SUBELEMENT T8

Modulation modes: amateur satellite operation; operating activities; non-voice communications

4 Exam Questions - 4 Groups

T8A –
Modulation modes: bandwidth of various signals; choice of emission type

From the previous sections, one should already be familiar with the common modulation modes of SSB and FM.

Single Sideband is a form of amplitude modulation. FM is a form of frequency modulation.

SSB is the type of voice modulation most often used for long-distance or weak signal contacts on the VHF and UHF bands.

FM is the type of modulation most commonly used for VHF and UHF voice repeaters.

FM is also the type of modulation most commonly used for VHF packet radio transmissions.

The primary advantage of single sideband over FM for voice transmissions is that SSB signals have narrower bandwidth.

The bandwidth of an SSB signal is about 3 KHz, whereas FM is between 10 and 15 KHz.

The approximate bandwidth of a VHF repeater FM phone signal is also between 10 and 15 kHz.

T8A01

Which of the following is a form of amplitude modulation?

A. Spread-spectrum

B. Packet radio

C. Single sideband

D. Phase shift keying

T8A01

Which of the following is a form of amplitude modulation?

C. Single sideband

T8A02

What type of modulation is most commonly used for VHF packet radio transmissions?

A. FM

B. SSB

C. AM

D. Spread Spectrum

T8A02

What type of modulation is most commonly used for VHF packet radio transmissions?

A. FM

T8A03

Which type of voice mode is most 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 most often used for long-distance (weak signal) contacts on the VHF and UHF bands?

C. SSB

T8A04

Which type of modulation is most commonly used for VHF and UHF voice repeaters?

A. AM

B. SSB

C. PSK

D. FM

T8A04

Which type of modulation is most commonly used for VHF and UHF voice repeaters?

D. FM

T8A07

What is the primary advantage of single sideband over FM for voice transmissions?

A. SSB signals are easier to tune

B. SSB signals are less susceptible to interference

C. SSB signals have narrower bandwidth

D. All of these choices are correct

T8A07

What is the primary advantage of single sideband over FM for voice transmissions?

C. SSB signals have narrower bandwidth

T8A08

What is the approximate bandwidth of a single sideband voice signal?

A. 1 kHz

B. 3 kHz

C. 6 kHz

D. 15 kHz

T8A08

What is the approximate bandwidth of a single sideband voice signal?

B. 3 kHz

T8A09

What is the approximate bandwidth of a VHF repeater FM phone 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 phone signal?

C. Between 10 and 15 kHz

There are two types of SSB signals. One is called LSB for lower sideband. The other is called USB for upper sideband.

Technically they are both the same mode. One modulates on the low frequency side of center and the other modulates on the upper side of center.

The sideband normally used for 10 meter HF, VHF and UHF single-sideband communications is upper sideband.

CW is the type of emission that has the narrowest bandwidth.

150 Hz is the approximate maximum bandwidth required to transmit a CW signal.

CW is a very efficient mode. One can fit about 20 CW signals in the space of one SSB signal.

Ever dream of having your own TV station? Well, as an Amateur Radio Operator, you can!

Amateur Fast scan TV uses the same specifications that commercial analog TV does. In fact, one may use a regular unmodified TV to receive these signals. They just happen to already receive on the ham frequencies!

For the Technician exam, you only need to know the bandwidth of fast scan TV: The typical bandwidth of analog fast-scan TV transmissions on the 70 cm band about 6 MHz.

T8A05

Which of the following types of emission has the narrowest bandwidth?

A. FM voice

B. SSB voice

C. CW

D. Slow-scan TV

T8A05

Which of the following types of emission 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

T8A10

What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

A. More than 10 MHz

B. About 6 MHz

C. About 3 MHz

D. About 1 MHz

T8A10

What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

B. About 6 MHz

T8A11

What is the approximate maximum 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 maximum bandwidth required to transmit a CW signal?

B. 150 Hz

T8B –

Amateur satellite operation; Doppler shift, basic orbits, operating protocols; control operator, transmitter power considerations; satellite tracking; digital modes

Another fun way to enjoy ham radio is to communicate through a fleet of Amateur Satellites.

Any amateur whose license privileges allow them to transmit on the satellite uplink frequency may be the control operator of a station communicating through an amateur satellite or space station.

Being a Technician Class ham allows you to do just that, as most of the satellites use the 2 meter and 70 cm bands or higher.

Some of the satellites or “birds” are simply one channel FM repeaters.

Some use 2 meters as the uplink, and 70 cm as the downlink. Other FM birds do just the opposite using 70 cm as the uplink and 2 meters as the downlink.

There are several satellites that use what is called a linear transponder. SSB and CW stations use linear transponders.

Unlike single channel FM birds, linear transponders have a very wide bandwidth in which many SSB or CW stations may use at the same time.

Because of the limited power resources of a satellite, The minimum amount of power needed to complete the contact is how much transmitter power should be used on the uplink frequency of an amateur satellite or space station.

Besides satellites, any amateur holding a Technician or higher class license may make contact with an amateur station on the International Space Station using amateur radio frequencies.

Yes, there is a ham radio aboard the International Space Station. They use 2 meters and 70 cm frequently.

T8B01

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 licensee or higher licensee who has a satellite operator certification

C. Only an Amateur Extra Class operator who is also an AMSAT member

D. Any amateur whose license privileges allow them to transmit on the satellite uplink frequency

T8B01

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

D. Any amateur whose license privileges allow them to transmit on the satellite uplink frequency

T8B02

How much transmitter power should be used on the uplink frequency of an amateur satellite or space station?

A. The maximum power of your transmitter

B. The minimum amount of power needed to complete the contact

C. No more than half the rating of your linear amplifier

D. Never more than 1 watt

T8B02

How much transmitter power should be used on the uplink frequency of an amateur satellite or space station?

B. The minimum amount of power needed to complete the contact

T8B04

Which amateur stations may make contact with an amateur station on the International Space Station using 2 meter and 70 cm band amateur radio frequencies?

A. Only members of amateur radio clubs at NASA facilities

B. Any amateur holding a Technician or higher class license

C. Only the astronaut's family members who are hams

D. You cannot talk to the ISS on amateur radio frequencies

T8B04

Which amateur stations may make contact with an amateur station on the International Space Station using 2 meter and 70 cm band amateur radio frequencies?

B. Any amateur holding a Technician or higher class license

A satellite tracking program can be used to determine the time period during which an amateur satellite or space station can be accessed.

There are several good tracking programs that can be downloaded free of charge. Tracking programs provide the following useful information:

- Maps showing the real-time position of the satellite track over the earth
- The time, azimuth, and elevation of the start, maximum altitude, and end of a pass
- The apparent frequency of the satellite transmission, including effects of Doppler shift
- All of these answers are correct

The Keplerian elements are inputs that provide the tracking program with information about the satellite.

These inputs are required so that the satellite can be accurately tracked and are updated on a regular basis.

The first thing one may wish to do after locating a satellite with the tracking program is to listen to the satellites beacon.

A satellite beacon is a transmission from a space station that contains information about a satellite.

T8B03

Which of the following are provided by satellite tracking programs?

A. Maps showing the real-time position of the satellite track over the 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 of these answers are correct

T8B03

Which of the following are provided by satellite tracking programs?

D. All of these answers are correct

T8B05

What is a satellite beacon?

A. The primary transmit antenna on the satellite

B. An indicator light that that shows where to point your antenna

C. A reflective surface on the satellite

D. A transmission from a space station that contains information about a satellite

T8B05

What is a satellite beacon?

D. A transmission from a space station that contains information about a satellite

T8B06

Which of the following are inputs to a satellite tracking program?

A. The weight of the satellite

B. The Keplerian elements

C. The last observed time of zero Doppler shift

D. All of these answers are correct

T8B06

Which of the following are inputs to a satellite tracking program?

B. The Keplerian elements

The available time for communications varies with the orbital pass projected by the satellite tracking software.

Another factor is how high the satellite is. If a satellite is in an elliptical orbit, then the satellite will be in view for several hours.

Presently all our satellites are in a low earth orbit, which gives one a10 to 25 minute window in which to make contacts.

The initials LEO tell you the satellite is in a Low Earth orbit.

The statement that a satellite is operating in "mode U/V" means that the satellite uplink is in the 70 cm band and the downlink is in the 2 meter band.

This is a shortcut for telling everyone that the uplink is on the UHF band and the Downlink is on the VHF band.

Many satellites use the mode V/U which of course means that the uplink is on the VHF band and the downlink is on the UHF band.

When listening to a satellite, one will notice a couple of things. The frequency seems to drift so that you have to constantly retune the receiver and there is some fading in and out if the signal is on the weak side.

Doppler shift is an observed change in signal frequency caused by relative motion between the satellite and the earth station, and Rotation of the satellite and its antennas cause "spin fading" when referring to satellite signals.

Besides FM voice, SSB voice, and CW, a commonly used method of sending signals to and from a digital satellite is FM Packet.

T8B07

With regard to satellite communications, what is Doppler shift?

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 the earth station

D. A special digital communications mode for some satellites

T8B07

With regard to satellite communications, what is Doppler shift?

C. An observed change in signal frequency caused by relative motion between the satellite and the earth station

T8B08

What is meant by the statement that a satellite is operating in mode U/V?

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 cm 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 mode U/V?

B. The satellite uplink is in the 70 cm band and the downlink is in the 2 meter band

T8B09

What causes spin fading when referring to 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 when referring to satellite signals?

B. Rotation of the satellite and its antennas

T8B10

What do the initials LEO tell you about an amateur satellite?

A. The satellite battery is in Low Energy Operation mode

B. The satellite is performing a Lunar Ejection Orbit maneuver

C. The satellite is in a Low Earth Orbit

D. The satellite uses Light Emitting Optics

T8B10

What do the initials LEO tell you about an amateur satellite?

C. The satellite is in a Low Earth Orbit

T8B11

What is a commonly used method of sending signals to and from a digital satellite?

A. USB AFSK

B. PSK31

C. FM Packet

D. WSJT

T8B11

What is a commonly used method of sending signals to and from a digital satellite?

C. FM Packet

T8C –

Operating activities: radio direction finding; radio control; contests; linking over the Internet; grid locators

As one may have noticed, there are many operating activities that can entertain hams for years.

In this section we will review just a few that may be on the exam. One popular activity is called Fox Hunting.

No, you don’t strap a radio onto a fox and then chase it! Fox hunting is another name used for Transmitter Hunting.

In its simplicity, a transmitter is hidden and hams try to find it. It is a fun event which takes up most of an afternoon.

Perhaps a picnic will follow the fox hunt. A directional antenna would be useful for a hidden transmitter hunt.

On the serious side, hams use fox hunting to prepare for real life situations. Radio direction finding methods are used to locate sources of noise interference or jamming.

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 of these choices are correct

T8C02

Which of these items would be useful for a hidden transmitter hunt?

B. A directional antenna

Contesting is a popular operating activity that involves contacting as many stations as possible during a specified period of time.

If one has been active in sports, or just likes to watch sports on TV, these contests may be of special interest. The term is actually called Radio Sports. You can figure the rest out.

A good procedure when contacting another station in a radio contest is to send only the minimum information needed for proper identification and the contest exchange.

The contest exchange is a piece of information that each station in the contest needs to receive accurately.

To receive the contest exchange incorrectly voids the contacts and reduces your point total.

One such exchange may be your grid location. A grid locator is a letter-number designator assigned to a geographic location.

An example would be EN80 is the grid locator for Mt. Vernon, Ohio.

T8C03

What popular operating activity involves contacting as many stations as possible during a specified period of time?

A. Contesting

B. Net operations

C. Public service events

D. Simulated emergency exercises

T8C03

What popular operating activity involves contacting as many stations as possible during a specified period of time?

A. Contesting

T8C04

Which of the following is good procedure when contacting another station in a radio contest?

A. Be sure to sign only the last two letters of your call if there is a pileup calling the station

B. Work 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 of these choices are correct

T8C04

Which of the following is good procedure when contacting another station in a radio 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

Another fun activity is controlling model crafts. Most popular are cars and airplanes, but the choice is yours. There are a few things that need abided by though:

- **The maximum power allowed when transmitting telecommand signals to radio controlled models is 1 watt.**
- **It is required that a label indicating the licensee's call sign and address must be affixed to the transmitter in place of on-air station identification when sending signals to a radio control model using amateur frequencies.**

Two rules easy enough to follow considering the enjoyment of using your own frequency for model control

T8C07

What is the maximum power allowed when transmitting telecommand signals to radio controlled models?

A. 500 milliwatts

B. 1 watt

C. 25 watts

D. 1500 watts

T8C07

What is the maximum power allowed when transmitting telecommand signals to radio controlled models?

B. 1 watt

T8C08

What is required in place of on-air station identification when sending signals to a radio control model using amateur frequencies?

A. Voice identification must be transmitted every 10 minutes

B. Morse code ID must be sent once per hour

C. A label indicating the licensee's name, call sign and address must be affixed to the transmitter

D. A flag must be affixed to the transmitter antenna with the station call sign in 1 inch high letters or larger

T8C08

What is required in place of on-air station identification when sending signals to a radio control model using amateur frequencies?

C. A label indicating the licensee’s name, call sign and address must be affixed to the transmitter

Communicating with hams over the internet has become a popular activity.

In fact, if one does not have his or own station he or she can use a computer to talk world-wide to other hams.

Yes, Technician Class hams are allowed to participate it this activity.

A gateway is the name given to an amateur radio station that is used to connect other amateur stations to the Internet.

You might obtain a list of active nodes that use VoIP (Voice Over Internet Protocol) from a repeater directory.

The Internet Radio Linking Project (IRLP) is a technique to connect amateur radio systems, such as repeaters, via the Internet using Voice Over Internet Protocol.

Voice Over Internet Protocol (VoIP) as used in amateur radio is a method of delivering voice communications over the Internet using digital techniques.

You can select a specific IRLP node when using a portable transceiver by using DTMF signals via the radios keypad to transmit the IRLP node ID.

T8C06

How is access to an IRLP node accomplished?

A. By obtaining a password which 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 access to an IRLP node accomplished?

B. By using DTMF signals

T8C09

How might you obtain a list of active nodes that use VoIP?

A. From the FCC Rulebook

B. From your local emergency coordinator

C. From a repeater directory

D. From the local repeater frequency coordinator

T8C09

How might you obtain a list of active nodes that use VoIP?

C. From a repeater directory

T8C10

How do you select a specific IRLP node when using a portable transceiver?

A. Choose a specific CTCSS tone

B. Choose the correct DSC tone

C. Access the repeater autopatch

D. Use the keypad to transmit the IRLP node ID

T8C10

How do you select a specific IRLP node when using a portable transceiver?

D. Use the keypad to transmit the IRLP node ID

T8C11

What name is given to an amateur radio station that is used to connect other amateur stations to the Internet?

A. A gateway

B. A repeater

C. A digipeater

D. A beacon

T8C11

What name is given to an amateur radio station that is used to connect other amateur stations to the Internet?

A. A gateway

T8C12

What is meant by Voice Over Internet Protocol (VoIP) as used in amateur radio?

A. A set of rules specifying how to identify your station when linked over the Internet to another station

B. A set of guidelines for working DX during contests using Internet access

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

T8C12

What is meant by Voice Over Internet Protocol (VoIP) as used in amateur radio?

D. A method of delivering voice communications over the Internet using digital techniques

T8C13

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

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

T8C13

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

T8D –

Non-voice communications: image signals; digital modes; CW; packet; PSK31; APRS; error detection and correction; NTSC

With the advent of computers and soundcards, many digital modes have been created. Most are as efficient or even more efficient than Morse Code.

Unlike Morse Code however, one cannot decode these digital signals with the human ear.

The following are examples of digital communications methods.

- **Packet**
- **PSK31**
- **MFSK**
- **All of these choices are correct**

PSK31 is a low-rate data transmission mode and is a very popular digital mode. The abbreviation PSK means Phase Shift Keying.

T8D01

Which of the following is an example of a digital communications method?

A. Packet

B. PSK31

C. MFSK

D. All of these choices are correct

T8D01

Which of the following is an example of a digital communications method?

D. All of these choices are correct

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

Packet mode arrived about the same time as the internet. Packet has dedicated Radio Bulletin Board Stations that send and retrieve email over the radio waves.

Packet stations also have their own mailbox so that other hams may leave messages for them. PSK is a low-rate data transmission mode.

Packet transmissions include:

- **A check sum which permits error detection;**
- **A header which contains the call sign of the station to which the information is being sent;**
- **Automatic repeat request in case of error.**
- **All of these choices are correct**

The term APRS means Automatic Position Reporting System. Packet stations use APRS as a way to keep track of where their ham friends are.

A Global Positioning System receiver is normally used when sending automatic location reports via amateur radio.

An application of APRS (Automatic Packet Reporting System) would be providing real time tactical digital communications in conjunction with a map showing the locations of stations.

T8D02

What does the term “APRS” mean?

A. Automatic Packet Reporting System

B. Associated Public Radio Station

C. Auto Planning Radio Set-up

D. Advanced Polar Radio System

T8D02

What does the term “APRS” mean?

A. Automatic Packet Reporting System

T8D03

Which of the following devices provides data to the transmitter when sending automatic position reports from a mobile amateur radio station?

A. The vehicle speedometer

B. A WWV receiver

C. A connection to a broadcast FM sub-carrier receiver

D. A Global Positioning System receiver

T8D03

Which of the following devices provides data to the transmitter when sending automatic position reports from a mobile amateur radio station?

D. A Global Positioning System receiver

T8D05

Which of the following is an application of APRS (Automatic Packet Reporting System)?

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 (Automatic Packet Reporting System)?

A. Providing real time tactical digital communications in conjunction with a map showing the locations of stations

T8D07

What is PSK31?

A. A high-rate data transmission mode

B. A method of reducing noise interference to FM signals

C. A method of compressing digital television signals

D. A low-rate data transmission mode

T8D07

What is PSK31?

D. A low-rate data transmission mode

T8D08

Which of the following may be included in packet transmissions?

A. A check sum which permits error detection

B. A header which contains the call sign of the station to which the information is being sent

C. Automatic repeat request in case of error

D. All of these choices are correct

T8D08

Which of the following may be included in packet transmissions?

D. All of these choices are correct

CW or Morse Code is the oldest form of digital communications. Morse Code is still a very popular mode on the ham bands and one does not need a computer to enjoy "talking" in Morse Code.

This may be on the test:

- **The digital code used when sending CW in the amateur bands is International Morse.**

- **The following devices can be used to transmit CW in the amateur bands:**
    1. **Straight Key**
    2. **Electronic Keyer**
    3. **Computer Keyboard**
    4. **All of these choices are correct**

T8D09

What code is used when sending CW in the amateur bands?

A. Baudot

B. Hamming

C. International Morse

D. Gray

T8D09

What code is used when sending CW in the amateur bands?

C. International Morse

T8D10

Which of the following can be used to transmit CW in the amateur bands?

A. Straight Key

B. Electronic Keyer

C. Computer Keyboard

D. All of these choices are correct

T8D10

Which of the following can be used to transmit CW in the amateur bands?

D. All of these choices are correct

Only two other items in this section need to be addressed:

- an ARQ transmission system is a digital scheme whereby the receiving station detects errors and sends a request to the sending station to retransmit the information.
- An analog fast scan color TV signal is a type of transmission that is indicated by the term NTSC.

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. A digital scheme whereby the receiving station detects errors and sends a request to the sending station to retransmit the information

D. A method of compressing the data in a message so more information can be sent in a shorter time

T8D11

What is an ARQ transmission system?

C. A digital scheme whereby the receiving station detects errors and sends a request to the sending station

T8D04

What type of transmission is indicated by the term NTSC?

A. A Normal Transmission mode in Static Circuit

B. A special mode for earth 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