal (or MDS) level, usually in microvolts (uV). The lower the MDS, the more sensitive the receiver. If a receiver is not sensitive enough, a preamplifier or “preamp” can be used. A preamp is connected between the antenna and receiver.

Questions?

T7A01

Which term describes the ability of a receiver to detect the presence of a signal?

- A. Linearity
- B. Sensitivity
- C. Selectivity
- D. Total Harmonic Distortion

T7A01

Which term describes the ability of a receiver to detect the presence of a signal?

B. Sensitivity

T7A02

What is a transceiver?

- A. A device that combines a receiver and transmitter
- B. A device for matching feed line impedance to 50 ohms
- C. A device for automatically sending and decoding Morse code
- D. A device for converting receiver and transmitter frequencies to another band

T7A02

What is a transceiver?

A. A device that combines a receiver and transmitter

T7A03

Which of the following is used to convert a signal from one frequency to another?

- A. Phase splitter
- B. Mixer
- C. Inverter
- D. Amplifier

T7A03

Which of the following is used to convert a signal from one frequency to another?

B. Mixer

T7A04

Which term describes the ability of a receiver to discriminate between multiple signals?

- A. Discrimination ratio
- B. Sensitivity
- C. Selectivity
- D. Harmonic distortion

T7A04

Which term describes the ability of a receiver to discriminate between multiple signals?

C. Selectivity

T7A05

What is the name of a circuit that generates a signal at a specific frequency?

- A. Reactance modulator
- B. Phase modulator
- C. Low-pass filter
- D. Oscillator

T7A05

What is the name of a circuit that generates a signal at a specific frequency?

D. Oscillator

T7A06

What device converts the RF input and output of a transceiver to another band?

- A. High-pass filter
- B. Low-pass filter
- C. Transverter
- D. Phase converter

T7A06

What device converts the RF input and output of a transceiver to another band?

C. Transverter

T7A07

What is the function of a transceiver's PTT input?

- A. Input for a key used to send CW
- B. Switches transceiver from receive to transmit when grounded
- C. Provides a transmit tuning tone when grounded
- D. Input for a preamplifier tuning tone

T7A07

What is the function of a transceiver's PTT input?

B. Switches transceiver from receive to transmit when grounded

T7A08

Which of the following describes combining speech with an RF carrier signal?

- A. Impedance matching
- B. Oscillation
- C. Modulation
- D. Low-pass filtering

T7A08

Which of the following describes combining speech with an RF carrier signal?

C. Modulation

T7A09

What is the function of the SSB/CW-FM switch on a VHF power amplifier?

- A. Change the mode of the transmitted signal
- B. Set the amplifier for proper operation in the selected mode
- C. Change the frequency range of the amplifier to operate in the proper segment of the band
- D. Reduce the received signal noise

T7A09

What is the function of the SSB/CW-FM switch on a VHF power amplifier?

B. Set the amplifier for proper operation in the selected mode

T7A10

What device increases the transmitted output power from a transceiver?

- A. A voltage divider
- B. An RF power amplifier
- C. An impedance network
- D. All these choices are correct

T7A10

What device increases the transmitted output power from a transceiver?

B. An RF power amplifier

T7A11

Where is an RF preamplifier installed?

- A. Between the antenna and receiver
- B. At the output of the transmitter power amplifier
- C. Between the transmitter and the antenna tuner
- D. At the output of the receiver audio amplifier

T7A11

Where is an RF preamplifier installed?

A. Between the antenna and receiver

T7B – Symptoms, causes, and cures of common transmitter and receiver problems: overload and overdrive, distortion, interference and consumer electronics, RF feedback

Points of Discussion

An overmodulated FM signal has excessive deviation and is said to be overdeviating. Overdeviation is usually caused by speaking too loudly into the microphone and may cause interference on adjacent channels. It often generates noise or distortion on voice peaks, called “breaking up.” To reduce overdeviation, speak more softly or move the microphone farther from your mouth.

Very strong signals may overwhelm a receiver's ability to reject them. This is called fundamental overload. Consumer equipment is often unable to reject strong signals outside the bands it is intended to receive.

The most common causes of RFI (Radio Frequency Interference) from your transmissions are fundamental overload, harmonics, and spurious emissions.

Ferrite chokes are also used to reduce RF current on the outside of shielded audio, microphone, and computer cables that might cause distorted audio.

Points of Discussion

A high-pass filter can be connected at the antenna input of FM and TV receivers to reject strong lower-frequency signals from amateur HF signals.

Eliminate interference to your own home appliances and television first. Demonstrating that you aren't interfering with your own devices is a good start. Eliminating interference at home is considered good practice.

A band-reject or notch filter can be used to reduce interference from amateur VHF or UHF signals.

On other occasion, you may be receiving harmful interference from equipment in the neighbor's home. Start with the following steps: make sure your station meets the standards of good amateur practice, you can offer to help determine the source of the interference (severe noise often indicates defective equipment that could be a safety hazard), you may have to politely explain to the neighbor that FCC rules prohibit them from using a device that causes harmful interference.

Points of Discussion

The most common cause of leakage in either direction is faulty coaxial connectors on the cable feed line. They might be improperly installed or simply loose. Be sure the connectors are installed correctly and attached tightly.

You could be transmitting from a bad location where your signal is distorted at the repeater input. Weak or low batteries can also cause distorted audio.

“RF feedback” via a microphone cable can cause distorted transmitted audio.

Questions?

T7B01

What can you do if you are told your FM handheld or mobile transceiver is over-deviating?

- A. Talk louder into the microphone
- B. Let the transceiver cool off
- C. Change to a higher power level
- D. Talk farther away from the microphone

T7B01

What can you do if you are told your FM handheld or mobile transceiver is over-deviating?

D. Talk farther away from the microphone

T7B02

What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

- A. The receiver is unable to reject strong signals outside the AM or FM band
- B. The microphone gain of the transmitter is turned up too high
- C. The audio amplifier of the transmitter is overloaded
- D. The deviation of an FM transmitter is set too low

T7B02

What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

A. The receiver is unable to reject strong signals outside the AM or FM band

T7B03

Which of the following can cause radio frequency interference?

- A. Fundamental overload
- B. Harmonics
- C. Spurious emissions
- D. All these choices are correct

T7B03

Which of the following can cause radio frequency interference?

D. All these choices are correct

T7B04

Which of the following could you use to cure distorted audio caused by RF current on the shield of a microphone cable?

- A. Band-pass filter
- B. Low-pass filter
- C. Preamplifier
- D. Ferrite choke

T7B04

Which of the following could you use to cure distorted audio caused by RF current on the shield of a microphone cable?

D. Ferrite choke

T7B05

How can fundamental overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

- A. Block the amateur signal with a filter at the antenna input of the affected receiver
- B. Block the interfering signal with a filter on the amateur transmitter
- C. Switch the transmitter from FM to SSB
- D. Switch the transmitter to a narrow-band mode

T7B05

How can fundamental overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

A. Block the amateur signal with a filter at the antenna input of the affected receiver

T7B06

Which of the following actions should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

- A. Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel
- B. Immediately turn off your transmitter and contact the nearest FCC office for assistance
- C. Install a harmonic doubler on the output of your transmitter and tune it until the interference is eliminated
- D. All these choices are correct

T7B06

Which of the following actions should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

- A. Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel

T7B07

Which of the following can reduce overload of a VHF transceiver by a nearby commercial FM station?

- A. Installing an RF preamplifier
- B. Using double-shielded coaxial cable
- C. Installing bypass capacitors on the microphone cable
- D. Installing a band-reject filter

T7B07

Which of the following can reduce overload of a VHF transceiver by a nearby commercial FM station?

D. Installing a band-reject filter

T7B08

What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

- A. Work with your neighbor to identify the offending device
- B. Politely inform your neighbor that FCC rules prohibit the use of devices that cause interference
- C. Make sure your station meets the standards of good amateur practice
- D. All these choices are correct

T7B08

What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

D. All these choices are correct

T7B09

What should be the first step to resolve non-fiber optic cable TV interference caused by your amateur radio transmission?

- A. Add a low-pass filter to the TV antenna input
- B. Add a high-pass filter to the TV antenna input
- C. Add a preamplifier to the TV antenna input
- D. Be sure all TV feed line coaxial connectors are installed properly

T7B09

What should be the first step to resolve non-fiber optic cable TV interference caused by your amateur radio transmission?

D. Be sure all TV feed line coaxial connectors are installed properly

T7B10

What might be a problem if you receive a report that your audio signal through an FM repeater is distorted or unintelligible?

- A. Your transmitter is slightly off frequency
- B. Your batteries are running low
- C. You are in a bad location
- D. All these choices are correct

T7B10

What might be a problem if you receive a report that your audio signal through an FM repeater is distorted or unintelligible?

D. All these choices are correct

T7B11

What is a symptom of RF feedback in a transmitter or transceiver?

- A. Excessive SWR at the antenna connection
- B. The transmitter will not stay on the desired frequency
- C. Reports of garbled, distorted, or unintelligible voice transmissions
- D. Frequent blowing of power supply fuses

T7B11

What is a symptom of RF feedback in a transmitter or transceiver?

C. Reports of garbled, distorted, or unintelligible voice transmissions

T7C – Antenna and transmission line measurements and troubleshooting: measuring SWR, effects of high SWR, causes of feed line failures; Basic coaxial cable characteristics; Use of dummy loads when testing

Points of Discussion

To avoid interfering with other stations while you're adjusting your transmitter or measuring its output power, it's a good idea to use a 'dummy load.' A dummy load is a heavy-duty resistor that can absorb and dissipate the output power from a transmitter.

An antenna analyzer contains a very low-power signal source with an adjustable frequency and one or more meters to show the impedance and SWR. It is used to measure an antenna system without using a transmitter whose signal might cause interference.

To avoid interfering with other stations while you're adjusting your transmitter or measuring its output power, it's a good idea to use a 'dummy load.' A dummy load is a heavy-duty resistor that can absorb and dissipate the output power from a transmitter.

SWR (standing wave ratio) is equal to the ratio of antenna-to-feed line or feed-line to antenna impedances, whichever ratio is greater than 1. When there is no reflected power there is no interference pattern and the SWR is 1:1. This condition is called a perfect match.

Points of Discussion

Most amateur transmitting equipment is designed to work at full power with an SWR of 2:1 or lower. SWR greater than 2:1 may cause the transmitter's protection circuits to reduce power automatically to avoid damage to the output transistors.

As more power is reflected, SWR increases. SWR is always greater than or equal to 1:1. SWR greater than 1:1 is called an impedance mismatch or just mismatch.

Feed lines used at radio frequencies use special materials and construction methods to minimize power being dissipated as heat by feed line loss and to avoid signals leaking in or out.

Instead of SWR meters, many amateurs prefer a wattmeter and better yet, a directional wattmeter.

The performance of coaxial cable depends on the integrity of its outer jacket. Nicks, cuts, and scrapes can all breach the jacket allowing moisture contamination, the most common cause of coaxial cable failure.

Points of Discussion

Prolonged exposure to ultraviolet (UV) in sunlight will also cause the plastic in the outer jacket to degrade, causing small cracks that allow water into the cable.

If you use low-loss air-core or “open-cell foam” coax, special techniques are required to prevent water absorption by this cable.

Questions?

T7C01

What is the primary purpose of a dummy load?

- A. To prevent transmitting signals over the air when making tests
- B. To prevent over-modulation of a transmitter
- C. To improve the efficiency of an antenna
- D. To improve the signal-to-noise ratio of a receiver

T7C01

What is the primary purpose of a dummy load?

A. To prevent transmitting signals over the air when making tests

T7C02

Which of the following is used to determine if an antenna is resonant at the desired operating frequency?

- A. A VTVM
- B. An antenna analyzer
- C. A Q meter
- D. A frequency counter

T7C02

Which of the following is used to determine if an antenna is resonant at the desired operating frequency?

B. An antenna analyzer

T7C03

What does a dummy load consist of?

- A. A high-gain amplifier and a TR switch
- B. A non-inductive resistor mounted on a heat sink
- C. A low-voltage power supply and a DC relay
- D. A 50-ohm reactance used to terminate a transmission line

T7C03

What does a dummy load consist of?

B. A non-inductive resistor mounted on a heat sink

T7C04

What reading on an SWR meter indicates a perfect impedance match between the antenna and the feed line?

- A. 50:50
- B. Zero
- C. 1:1
- D. Full Scale

T7C04

What reading on an SWR meter indicates a perfect impedance match between the antenna and the feed line?

C. 1:1

T7C05

Why do most solid-state transmitters reduce output power as SWR increases beyond a certain level?

- A. To protect the output amplifier transistors
- B. To comply with FCC rules on spectral purity
- C. Because power supplies cannot supply enough current at high SWR
- D. To lower the SWR on the transmission line

T7C05

Why do most solid-state transmitters reduce output power as SWR increases beyond a certain level?

A. To protect the output amplifier transistors

T7C06

What does an SWR reading of 4:1 indicate?

- A. Loss of -4 dB
- B. Good impedance match
- C. Gain of +4 dB
- D. Impedance mismatch

T7C06

What does an SWR reading of 4:1 indicate?

D. Impedance mismatch

T7C07

What happens to power lost in a feed line?

- A. It increases the SWR
- B. It is radiated as harmonics
- C. It is converted into heat
- D. It distorts the signal

T7C07

What happens to power lost in a feed line?

C. It is converted into heat

T7C08

Which instrument can be used to determine SWR?

- A. Voltmeter
- B. Ohmmeter
- C. Iambic pentameter
- D. Directional wattmeter

T7C08

Which instrument can be used to determine SWR?

D. Directional wattmeter

T7C09

Which of the following causes failure of coaxial cables?

- A. Moisture contamination
- B. Solder flux contamination
- C. Rapid fluctuation in transmitter output power
- D. Operation at 100% duty cycle for an extended period

T7C09

Which of the following causes failure of coaxial cables?

A. Moisture contamination

T7C10

Why should the outer jacket of coaxial cable be resistant to ultraviolet light?

- A. Ultraviolet resistant jackets prevent harmonic radiation
- B. Ultraviolet light can increase losses in the cable's jacket
- C. Ultraviolet and RF signals can mix, causing interference
- D. Ultraviolet light can damage the jacket and allow water to enter the cable

T7C10

Why should the outer jacket of coaxial cable be resistant to ultraviolet light?

D. Ultraviolet light can damage the jacket and allow water to enter the cable

T7C11

What is a disadvantage of air core coaxial cable when compared to foam or solid dielectric types?

- A. It has more loss per foot
- B. It cannot be used for VHF or UHF antennas
- C. It requires special techniques to prevent moisture in the cable
- D. It cannot be used at below freezing temperatures

T7C11

What is a disadvantage of air core coaxial cable when compared to foam or solid dielectric types?

C. It requires special techniques to prevent moisture in the cable

T7D – Using basic test instruments: voltmeter, ammeter, and ohmmeter; Soldering

Points of Discussion

Voltage is measured in units of volts, which are abbreviated as V. (Sometimes V or v is used in equations as a symbol for voltage, as well.) Voltage is measured with a voltmeter.

Volt meters are connected in parallel with, or “across,” a component or circuit to measure voltage.

Ammeters and multimeters configured to measure current are connected in series with a component or circuit.

Current is always measured as the flow through something, such as a wire or electronic component. An ammeter is used to measure current.

[question removed from the pool]

It is important to use the meter properly and safely. Trying to measure voltage or connecting the probes to an energized circuit when the meter is set to measure resistance is a common way to damage a multimeter.

Points of Discussion

The basic electrical test instruments are simple meters: voltmeters, ammeters, and ohmmeters. So that a separate meter isn't needed for each parameter, the multimeter was invented -- short for "multifunction meter." It measures all three electrical values of voltage, current, and resistance.

When soldering on radio and electronics use rosin-core solder and not acid-core solder.

A cold tin-lead solder joint has a rough or lumpy surface.

If you are measuring the resistance of a circuit and the reading starts out low, but gradually increases, that indicates the presence of a large-value discharged capacitor.

It is important to use the meter properly and safely. Trying to measure voltage or connecting the probes to an energized circuit when the meter is set to measure resistance is a common way to damage a multimeter.

Questions?

T7D01

Which instrument would you use to measure electric potential?

- A. An ammeter
- B. A voltmeter
- C. A wavemeter
- D. An ohmmeter

T7D01

Which instrument would you use to measure electric potential?

B. A voltmeter

T7D02

How is a voltmeter connected to a component to measure applied voltage?

- A. In series
- B. In parallel
- C. In quadrature
- D. In phase

T7D02

How is a voltmeter connected to a component to measure applied voltage?

B. In parallel

T7D03

When configured to measure current, how is a multimeter connected to a component?

- A. In series
- B. In parallel
- C. In quadrature
- D. In phase

T7D03

When configured to measure current, how is a multimeter connected to a component?

A. In series

T7D04

Which instrument is used to measure electric current?

- A. An ohmmeter
- B. An electrometer
- C. A voltmeter
- D. An ammeter

T7D04

Which instrument is used to measure electric current?

D. An ammeter

T7D05

How is an ohmmeter connected to a component to measure its resistance?

- A. In parallel
- B. In series
- C. In cascade
- D. All these choices are correct

T7D05

How is an ohmmeter connected to a component to measure its resistance?

A. In parallel

T7D06

Which of the following can damage a multimeter?

- A. Attempting to measure resistance using the voltage setting
- B. Failing to connect one of the probes to ground
- C. Attempting to measure voltage when using the resistance setting
- D. Not allowing it to warm up properly

T7D06

Which of the following can damage a multimeter?

C. Attempting to measure voltage when using the resistance setting

T7D07

Which of the following measurements are made using a multimeter?

- A. Signal strength and noise
- B. Impedance and reactance
- C. Voltage and resistance
- D. All these choices are correct

T7D07

Which of the following measurements are made using a multimeter?

C. Voltage and resistance

T7D08

Which of the following types of solder should not be used for radio and electronic applications?

- A. Acid-core solder
- B. Lead-tin solder
- C. Rosin-core solder
- D. Tin-copper solder

T7D08

Which of the following types of solder should not be used for radio and electronic applications?

A. Acid-core solder

T7D09

What is the characteristic appearance of a cold tin-lead solder joint?

- A. Dark black spots
- B. A bright or shiny surface
- C. A rough or lumpy surface
- D. Excessive solder

T7D09

What is the characteristic appearance of a cold tin-lead solder joint?

C. A rough or lumpy surface

T7D10

What reading indicates that an ohmmeter is connected across a large, discharged capacitor?

- A. Increasing resistance with time
- B. Decreasing resistance with time
- C. Steady full-scale reading
- D. Alternating between open and short circuit

T7D10

What reading indicates that an ohmmeter is connected across a large, discharged capacitor?

A. Increasing resistance with time

T7D11

Which of the following precautions should be taken when measuring in-circuit resistance with an ohmmeter?

- A. Ensure that the applied voltages are correct
- B. Ensure that the circuit is not powered
- C. Ensure that the circuit is grounded
- D. Ensure that the circuit is operating at the correct frequency

T7D11

Which of the following precautions should be taken when measuring in-circuit resistance with an ohmmeter?

B. Ensure that the circuit is not powered

SUBELEMENT T8

SIGNALS AND EMISSIONS

[4 Exam Questions - 4 Groups]

T8A – Basic characteristics of FM and SSB; Bandwidth of various modulation modes: CW, SSB, FM, fast-scan TV; Choice of emission type: selection of USB vs LSB, use of SSB for weak signal work, use of FM for VHF packet and repeaters

Points of Discussion

In an amplitude modulated (or AM) signal the carrier doesn't carry any information. In addition, each sideband contains a copy of the modulating signal. Only one sideband is needed to transmit the information and that's just what single-sideband or SSB signals are: an AM signal with the carrier and one sideband removed or suppressed.

FM (or frequency modulation) is also commonly used for packet radio on VHF and UHF.

Because the SSB signal's power is concentrated into a narrow bandwidth, it is possible to communicate with SSB over much longer ranges and in poorer conditions than with FM or AM, particularly on the VHF and UHF bands.

Because of frequency modulation's (or FM) excellent noise-rejection qualities, it is mode used by most VHF and UHF repeaters.

A CW signal has the narrowest bandwidth.

Points of Discussion

Although upper sideband (USB) and lower sideband (LSB) signals perform identically, ham radio has standardized on the following conventions: below 10 MHz LSB is used, above 10MHz, USB is used (and this includes all of the VHF and UHF bands).

Because the SSB signal's power is concentrated into a narrow bandwidth, it is possible to communicate with SSB over much longer ranges and in poorer conditions than with FM or AM, particularly on the VHF and UHF bands.

A SSB voice signal has a bandwidth of 3 kHz.

A VHF repeater FM voice signal has a bandwidth of between 10 and 15 kHz.

An AM fast-scan TV transmission has a bandwidth of 6 MHz

A CW signal has a bandwidth of 150 Hz.

Because of the way FM receivers work, only one signal can be received at a time. This is called the capture effect and if multiple signals are present, only the strongest will be heard in the receiver.

Questions?

T8A01

Which of the following is a form of amplitude modulation?

- A. Spread spectrum
- B. Packet radio
- C. Single sideband
- D. Phase shift keying (PSK)

T8A01

Which of the following is a form of amplitude modulation?

C. Single sideband

T8A02

What type of modulation is commonly used for VHF packet radio transmissions?

- A. FM or PM
- B. SSB
- C. AM
- D. PSK

T8A02

What type of modulation is commonly used for VHF packet radio transmissions?

A. FM or PM

T8A03

Which type of voice mode is often used for long-distance (weak signal) contacts on the VHF and UHF bands?

- A. FM
- B. DRM
- C. SSB
- D. PM

T8A03

Which type of voice mode is often used for long-distance (weak signal) contacts on the VHF and UHF bands?

C. SSB

T8A04

Which type of modulation is commonly used for VHF and UHF voice repeaters?

- A. AM
- B. SSB
- C. PSK
- D. FM or PM

T8A04

Which type of modulation is commonly used for VHF and UHF voice repeaters?

D. FM or PM

T8A05

Which of the following types of signal has the narrowest bandwidth?

- A. FM voice
- B. SSB voice
- C. CW
- D. Slow-scan TV

T8A05

Which of the following types of signal has the narrowest bandwidth?

C. CW

T8A06

Which sideband is normally used for 10 meter HF, VHF, and UHF single-sideband communications?

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

T8A06

Which sideband is normally used for 10 meter HF, VHF, and UHF single-sideband communications?

A. Upper sideband

T8A07

What is a characteristic of single sideband (SSB) compared to FM?

- A. SSB signals are easier to tune in correctly
- B. SSB signals are less susceptible to interference
- C. SSB signals have narrower bandwidth
- D. All these choices are correct

T8A07

What is a characteristic of single sideband (SSB) compared to FM?

C. SSB signals have narrower bandwidth

T8A08

What is the approximate bandwidth of a typical single sideband (SSB) voice signal?

- A. 1 kHz
- B. 3 kHz
- C. 6 kHz
- D. 15 kHz

T8A08

What is the approximate bandwidth of a typical single sideband (SSB) voice signal?

B. 3 kHz

T8A09

What is the approximate bandwidth of a VHF repeater FM voice signal?

- A. Less than 500 Hz
- B. About 150 kHz
- C. Between 10 and 15 kHz
- D. Between 50 and 125 kHz

T8A09

What is the approximate bandwidth of a VHF repeater FM voice signal?

C. Between 10 and 15 kHz

T8A10

What is the approximate bandwidth of AM fast-scan TV transmissions?

- A. More than 10 MHz
- B. About 6 MHz
- C. About 3 MHz
- D. About 1 MHz

T8A10

What is the approximate bandwidth of AM fast-scan TV transmissions?

B. About 6 MHz

T8A11

What is the approximate bandwidth required to transmit a CW signal?

- A. 2.4 kHz
- B. 150 Hz
- C. 1000 Hz
- D. 15 kHz

T8A11

What is the approximate bandwidth required to transmit a CW signal?

B. 150 Hz

T8A12

Which of the following is a disadvantage of FM compared with single sideband?

- A. Voice quality is poorer
- B. Only one signal can be received at a time
- C. FM signals are harder to tune
- D. All these choices are correct

T8A12

Which of the following is a disadvantage of FM compared with single sideband?

B. Only one signal can be received at a time

T8B - Amateur satellite operation: Doppler shift, basic orbits, operating protocols, modulation mode selection, transmitter power considerations, telemetry and telecommand, satellite tracking programs, beacons, uplink and downlink mode definitions, spin fading, definition of "LEO", setting uplink power

Points of Discussion

The telemetry data from the satellite contains information on the health and status of the satellite.

Always use the minimum amount of transmitter power to contact satellites, since their relay transmitter power is limited by their solar panels and batteries.

Using those values, the software can provide real-time maps of the satellite's location

Satellites can use any amateur mode. The most common are SSB, FM, CW, and data.

Beacon: A signal from the satellite containing information about a satellite.

To find out when a satellite will make a pass above the horizon at your location and can be accessed, you'll need a satellite tracking program. The tracking program will need you to enter certain bits of data about the satellite's orbit called the Keplerian elements.

Points of Discussion

Doppler Shift: An observed change in a signal frequency caused by relative motion between the satellite and the Earth station.

Mode is specified as two letters separated by a slash. The first letter indicates the uplink band and the second letter indicates the downlink band. For example, the uplink for a satellite in U/V mode is in the UHF band (70 cm) and a downlink is in the VHF band (2 meters).

Spin fading: Signal fading caused by rotation of the satellite and its antenna.

LEO: A satellite in low-Earth orbit.

Even if you don't have an amateur license, you can still tune in to the stream of telemetry data from a space station. Anyone can receive satellite telemetry!

If your signal on the satellite downlink is about the same strength as that of the satellite's beacon, you're using the right amount of power.

Questions?

T8B01

What telemetry information is typically transmitted by satellite beacons?

- A. The signal strength of received signals
- B. Time of day accurate to plus or minus 1/10 second
- C. Health and status of the satellite
- D. All these choices are correct

T8B01

What telemetry information is typically transmitted by satellite beacons?

C. Health and status of the satellite

T8B02

What is the impact of using excessive effective radiated power on a satellite uplink?

- A. Possibility of commanding the satellite to an improper mode
- B. Blocking access by other users
- C. Overloading the satellite batteries
- D. Possibility of rebooting the satellite control computer

T8B02

What is the impact of using excessive effective radiated power on a satellite uplink?

B. Blocking access by other users

T8B03

Which of the following are provided by satellite tracking programs?

- A. Maps showing the real-time position of the satellite track over Earth
- B. The time, azimuth, and elevation of the start, maximum altitude, and end of a pass
- C. The apparent frequency of the satellite transmission, including effects of Doppler shift
- D. All these choices are correct

T8B03

Which of the following are provided by satellite tracking programs?

D. All these choices are correct

T8B04

What mode of transmission is commonly used by amateur radio satellites?

- A. SSB
- B. FM
- C. CW/data
- D. All these choices are correct

T8B04

What mode of transmission is commonly used by amateur radio satellites?

D. All these choices are correct

T8B05

What is a satellite beacon?

- A. The primary transmit antenna on the satellite
- B. An indicator light that shows where to point your antenna
- C. A reflective surface on the satellite
- D. A transmission from a satellite that contains status information

T8B05

What is a satellite beacon?

D. A transmission from a satellite that contains status information

T8B06

Which of the following are inputs to a satellite tracking program?

- A. The satellite transmitted power
- B. The Keplerian elements
- C. The last observed time of zero Doppler shift
- D. All these choices are correct

T8B06

Which of the following are inputs to a satellite tracking program?

B. The Keplerian elements

T8B07

What is Doppler shift in reference to satellite communications?

- A. A change in the satellite orbit
- B. A mode where the satellite receives signals on one band and transmits on another
- C. An observed change in signal frequency caused by relative motion between the satellite and Earth station
- D. A special digital communications mode for some satellites

T8B07

What is Doppler shift in reference to satellite communications?

C. An observed change in signal frequency caused by relative motion between the satellite and Earth station

T8B08

What is meant by the statement that a satellite is operating in U/V mode?

- A. The satellite uplink is in the 15 meter band and the downlink is in the 10 meter band
- B. The satellite uplink is in the 70 centimeter band and the downlink is in the 2 meter band
- C. The satellite operates using ultraviolet frequencies
- D. The satellite frequencies are usually variable

T8B08

What is meant by the statement that a satellite is operating in U/V mode?

B. The satellite uplink is in the 70 centimeter band and the downlink is in the 2 meter band

T8B09

What causes spin fading of satellite signals?

- A. Circular polarized noise interference radiated from the sun
- B. Rotation of the satellite and its antennas
- C. Doppler shift of the received signal
- D. Interfering signals within the satellite uplink band

T8B09

What causes spin fading of satellite signals?

B. Rotation of the satellite and its antennas

T8B10

What is a LEO satellite?

- A. A sun synchronous satellite
- B. A highly elliptical orbit satellite
- C. A satellite in low energy operation mode
- D. A satellite in low earth orbit

T8B10

What is a LEO satellite?

D. A satellite in low earth orbit

T8B11

Who may receive telemetry from a space station?

- A. Anyone
- B. A licensed radio amateur with a transmitter equipped for interrogating the satellite
- C. A licensed radio amateur who has been certified by the protocol developer
- D. A licensed radio amateur who has registered for an access code from AMSAT

T8B11

Who may receive telemetry from a space station?

A. Anyone

T8B12

Which of the following is a way to determine whether your satellite uplink power is neither too low nor too high?

- A. Check your signal strength report in the telemetry data
- B. Listen for distortion on your downlink signal
- C. Your signal strength on the downlink should be about the same as the beacon
- D. All these choices are correct

T8B12

Which of the following is a way to determine whether your satellite uplink power is neither too low nor too high?

C. Your signal strength on the downlink should be about the same as the beacon

T8C – Operating activities: radio direction finding, contests, linking over the internet, exchanging grid locators

Points of Discussion

A different and more physical type of contest is known as foxhunting. Locating a hidden transmitter (the fox) has been a popular ham activity for many years. It has a practical side, too, training hams to find downed aircraft, lost hikers, and sources of interference or jamming.

For a foxhunt, you can get started with a portable radio with a signal strength indicator and a handheld or portable directional antenna, such as a small Yagi beam.

If you like competitive activities, radio contests are held in which the competitors try to make as many short contacts as possible in a fixed period of time.

To keep things moving during a contest, send only the minimum information needed to identify your station and complete the exchange.

The Maidenhead Locator System divides the Earth's surface into a system of rectangles based on latitude and longitude. Each rectangle is identified with a combination of letters and numbers.

Points of Discussion

To initiate a contact via IRLP or EchoLink, the initiating station must know the repeater control code to request an IRLP connection. The code is a sequence of DTMF (Dual-tone Multi-Frequency) tones, like dialing a phone number.

VoIP allows voice communications to be transferred over the internet.

The two oldest digitally-linked systems are IRLP and EchoLink. Both use VoIP (Voice over Internet Protocol) technology to link repeaters.

The EchoLink system uses VoIP to enable amateur stations to transmit through an internet-connected repeater without using a radio to initiate the transmission.

EchoLink allows audio to come from a PC and microphone, so a radio is not necessary but hams are required to register their call sign and provide proof of license to the EchoLink system administrators to be authorized to use the system.

A gateway is a special kind of digital station that provides a connection to the internet via Amateur Radio.

Questions?

T8C01

Which of the following methods is used to locate sources of noise interference or jamming?

- A. Echolocation
- B. Doppler radar
- C. Radio direction finding
- D. Phase locking

T8C01

Which of the following methods is used to locate sources of noise interference or jamming?

C. Radio direction finding

T8C02

Which of these items would be useful for a hidden transmitter hunt?

- A. Calibrated SWR meter
- B. A directional antenna
- C. A calibrated noise bridge
- D. All these choices are correct

T8C02

Which of these items would be useful for a hidden transmitter hunt?

B. A directional antenna

T8C03

What operating activity involves contacting as many stations as possible during a specified period?

- A. Simulated emergency exercises
- B. Net operations
- C. Public service events
- D. Contesting

T8C03

What operating activity involves contacting as many stations as possible during a specified period?

D. Contesting

T8C04

Which of the following is good procedure when contacting another station in a contest?

- A. Sign only the last two letters of your call if there are many other stations calling
- B. Contact the station twice to be sure that you are in his log
- C. Send only the minimum information needed for proper identification and the contest exchange
- D. All these choices are correct

T8C04

Which of the following is good procedure when contacting another station in a contest?

- C. Send only the minimum information needed for proper identification and the contest exchange**

T8C05

What is a grid locator?

- A. A letter-number designator assigned to a geographic location
- B. A letter-number designator assigned to an azimuth and elevation
- C. An instrument for neutralizing a final amplifier
- D. An instrument for radio direction finding

T8C05

What is a grid locator?

A. A letter-number designator assigned to a geographic location

T8C06

How is over the air access to IRLP nodes accomplished?

- A. By obtaining a password that is sent via voice to the node
- B. By using DTMF signals
- C. By entering the proper internet password
- D. By using CTCSS tone codes

T8C06

How is over the air access to IRLP nodes accomplished?

B. By using DTMF signals

T8C07

What is Voice Over Internet Protocol (VoIP)?

- A. A set of rules specifying how to identify your station when linked over the internet to another station
- B. A technique employed to “spot” DX stations via the internet
- C. A technique for measuring the modulation quality of a transmitter using remote sites monitored via the internet
- D. A method of delivering voice communications over the internet using digital techniques

T8C07

What is Voice Over Internet Protocol (VoIP)?

D. A method of delivering voice communications over the internet using digital techniques

T8C08

What is the Internet Radio Linking Project (IRLP)?

- A. A technique to connect amateur radio systems, such as repeaters, via the internet using Voice Over Internet Protocol (VoIP)
- B. A system for providing access to websites via amateur radio
- C. A system for informing amateurs in real time of the frequency of active DX stations
- D. A technique for measuring signal strength of an amateur transmitter via the internet

T8C08

What is the Internet Radio Linking Project (IRLP)?

A. A technique to connect amateur radio systems, such as repeaters, via the internet using Voice Over Internet Protocol (VoIP)

T8C09

Which of the following protocols enables an amateur station to transmit through a repeater without using a radio to initiate the transmission?

- A. IRLP
- B. D-STAR
- C. DMR
- D. EchoLink

T8C09

Which of the following protocols enables an amateur station to transmit through a repeater without using a radio to initiate the transmission?

D. EchoLink

T8C10

What is required before using the EchoLink system?

- A. Complete the required EchoLink training
- B. Purchase a license to use the EchoLink software
- C. Register your call sign and provide proof of license
- D. All these choices are correct

T8C10

What is required before using the EchoLink system?

C. Register your call sign and provide proof of license

T8C11

What is an amateur radio station that connects other amateur stations to the internet?

- A. A gateway
- B. A repeater
- C. A digipeater
- D. A beacon

T8C11

What is an amateur radio station that connects other amateur stations to the internet?

A. A gateway

T8D – Non-voice and digital communications: image signals and definition of NTSC, CW, packet radio, PSK, APRS, error detection and correction, amateur radio networking, Digital Mobile Radio, WSJT modes, Broadband-Hamnet

Points of Discussion

Popular HF digital modes include: Radioteletype (RTTY) using the 5-bit Baudot code, Keyboard-to-keyboard modes such as PSK31, Weak-signal modes such as FT8 or WSPR, PACTOR or WINMOR modes for Winlink system messaging. Popular VHF/UHF digital modes include: Packet radio based on the AX.25 protocol, B2F protocol for Winlink system messaging, JT65 for moonbounce and MSK144 for scatter paths, IEEE 802.11 (WiFi) adapted to amateur use on microwave bands.

Talk groups allow groups of users to share a channel at different times without being heard by other users on the channel.

An APRS station is basically a packet radio station combined with a Global Positioning System (GPS) receiver, and as such can transmit GPS position data. The GPS receiver outputs a stream of position data that is then retransmitted in packet form. Along with position information, you can also transmit weather information and short text messages.

NTSC (National Television System Committee) fast-scan color television signals are the same as analog broadcast TV signals.

Points of Discussion

A common public service application of APRS is to provide maps of station locations while they are providing realtime tactical communications.

The most popular keyboard-to-keyboard mode today is PSK31, which stands for phase shift keying, 31 baud.

The DMR (Digital Mobile Radio) system was developed for the Land Mobile Radio service. Over the air, DMR is a technique for time-multiplexing two digital voice signals on a single 12.5 kHz repeater channel.

Each packet consists of a header, data, and checksum. The header contains information about the packet and the call sign of the destination station. Following the data, there is a checksum that allows the receiver to detect errors. If an error is detected, the receiver automatically request the packet be retransmitted until the data is received properly. This is called ARQ for automatic repeat request.

Points of Discussion

The simplest radio signal with a strength and frequency that never change is called a 'continuous wave,' abbreviated CW. The simplest type of modulation is a continuous wave turned on and off in a coded pattern, such as Morse Code. In fact, Morse Code radio signals are called CW for that reason.

The WSJT Suite is a package of open-source software that was initially developed by Joe Taylor, K1JT, using techniques he developed as part of his Nobel-winning career as an astrophysicist. A team maintains and extends the software today, including modes designed for special types of communication such as JT65 for moonbounces (or Earth-Moon-Earth / EME), weak-signal propagation beacons (WSPR), and meteor scatter (MSK144)

Questions?

T8D01

Which of the following is a digital communications mode?

- A. Packet radio
- B. IEEE 802.11
- C. FT8
- D. All these choices are correct

T8D01

Which of the following is a digital communications mode?

D. All these choices are correct

T8D02

What is a “talkgroup” on a digital repeater?

- A. A group of operators sharing common interests
- B. A way for groups of users to share a channel at different times without hearing other users on the channel
- C. A protocol that increases the signal-to-noise ratio when multiple repeaters are linked together
- D. A net that meets at a specified time

T8D02

What is a “talkgroup” on a digital repeater?

- B. A way for groups of users to share a channel at different times without hearing other users on the channel

T8D03

What kind of data can be transmitted by APRS?

- A. GPS position data
- B. Text messages
- C. Weather data
- D. All these choices are correct

T8D03

What kind of data can be transmitted by APRS?

D. All these choices are correct

T8D04

What type of transmission is indicated by the term "NTSC?"

- A. A Normal Transmission mode in Static Circuit
- B. A special mode for satellite uplink
- C. An analog fast-scan color TV signal
- D. A frame compression scheme for TV signals

T8D04

What type of transmission is indicated by the term "NTSC?"

C. An analog fast-scan color TV signal

T8D05

Which of the following is an application of APRS?

- A. Providing real-time tactical digital communications in conjunction with a map showing the locations of stations
- B. Showing automatically the number of packets transmitted via PACTOR during a specific time interval
- C. Providing voice over internet connection between repeaters
- D. Providing information on the number of stations signed into a repeater

T8D05

Which of the following is an application of APRS?

- A. Providing real-time tactical digital communications in conjunction with a map showing the locations of stations

T8D06

What does the abbreviation "PSK" mean?

- A. Pulse Shift Keying
- B. Phase Shift Keying
- C. Packet Short Keying
- D. Phased Slide Keying

T8D06

What does the abbreviation "PSK" mean?

B. Phase Shift Keying

T8D07

Which of the following describes DMR?

- A. A technique for time-multiplexing two digital voice signals on a single 12.5 kHz repeater channel
- B. An automatic position tracking mode for FM mobiles communicating through repeaters
- C. An automatic computer logging technique for hands-off logging when communicating while operating a vehicle
- D. A digital technique for transmitting on two repeater inputs simultaneously for automatic error correction

T8D07

Which of the following describes DMR?

- A. A technique for time-multiplexing two digital voice signals on a single 12.5 kHz repeater channel

T8D08

Which of the following is included in packet radio transmissions?

- A. A check sum that permits error detection
- B. A header that contains the call sign of the station to which the information is being sent
- C. Automatic repeat request in case of error
- D. All these choices are correct

T8D08

Which of the following is included in packet radio transmissions?

D. All these choices are correct

T8D09

What is CW?

- A. A type of electromagnetic propagation
- B. A digital mode used primarily on 2 meter FM
- C. A technique for coil winding
- D. Another name for a Morse code transmission

T8D09

What is CW?

D. Another name for a Morse code transmission

T8D10

Which of the following operating activities is supported by digital mode software in the WSJT-X software suite?

- A. Earth-Moon-Earth
- B. Weak signal propagation beacons
- C. Meteor scatter
- D. All these choices are correct

T8D10

Which of the following operating activities is supported by digital mode software in the WSJT-X software suite?

D. All these choices are correct

T8D11

What is an ARQ transmission system?

- A. A special transmission format limited to video signals
- B. A system used to encrypt command signals to an amateur radio satellite
- C. An error correction method in which the receiving station detects errors and sends a request for retransmission
- D. A method of compressing data using autonomous reiterative Q codes prior to final encoding

T8D11

What is an ARQ transmission system?

C. An error correction method in which the receiving station detects errors and sends a request for retransmission

T8D12

Which of the following best describes an amateur radio mesh network?

- A. An amateur-radio based data network using commercial Wi-Fi equipment with modified firmware
- B. A wide-bandwidth digital voice mode employing DMR protocols
- C. A satellite communications network using modified commercial satellite TV hardware
- D. An internet linking protocol used to network repeaters

T8D12

Which of the following best describes an amateur radio mesh network?

- A. An amateur-radio based data network using commercial Wi-Fi equipment with modified firmware

T8D13

What is FT8?

- A. A wideband FM voice mode
- B. A digital mode capable of low signal-to-noise operation
- C. An eight channel multiplex mode for FM repeaters
- D. A digital slow-scan TV mode with forward error correction and automatic color compensation

T8D13

What is FT8?

B. A digital mode capable of low signal-to-noise operation

SUBELEMENT T9

ANTENNAS AND FEED LINES

[2 Exam Questions - 2 Groups]

T9A – Antennas: vertical and horizontal polarization, concept of antenna gain, definition and types of beam antennas, antenna loading, common portable and mobile antennas, relationships between resonant length and frequency, dipole pattern

Points of Discussion

In many situations, it is desired to focus transmitted power and get the best reception in one direction, so a directional beam antenna is used.

To reduce the physical size of the antenna, it is often constructed with some of the radiating conductor wound into a coil or with a separate inductor inserted in the antenna. This technique is called 'inductive loading' and it makes the antenna longer electronically than it is physically.

Dipole antennas are easy to make, easy to use, and work quite well in a variety of environments. Most are oriented horizontally, particularly on the lower frequency bands, and radiate a horizontally-polarized signal.

A “rubber duck” antenna is conveniently sized but doesn't transmit or receive as well as a full-sized ground-plane antenna.

Make the dipole a few percent longer at first (use 490 instead of 468), then use an SWR meter or antenna analyzer to determine the resonant frequency. Assuming the resonant frequency is too low because the dipole is too long, shorten it until the dipole is resonant at the desired frequency.

Points of Discussion

Compared to the theoretical isotropic antenna or practical omnidirectional antennas like the J-pole or 5/8-wavelength vertical, Yagi beam antennas have much more gain in their preferred direction.

A vehicle's metal roof and doors act like shields, trapping the radio waves inside. Some of the signal gets out through the windows (unless they are tinted with a thin metal coating), but it's as much as 10 to 20 times weaker than an external mobile antenna.

The length of a ground-plane antenna is half that of a dipole and is often estimated as having length (feet) = $234 / \text{frequency (MHz)}$. At 146 MHz, a 1/4-wavelength ground-plane antenna is $234 / 146 = 1.6$ feet (or 19 inches)

Length of a 1/2-wavelength antenna (feet) = $468 / \text{frequency (MHz)}$. At 50.1 MHz (in the 6 meter band), dipole length is calculated as $468 / 50.1 = 9.34$ feet (or 112 inches)

Points of Discussion

A dipole antenna radiates strongest broadside to the antenna and weakest off the ends. The radiation pattern for a dipole isolated in space looks like a donut with the antenna running through the donut hole.

Concentrating an antenna's radiated signals in a specific direction is called gain. Antenna gain increases signal strength in a specified direction when compared to a reference antenna.

The $5/8$ -wavelength ground-plane antenna offers some improvement over the $1/4$ -wavelength version. Due to its extended length, the $5/8$ -wavelength antenna focuses a bit more energy toward the horizon, improving range.

Questions?

T9A01

What is a beam antenna?

- A. An antenna built from aluminum I-beams
- B. An omnidirectional antenna invented by Clarence Beam
- C. An antenna that concentrates signals in one direction
- D. An antenna that reverses the phase of received signals

T9A01

What is a beam antenna?

C. An antenna that concentrates signals in one direction

T9A02

Which of the following describes a type of antenna loading?

- A. Electrically lengthening by inserting inductors in radiating elements
- B. Inserting a resistor in the radiating portion of the antenna to make it resonant
- C. Installing a spring in the base of a mobile vertical antenna to make it more flexible
- D. Strengthening the radiating elements of a beam antenna to better resist wind damage

T9A02

Which of the following describes a type of antenna loading?

A. Electrically lengthening by inserting inductors in radiating elements

T9A03

Which of the following describes a simple dipole oriented parallel to Earth's surface?

- A. A ground-wave antenna
- B. A horizontally polarized antenna
- C. A travelling-wave antenna
- D. A vertically polarized antenna

T9A03

Which of the following describes a simple dipole oriented parallel to Earth's surface?

B. A horizontally polarized antenna

T9A04

What is a disadvantage of the short, flexible antenna supplied with most handheld radio transceivers, compared to a full-sized quarter-wave antenna?

- A. It has low efficiency
- B. It transmits only circularly polarized signals
- C. It is mechanically fragile
- D. All these choices are correct

T9A04

What is a disadvantage of the short, flexible antenna supplied with most handheld radio transceivers, compared to a full-sized quarter-wave antenna?

A. It has low efficiency

T9A05

Which of the following increases the resonant frequency of a dipole antenna?

- A. Lengthening it
- B. Inserting coils in series with radiating wires
- C. Shortening it
- D. Adding capacitive loading to the ends of the radiating wires

T9A05

Which of the following increases the resonant frequency of a dipole antenna?

C. Shortening it

T9A06

Which of the following types of antenna offers the greatest gain?

- A. 5/8 wave vertical
- B. Isotropic
- C. J pole
- D. Yagi

T9A06

Which of the following types of antenna offers the greatest gain?

D. Yagi

T9A07

What is a disadvantage of using a handheld VHF transceiver with a flexible antenna inside a vehicle?

- A. Signal strength is reduced due to the shielding effect of the vehicle
- B. The bandwidth of the antenna will decrease, increasing SWR
- C. The SWR might decrease, decreasing the signal strength
- D. All these choices are correct

T9A07

What is a disadvantage of using a handheld VHF transceiver with a flexible antenna inside a vehicle?

A. Signal strength is reduced due to the shielding effect of the vehicle

T9A08

What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?

- A. 112
- B. 50
- C. 19
- D. 12

T9A08

What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?

C. 19

T9A09

What is the approximate length, in inches, of a half-wavelength 6 meter dipole antenna?

- A. 6
- B. 50
- C. 112
- D. 236

T9A09

What is the approximate length, in inches, of a half-wavelength 6 meter dipole antenna?

C. 112

T9A10

In which direction does a half-wave dipole antenna radiate the strongest signal?

- A. Equally in all directions
- B. Off the ends of the antenna
- C. In the direction of the feed line
- D. Broadside to the antenna

T9A10

In which direction does a half-wave dipole antenna radiate the strongest signal?

D. Broadside to the antenna

T9A11

What is antenna gain?

- A. The additional power that is added to the transmitter power
- B. The additional power that is required in the antenna when transmitting on a higher frequency
- C. The increase in signal strength in a specified direction compared to a reference antenna
- D. The increase in impedance on receive or transmit compared to a reference antenna

T9A11

What is antenna gain?

C. The increase in signal strength in a specified direction compared to a reference antenna

T9A12

What is an advantage of a $5/8$ wavelength whip antenna for VHF or UHF mobile service?

- A. It has more gain than a $1/4$ -wavelength antenna
- B. It radiates at a very high angle
- C. It eliminates distortion caused by reflected signals
- D. It has 10 times the power gain of a $1/4$ wavelength whip

T9A12

What is an advantage of a $5/8$ wavelength whip antenna for VHF or UHF mobile service?

A. It has more gain than a $1/4$ -wavelength antenna

T9B – Feed lines: types, attenuation vs frequency, selecting; SWR concepts; Antenna tuners (couplers); RF Connectors: selecting, weather protection

Points of Discussion

Low SWR indicates efficient transfer of power from the feed line because less power is reflected by the antenna. That means there is less loss from reflected power in the feed line traveling back and forth between the antenna and transmitter.

Most coaxial cable used in ham radio has a characteristic impedance of 50 ohms.

The most popular feed line used by amateurs to connect radios and antennas is coaxial cable or coax. It is easy to use and requires few special installation considerations.

An antenna tuner is adjusted until the SWR measured at the transmitter output is acceptably close to 1:1. This means the antenna system's impedance has been matched to that of the transmitter output.

Feed line loss increases with frequency for all types of feed lines.

Above 400 MHz, the type N connectors are used.

Points of Discussion

The UHF series of connectors -- PL-259 plugs and SO-239 receptacles -- are the most widely-used for HF equipment (UHF, in this case, does not stand for “ultra-high frequency”).

Coax connectors exposed to the weather must be carefully waterproofed. Water in coaxial cable degrades the effectiveness of the braided shield and dramatically increases losses.

What causes high SWR? Antennas that are much too short or too long for the frequency being used often have extreme feed point impedances, causing high SWR. A faulty feed line or feed line connectors can also raise SWR. Erratic SWR usually indicates a loose connection in the feed line or antenna.

Next to characteristic impedance, the most important characteristic of coax is feed line loss. Loss is specified in db per 100 feet of cable at a specified frequency. In general, RG-213 has less loss than RG-58.

Points of Discussion

A special type of coaxial feed line is called hardline because its shield is made from a semi-flexible solid tube of aluminum or copper. This limits the amount of bending the cable can do, but hardline has the lowest loss of any type of coaxial feed line.

Because SWR (standing wave ratio) is determined by the amounts of forward and reflected power, SWR in an antenna system is also a measure of how well the antenna (or load) and feed line impedances are matched.

Questions?

T9B01

What is a benefit of low SWR?

- A. Reduced television interference
- B. Reduced signal loss
- C. Less antenna wear
- D. All these choices are correct

T9B01

What is a benefit of low SWR?

B. Reduced signal loss

T9B02

What is the most common impedance of coaxial cables used in amateur radio?

- A. 8 ohms
- B. 50 ohms
- C. 600 ohms
- D. 12 ohms

T9B02

What is the most common impedance of coaxial cables used in amateur radio?

B. 50 ohms

T9B03

Why is coaxial cable the most common feed line for amateur radio antenna systems?

- A. It is easy to use and requires few special installation considerations
- B. It has less loss than any other type of feed line
- C. It can handle more power than any other type of feed line
- D. It is less expensive than any other type of feed line

T9B03

Why is coaxial cable the most common feed line for amateur radio antenna systems?

A. It is easy to use and requires few special installation considerations

T9B04

What is the major function of an antenna tuner (antenna coupler)?

- A. It matches the antenna system impedance to the transceiver's output impedance
- B. It helps a receiver automatically tune in weak stations
- C. It allows an antenna to be used on both transmit and receive
- D. It automatically selects the proper antenna for the frequency band being used

T9B04

What is the major function of an antenna tuner (antenna coupler)?

A. It matches the antenna system impedance to the transceiver's output impedance

T9B05

What happens as the frequency of a signal in coaxial cable is increased?

- A. The characteristic impedance decreases
- B. The loss decreases
- C. The characteristic impedance increases
- D. The loss increases

T9B05

What happens as the frequency of a signal in coaxial cable is increased?

D. The loss increases

T9B06

Which of the following RF connector types is most suitable for frequencies above 400 MHz?

- A. UHF (PL-259/SO-239)
- B. Type N
- C. RS-213
- D. DB-25

T9B06

Which of the following RF connector types is most suitable for frequencies above 400 MHz?

B. Type N

T9B07

Which of the following is true of PL-259 type coax connectors?

- A. They are preferred for microwave operation
- B. They are watertight
- C. They are commonly used at HF and VHF frequencies
- D. They are a bayonet-type connector

T9B07

Which of the following is true of PL-259 type coax connectors?

C. They are commonly used at HF and VHF frequencies

T9B08

Which of the following is a source of loss in coaxial feed line?

- A. Water intrusion into coaxial connectors
- B. High SWR
- C. Multiple connectors in the line
- D. All these choices are correct

T9B08

Which of the following is a source of loss in coaxial feed line?

D. All these choices are correct

T9B09

What can cause erratic changes in SWR?

- A. Local thunderstorm
- B. Loose connection in the antenna or feed line
- C. Over-modulation
- D. Overload from a strong local station

T9B09

What can cause erratic changes in SWR?

B. Loose connection in the antenna or feed line

T9B10

What is the electrical difference between RG-58 and RG-213 coaxial cable?

- A. There is no significant difference between the two types
- B. RG-58 cable has two shields
- C. RG-213 cable has less loss at a given frequency
- D. RG-58 cable can handle higher power levels

T9B10

What is the electrical difference between RG-58 and RG-213 coaxial cable?

C. RG-213 cable has less loss at a given frequency

T9B11

Which of the following types of feed line has the lowest loss at VHF and UHF?

- A. 50-ohm flexible coax
- B. Multi-conductor unbalanced cable
- C. Air-insulated hardline
- D. 75-ohm flexible coax

T9B11

Which of the following types of feed line has the lowest loss at VHF and UHF?

C. Air-insulated hardline

T9B12

What is standing wave ratio (SWR)?

- A. A measure of how well a load is matched to a transmission line
- B. The ratio of amplifier power output to input
- C. The transmitter efficiency ratio
- D. An indication of the quality of your station's ground connection

T9B12

What is standing wave ratio (SWR)?

A. A measure of how well a load is matched to a transmission line

SUBELEMENT TO

SAFETY

[3 Exam Questions - 3 Groups]

T0A – Power circuits and hazards: hazardous voltages, fuses and circuit breakers, grounding, electrical code compliance; Lightning protection; Battery safety

Points of Discussion

Storage batteries release a lot of energy if shorted, leading to burns, fire, or an explosion.

Electrical currents through the body can disrupt the electrical function of cells. Currents of more than a few milliamps can cause involuntary muscle contractions which leads to the jerking and jumping image on TV and in the movies. Muscle spasms can cause falls and sudden large movements. The sudden pulling back of an outstretched hand or finger that comes in contact with an energized conductor is a result of arm muscles contracting. Large currents can burn the skin and heat tissue.

Be sure to follow the US standard of hot (black, occasionally red) wire, neutral (white wire), and safety or equipment ground (green or bare wire).

When the metal of a fuse melts or “blows,” the current path is broken and power is removed from circuits supplied by the fuse.

Points of Discussion

When replacing a fuse or circuit breaker, use one with the same current rating to avoid creating a safety hazard. Using one with a higher current rating, even temporarily, could allow the fault to permanently damage the equipment or start a fire. Do not use a device with a higher current rating, even temporarily.

Most ham stations don't require new wiring and can operate with complete safety when powered from your home's ac wiring. That is, as long as you follow simple guidelines: use three-wire power cords and plugs for all ac-powered equipment, make sure all of your equipment has a connection to the ac safety ground, use fault circuit interrupter (GFCI) circuit breakers or circuit breaker outlets, and verify ac wiring is done properly by using an ac circuit tester.

Where cables and feed lines enter the house, use lightning arrestors grounded to a common plate that is in turn connected to a nearby external ground such as a ground rod.

If you build your own equipment and power it from 120 V or 240 V ac lines, be sure fuses or circuit breakers are installed in series with the hot conductor or conductors.

Points of Discussion

All ground rods and earth connections must be bonded together with heavy wire, as well

Storage batteries hold a lot of energy and must be treated with respect. They contain strong acids that can be hazardous if spilled or allowed to leak. Storage batteries can also release or vent flammable hydrogen gas, that can cause an explosion.

Capacitors in a power supply can store charge after a charging circuit is turned off, presenting a hazardous voltage for a long time. Make sure capacitors are discharge by testing them with a meter or use a grounding stick to shunt their charge to ground.

Voltages beyond the meter's rating can “flashover” to other pieces of equipment or to you, creating a serious shock hazard. Ensure that the voltmeter and the leads are rated for use at the voltages to be measured.

Questions?

T0A01

Which of the following is a safety hazard of a 12-volt storage battery?

- A. Touching both terminals with the hands can cause electrical shock
- B. Shorting the terminals can cause burns, fire, or an explosion
- C. RF emissions from a nearby transmitter can cause the electrolyte to emit poison gas
- D. All these choices are correct

T0A01

Which of the following is a safety hazard of a 12-volt storage battery?

B. Shorting the terminals can cause burns, fire, or an explosion

T0A02

What health hazard is presented by electrical current flowing through the body?

- A. It may cause injury by heating tissue
- B. It may disrupt the electrical functions of cells
- C. It may cause involuntary muscle contractions
- D. All these choices are correct

T0A02

What health hazard is presented by electrical current flowing through the body?

D. All these choices are correct

T0A03

In the United States, what circuit does black wire insulation indicate in a three-wire 120 V cable?

- A. Neutral
- B. Hot
- C. Equipment ground
- D. Black insulation is never used

T0A03

In the United States, what circuit does black wire insulation indicate in a three-wire 120 V cable?

B. Hot

T0A04

What is the purpose of a fuse in an electrical circuit?

- A. To prevent power supply ripple from damaging a component
- B. To remove power in case of overload
- C. To limit current to prevent shocks
- D. All these choices are correct

T0A04

What is the purpose of a fuse in an electrical circuit?

B. To remove power in case of overload

T0A05

Why should a 5-ampere fuse never be replaced with a 20-ampere fuse?

- A. The larger fuse would be likely to blow because it is rated for higher current
- B. The power supply ripple would greatly increase
- C. Excessive current could cause a fire
- D. All these choices are correct

T0A05

Why should a 5-ampere fuse never be replaced with a 20-ampere fuse?

C. Excessive current could cause a fire

T0A06

What is a good way to guard against electrical shock at your station?

- A. Use three-wire cords and plugs for all AC powered equipment
- B. Connect all AC powered station equipment to a common safety ground
- C. Install mechanical interlocks in high-voltage circuits
- D. All these choices are correct

T0A06

What is a good way to guard against electrical shock at your station?

D. All these choices are correct

T0A07

Where should a lightning arrester be installed in a coaxial feed line?

- A. At the output connector of a transceiver
- B. At the antenna feed point
- C. At the ac power service panel
- D. On a grounded panel near where feed lines enter the building

T0A07

Where should a lightning arrester be installed in a coaxial feed line?

D. On a grounded panel near where feed lines enter the building

T0A08

Where should a fuse or circuit breaker be installed in a 120V AC power circuit?

- A. In series with the hot conductor only
- B. In series with the hot and neutral conductors
- C. In parallel with the hot conductor only
- D. In parallel with the hot and neutral conductors

T0A08

Where should a fuse or circuit breaker be installed in a 120V AC power circuit?

A. In series with the hot conductor only

T0A09

What should be done to all external ground rods or earth connections?

- A. Waterproof them with silicone caulk or electrical tape
- B. Keep them as far apart as possible
- C. Bond them together with heavy wire or conductive strap
- D. Tune them for resonance on the lowest frequency of operation

T0A09

What should be done to all external ground rods or earth connections?

C. Bond them together with heavy wire or conductive strap

T0A10

What hazard is caused by charging or discharging a battery too quickly?

- A. Overheating or out-gassing
- B. Excess output ripple
- C. Half-wave rectification
- D. Inverse memory effect

T0A10

What hazard is caused by charging or discharging a battery too quickly?

A. Overheating or out-gassing

T0A11

What hazard exists in a power supply immediately after turning it off?

- A. Circulating currents in the dc filter
- B. Leakage flux in the power transformer
- C. Voltage transients from kickback diodes
- D. Charge stored in filter capacitors

T0A11

What hazard exists in a power supply immediately after turning it off?

D. Charge stored in filter capacitors

T0A12

Which of the following precautions should be taken when measuring high voltages with a voltmeter?

- A. Ensure that the voltmeter has very low impedance
- B. Ensure that the voltmeter and leads are rated for use at the voltages to be measured
- C. Ensure that the circuit is grounded through the voltmeter
- D. Ensure that the voltmeter is set to the correct frequency

T0A12

Which of the following precautions should be taken when measuring high voltages with a voltmeter?

B. Ensure that the voltmeter and leads are rated for use at the voltages to be measured

T0B – Antenna safety: tower safety and grounding, installing antennas, antenna supports

Points of Discussion

These connections are made at the tower base, or in the case of roof mounts, through a large-diameter wire to a ground rod. Ground connections should be as short and direct as possible -- avoid sharp bends.

If you are the climber be sure to get sufficient training on safe tower climbing techniques before beginning, use appropriate tie-off to the tower at all times, and always wear an approved climbing harness.

Having a ground crew is important; avoid climbing alone and don't forget the sunblock lotion.

Power lines are the enemy of antenna installers. Place all antennas and feed lines well clear of power lines, including the utility service drop to your home.

Guy wires must be installed according to the tower manufacturer's instructions. Place a safety wire through any turnbuckles used to tension guy lines. This prevents them from loosening due to vibration and twisting.

Points of Discussion

A good guideline is to separate the antenna from the nearest power line by 150% of total height of tower or mast plus antenna -- a minimum of 10 feet of clearance during a fall is a must.

Crank-up towers must be fully retracted or mechanical safety locking devices must have been installed. Never climb up a crank-up tower supported only by the cable that supports the sections.

Grounding rules for antennas and supports must be followed according to your local electrical code. Towers should be grounded with separate 8-foot long ground rods for each tower leg, bonded to the tower and each other.

Never attach an antenna or guy wire to a utility pole, since a mechanical failure could result in contact with high-voltage power lines.

These connections are made at the tower base, or in the case of roof mounts, through a large-diameter wire to a ground rod. Ground connections should be as short and direct as possible -- avoid sharp bends.

Points of Discussion

Starting at your antennas, all towers, masts, and antenna mounts should be grounded according to your local building and electrical codes.

Questions?

T0B01

Which of the following is good practice when installing ground wires on a tower for lightning protection?

- A. Put a drip loop in the ground connection to prevent water damage to the ground system
- B. Make sure all ground wire bends are right angles
- C. Ensure that connections are short and direct
- D. All these choices are correct

T0B01

Which of the following is good practice when installing ground wires on a tower for lightning protection?

C. Ensure that connections are short and direct

T0B02

What is required when climbing an antenna tower?

- A. Have sufficient training on safe tower climbing techniques
- B. Use appropriate tie-off to the tower at all times
- C. Always wear an approved climbing harness
- D. All these choices are correct

T0B02

What is required when climbing an antenna tower?

D. All these choices are correct

T0B03

Under what circumstances is it safe to climb a tower without a helper or observer?

- A. When no electrical work is being performed
- B. When no mechanical work is being performed
- C. When the work being done is not more than 20 feet above the ground
- D. Never

T0B03

Under what circumstances is it safe to climb a tower without a helper or observer?

D. Never

T0B04

Which of the following is an important safety precaution to observe when putting up an antenna tower?

- A. Wear a ground strap connected to your wrist at all times
- B. Insulate the base of the tower to avoid lightning strikes
- C. Look for and stay clear of any overhead electrical wires
- D. All these choices are correct

T0B04

Which of the following is an important safety precaution to observe when putting up an antenna tower?

C. Look for and stay clear of any overhead electrical wires

T0B05

What is the purpose of a safety wire through a turnbuckle used to tension guy lines?

- A. Secure the guy line if the turnbuckle breaks
- B. Prevent loosening of the turnbuckle from vibration
- C. Provide a ground path for lightning strikes
- D. Provide an ability to measure for proper tensioning

T0B05

What is the purpose of a safety wire through a turnbuckle used to tension guy lines?

B. Prevent loosening of the turnbuckle from vibration

T0B06

What is the minimum safe distance from a power line to allow when installing an antenna?

- A. Add the height of the antenna to the height of the power line and multiply by a factor of 1.5
- B. The height of the power line above ground
- C. 1/2 wavelength at the operating frequency
- D. Enough so that if the antenna falls, no part of it can come closer than 10 feet to the power wires

T0B06

What is the minimum safe distance from a power line to allow when installing an antenna?

- D. Enough so that if the antenna falls, no part of it can come closer than 10 feet to the power wires**

T0B07

Which of the following is an important safety rule to remember when using a crank-up tower?

- A. This type of tower must never be painted
- B. This type of tower must never be grounded
- C. This type of tower must not be climbed unless it is retracted, or mechanical safety locking devices have been installed
- D. All these choices are correct

T0B07

Which of the following is an important safety rule to remember when using a crank-up tower?

- C. This type of tower must not be climbed unless it is retracted, or mechanical safety locking devices have been installed**

T0B08

Which is a proper grounding method for a tower?

- A. A single four-foot ground rod, driven into the ground no more than 12 inches from the base
- B. A ferrite-core RF choke connected between the tower and ground
- C. A connection between the tower base and a cold water pipe
- D. Separate eight-foot ground rods for each tower leg, bonded to the tower and each other

T0B08

Which is a proper grounding method for a tower?

- D. Separate eight-foot ground rods for each tower leg, bonded to the tower and each other

T0B09

Why should you avoid attaching an antenna to a utility pole?

- A. The antenna will not work properly because of induced voltages
- B. The 60 Hz radiations from the feed line may increase the SWR
- C. The antenna could contact high-voltage power lines
- D. All these choices are correct

T0B09

Why should you avoid attaching an antenna to a utility pole?

C. The antenna could contact high-voltage power lines

T0B10

Which of the following is true when installing grounding conductors used for lightning protection?

- A. Use only non-insulated wire
- B. Wires must be carefully routed with precise right-angle bends
- C. Sharp bends must be avoided
- D. Common grounds must be avoided

T0B10

Which of the following is true when installing grounding conductors used for lightning protection?

C. Sharp bends must be avoided

T0B11

Which of the following establishes grounding requirements for an amateur radio tower or antenna?

- A. FCC Part 97 rules
- B. Local electrical codes
- C. FAA tower lighting regulations
- D. UL recommended practices

T0B11

Which of the following establishes grounding requirements for an amateur radio tower or antenna?

B. Local electrical codes

T0C - RF hazards: radiation exposure, proximity to antennas, recognized safe power levels, radiation types, duty cycle

Points of Discussion

With its relatively low frequency, RF energy is non-ionizing radiation.

When comparing Maximum Permissible Exposure (MPE) limits for amateur bands at 3.5, 50, 440, and 1296 MHz, you can see that MPE is lowest at 50 MHz and highest at 3.5 MHz

If, over a 6 minute period, there is a signal present for 3 minutes and absent for 3 minutes, the duty cycle is considered to be 50%. Because the signal is present for only $\frac{1}{2}$ the time, the signal power can be twice as high and still have the same average power as it would if transmitted continuously with a duty cycle of 100%

The Ham Radio License Manual web page lists resources that make the job of an exposure evaluation a lot easier, such as on-line exposure calculators and pre-calculated tables you can use for common antennas. You'll need information on the RF signal's frequency and power level, distance from the antenna and the antenna's radiation pattern.

Points of Discussion

Absorption (of RF energy due to exposure to RF fields) also varies with frequency because the body absorbs more RF energy at some frequencies than at others.

There are three ways to make an exposure evaluation. Of the three, the most common evaluation uses the techniques outlined in the FCC's OET (Office of Engineering Technology) Bulletin 65.

RF burns caused by touching or coming close to conducting surfaces with a high RF voltage present are also an effect of heating. While these are sometimes painful, they are rarely hazardous.

Locate antennas away from where people can get close to them and away from property lines. This always a good idea since touching an antenna energized with even low-power signals can result in an RF burn.

Once you've done an evaluation, you don't need to re-evaluate unless you change equipment in your station that affects average output power, such as increasing your transmitter power or antenna gain. You'll also need to re-evaluate if you add a new frequency band.

Points of Discussion

Since duty cycle affects the average power level of transmissions, as well as exposure to radiation, it must be considered when evaluating exposure.

Stated simply, duty cycle is the percentage of time a transmitter is transmitting.

RF radiation is not the same as ionizing radiation from radioactivity because the energy in signals at radio frequencies is far too low to cause an electron to leave an atom (ionize) and therefore cannot cause genetic damage.

The rules make the station licensee responsible for ensuring that no one is exposed to RF energy above the FCC exposure limits.

Questions?

T0C01

What type of radiation are radio signals?

- A. Gamma radiation
- B. Ionizing radiation
- C. Alpha radiation
- D. Non-ionizing radiation

TOC01

What type of radiation are radio signals?

D. Non-ionizing radiation

T0C02

At which of the following frequencies does maximum permissible exposure have the lowest value?

- A. 3.5 MHz
- B. 50 MHz
- C. 440 MHz
- D. 1296 MHz

T0C02

At which of the following frequencies does maximum permissible exposure have the lowest value?

B. 50 MHz

T0C03

How does the allowable power density for RF safety change if duty cycle changes from 100 percent to 50 percent?

- A. It increases by a factor of 3
- B. It decreases by 50 percent
- C. It increases by a factor of 2
- D. There is no adjustment allowed for lower duty cycle

T0C03

How does the allowable power density for RF safety change if duty cycle changes from 100 percent to 50 percent?

C. It increases by a factor of 2

T0C04

What factors affect the RF exposure of people near an amateur station antenna?

- A. Frequency and power level of the RF field
- B. Distance from the antenna to a person
- C. Radiation pattern of the antenna
- D. All these choices are correct

T0C04

What factors affect the RF exposure of people near an amateur station antenna?

D. All these choices are correct

T0C05

Why do exposure limits vary with frequency?

- A. Lower frequency RF fields have more energy than higher frequency fields
- B. Lower frequency RF fields do not penetrate the human body
- C. Higher frequency RF fields are transient in nature
- D. The human body absorbs more RF energy at some frequencies than at others

T0C05

Why do exposure limits vary with frequency?

D. The human body absorbs more RF energy at some frequencies than at others

T0C06

Which of the following is an acceptable method to determine whether your station complies with FCC RF exposure regulations?

- A. By calculation based on FCC OET Bulletin 65
- B. By calculation based on computer modeling
- C. By measurement of field strength using calibrated equipment
- D. All these choices are correct

T0C06

Which of the following is an acceptable method to determine whether your station complies with FCC RF exposure regulations?

D. All these choices are correct

TOC07

What hazard is created by touching an antenna during a transmission?

- A. Electrocution
- B. RF burn to skin
- C. Radiation poisoning
- D. All these choices are correct

TOC07

What hazard is created by touching an antenna during a transmission?

B. RF burn to skin

TOC08

Which of the following actions can reduce exposure to RF radiation?

- A. Relocate antennas
- B. Relocate the transmitter
- C. Increase the duty cycle
- D. All these choices are correct

TOC08

Which of the following actions can reduce exposure to RF radiation?

A. Relocate antennas

T0C09

How can you make sure your station stays in compliance with RF safety regulations?

- A. By informing the FCC of any changes made in your station
- B. By re-evaluating the station whenever an item in the transmitter or antenna system is changed
- C. By making sure your antennas have low SWR
- D. All these choices are correct

T0C09

How can you make sure your station stays in compliance with RF safety regulations?

- B. By re-evaluating the station whenever an item in the transmitter or antenna system is changed**

T0C10

Why is duty cycle one of the factors used to determine safe RF radiation exposure levels?

- A. It affects the average exposure to radiation
- B. It affects the peak exposure to radiation
- C. It takes into account the antenna feed line loss
- D. It takes into account the thermal effects of the final amplifier

T0C10

Why is duty cycle one of the factors used to determine safe RF radiation exposure levels?

A. It affects the average exposure to radiation

T0C11

What is the definition of duty cycle during the averaging time for RF exposure?

- A. The difference between the lowest power output and the highest power output of a transmitter
- B. The difference between the PEP and average power output of a transmitter
- C. The percentage of time that a transmitter is transmitting
- D. The percentage of time that a transmitter is not transmitting

T0C11

What is the definition of duty cycle during the averaging time for RF exposure?

C. The percentage of time that a transmitter is transmitting

T0C12

How does RF radiation differ from ionizing radiation (radioactivity)?

- A. RF radiation does not have sufficient energy to cause chemical changes in cells and damage DNA
- B. RF radiation can only be detected with an RF dosimeter
- C. RF radiation is limited in range to a few feet
- D. RF radiation is perfectly safe

T0C12

How does RF radiation differ from ionizing radiation (radioactivity)?

- A. RF radiation does not have sufficient energy to cause chemical changes in cells and damage DNA**

T0C13

Who is responsible for ensuring that no person is exposed to RF energy above the FCC exposure limits?

- A. The FCC
- B. The station licensee
- C. Anyone who is near an antenna
- D. The local zoning board

T0C13

Who is responsible for ensuring that no person is exposed to RF energy above the FCC exposure limits?

B. The station licensee

FIN