



Amateur Extra License Class

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Amateur Extra Class

Chapter 3 Rules & Regulations

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FCC Rules

FCC Rules

- The rules governing everything that the FCC is responsible for are found in:
 - The Code of Federal Regulations (CFR) Title 47
- The majority of the rules governing the Amateur Radio Service are found in:
 - CFR Title 47, Part 97.



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FCC Rules

FCC Rules

- The following parts also contain rules affecting the Amateur Radio Service:
 - CFR Title 47, Part 2 -- Frequency Allocations and Radio Treaty Matters, and General Rules & Regulations
 - CFR Title 47, Part 15 – Radio Frequency Devices
 - CFR Title 47, Part 17 – Antenna Structures

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ITU Rules

ITU Rules

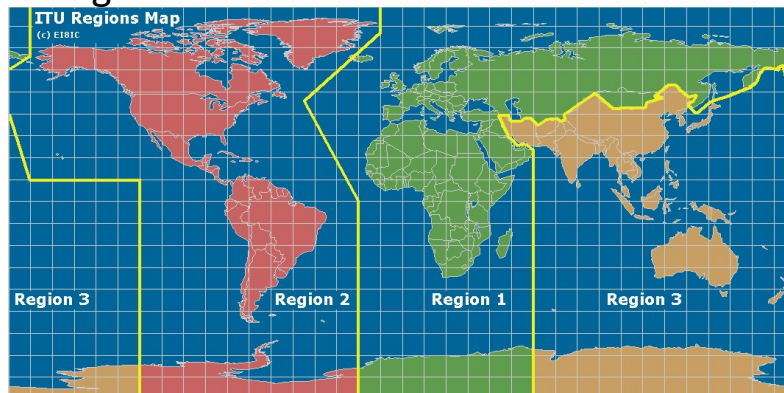
- The International Telecommunications Union (ITU) is an agency of the United Nations that coordinates the use of the radio spectrum and other matters relating to radio communications between the member countries.
- The ITU has divided the world into 3 regions.
 - Different frequency allocations in each region.

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ITU Rules & Regulations

ITU Regions



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Operating Standards

Frequency and Emission Privileges

- Amateur Extra class licensees have access to all frequency & emission privileges granted to the Amateur Radio Service by the FCC.
 - Frequencies above 50 MHz in §97.301(a).
 - Frequencies below 30 MHz in §97.301(b).
- Not all frequencies available to US amateurs are exclusive to the Amateur Radio Service.
 - Frequency sharing requirements are in §97.303

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Operating Standards

Frequency and Emission Privileges

- Amateur Extra class licensees have exclusive frequency privileges on certain amateur radio bands.
 - 80m: 3.500 MHz to 3.525 MHz
 - 75m: 3.600 MHz to 3.700 MHz
 - 40m: 7.000 MHz to 7.025 MHz
 - 20m: 14.000 MHz to 14.025 MHz
 - 20m: 14.150 MHz to 14.175 MHz
 - 15m: 21.000 MHz to 21.025 MHz
 - 15m: 21.200 MHz to 21.225 MHz

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Operating Standards

Frequency and Emission Privileges

- The FCC has recently allocated an LF and a new MF band to the Amateur Radio Service
 - LF = 2200 meters.
 - MF = 630 meters.
 - CW, RTTY, digital, phone, & image transmissions authorized.
 - Digital & SSB must use USB.
 - Must notify the Utilities Power Council at least 30 days before beginning operations.
 - Call sign.
 - Station coordinates (latitude & longitude).

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Operating Standards

Frequency and Emission Privileges

- 2200 meters.
 - 135.7 kHz to 137.8 kHz.
 - Maximum power = 1W EIRP¹.
- 630 meters.
 - 472 kHz to 479 kHz.
 - Maximum power = 5W EIRP¹.
 - 1W EIRP¹ if less than 800 km (497 miles) from Russia.

¹EIRP = Effective Isotropic Radiated Power

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Operating Standards

Frequency and Emission Privileges

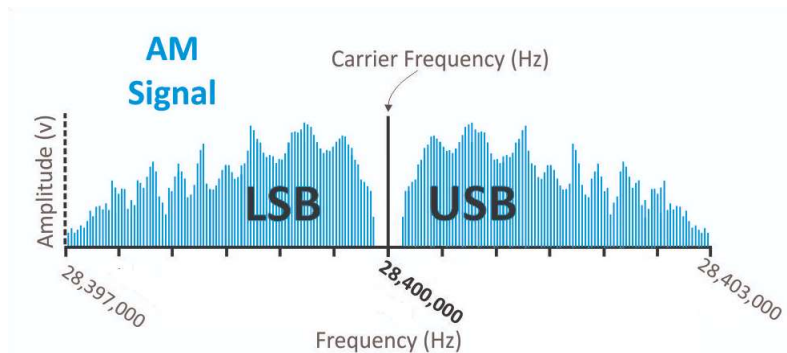
- All energy emitted by your transmitter must be contained within the band segment authorized.
- The frequency shown on your VFO display is **NOT** where your signal actually is.
 - All modulated signals, including CW, have sidebands.
 - **Know where your sidebands are!**

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Operating Standards

Frequency and Emission Privileges



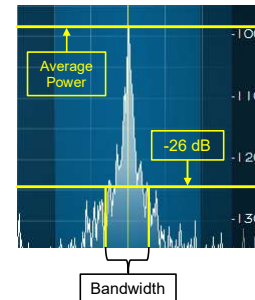
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Operating Standards

Frequency and Emission Privileges

- Signal Bandwidth.
 - The FCC defines signal bandwidth as the frequency range outside of which the signal strength is at least 26 dB (400:1) below the average signal power.



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Operating Standards

Special Restrictions

- Shared MF & HF allocations.
 - 1800 kHz to 1810 kHz -- Non-amateur in Region 1.
 - 3950 kHz to 4000 kHz -- Broadcasting in Regions 1 & 3.
 - 60m – Entire band shared.
 - 7000 kHz to 7050 kHz – Non-amateur in some countries.
 - 7100 kHz to 7200 kHz – Non-amateur in some countries.
 - 7200 kHz to 7300 kHz -- Broadcasting in Regions 1 & 3
 - 30m – Entire band shared

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Operating Standards

Special Restrictions – 60m

- Amateur Extra, Advanced, General class licensees only.
- CW, digital, & USB modes only with 2.8 kHz maximum bandwidth.
 - CW & digital signals must be on center frequency of channel.
- Maximum of 100 Watts ERP relative to a dipole.

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Operating Standards

Special Restrictions – 60m

- Assigned frequencies only.

Channel Center (kHz)	5332.0	5348.0	5358.5	5373.0	5405.0
VFO Frequency (kHz)	5330.5	5346.5	5357.0	5371.5	5403.5

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Operating Standards

Special Restrictions – 30m

- Maximum of 200 Watts PEP.
- CW & data only.


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E1A01 -- Why is it not legal to transmit a 3 kHz bandwidth USB signal with a carrier frequency of 14.348 MHz?

- A. USB is not used on 20-meter phone
- B. The lower 1 kHz of the signal is outside the 20-meter band
- C. 14.348 MHz is outside the 20-meter band
- ➡ D. The upper 1 kHz of the signal is outside the 20-meter band

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E1A02 -- When using a transceiver that displays the carrier frequency of phone signals, which of the following displayed frequencies represents the lowest frequency at which a properly adjusted LSB emission will be totally within the band?

- A. The exact lower band edge
- B. 300 Hz above the lower band edge
- C. 1 kHz above the lower band edge
-  D. 3 kHz above the lower band edge


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E1A03 -- What is the highest legal carrier frequency on the 20-meter band for transmitting a 2.8 kHz wide USB data signal?

- A. 14.0708 MHz
- B. 14.1002 MHz
-  C. 14.1472 MHz
- D. 14.3490 MHz


20

E1A04 -- May an Extra class operator answer the CQ of a station on 3.601 MHz LSB phone?

- A. Yes, the entire signal will be inside the SSB allocation for Extra class operators
- B. Yes, the displayed frequency is within the 75-meter phone band segment
-  C. No, the sideband components will extend beyond the edge of the phone band segment
- D. No, US stations are not permitted to use phone emissions below 3.610 MHz


21

E1A06 -- What is the required transmit frequency of a CW signal for channelized 60 meter operation?

- A. At the lowest frequency of the channel
-  B. At the center frequency of the channel
- C. At the highest frequency of the channel
- D. On any frequency where the signal's sidebands are within the channel


22

E1A07 -- What is the maximum power permitted on the 2200-meter band?

- A. 50 watts PEP (peak envelope power)
- B. 100 watts PEP (peak envelope power)
-  C. 1 watt EIRP (equivalent isotropic radiated power)
- D. 5 watts EIRP (equivalent isotropic radiated power)


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E1A09 -- Except in some parts of Alaska, what is the maximum power permitted on the 630-meter band?

- A. 50 watts PEP (peak envelope power)
- B. 100 watts PEP (peak envelope power)
- C. 1 watt EIRP (equivalent isotropic radiated power)
-  D. 5 watts EIRP (equivalent isotropic radiated power)


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E1C01 -- What is the maximum bandwidth for a data emission on 60 meters?

- A. 60 Hz
- B. 170 Hz
- C. 1.5 kHz
-  D. 2.8 kHz


25

E1C03 -- How long must an operator wait after filing a notification with the Utilities Technology Council (UTC) before operating on the 2200-meter or 630-meter band?

- A. Operators must not operate until approval is received
-  B. Operators may operate after 30 days, providing they have not been told that their station is within 1 kilometer of PLC systems using those frequencies
- C. Operators may not operate until a test signal has been transmitted in coordination with the local power company
- D. Operations may commence immediately, and may continue unless interference is reported by the UTC


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E1C07 -- What notifications must be given before transmitting on the 630- or 2200-meter bands?

- A. A special endorsement must be requested from the FCC
- B. An environmental impact statement must be filed with the Department of the Interior
- C. Operators must inform the FAA of their intent to operate, giving their call sign and distance to the nearest runway
-  D. Operators must inform the Utilities Technology Council (UTC) of their call sign and coordinates of the station

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E1C12 -- In what portion of the 630-meter band are phone emissions permitted?

- A. None
- B. Only the top 3 kHz
- C. Only the bottom 3 kHz
-  D. The entire band

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Operating Standards

Special Operating Rules

- Automatic Message Forwarding.
 - Is the control operator ALWAYS responsible for the content of their station's transmissions?
 - In an automatic message forwarding system, **ONLY** the originator of the message is responsible for its content.
 - Of course, if the control operator of a station in an automatic message forwarding system becomes aware of a violation, he should take steps to prevent a recurrence of the violation.

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Operating Standards

Special Operating Rules

- Radio Amateur Civil Emergency Service (RACES).



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Operating Standards

Special Operating Rules

- Radio Amateur Civil Emergency Service (RACES).
 - A radio service comprised of amateur radio stations used for civil defense communications under the control of an emergency management agency.
 - FEMA
 - SEMA
 - Local EMA
- Specified in FCC Rules §97.407.

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Operating Standards

Special Operating Rules

- Radio Amateur Civil Emergency Service (RACES).
 - RACES is a radio service, **NOT** an organization.
 - An amateur radio station may be authorized to operate in RACES.
 - An individual amateur radio operator cannot be a “member” of RACES.
 - **Do not confuse with ARES!**

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Operating Standards

Special Operating Rules

- Radio Amateur Civil Emergency Service (RACES).
 - All communications must be authorized by the EMA director of the area served.
 - May communicate with non-RACES (non-amateur) stations if authorized.
- Presidential War Emergency Powers
 - Communications Act of 1934
 - Specific frequencies listed in FCC Part 214

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Operating Standards

Special Operating Rules

- Radio Amateur Civil Emergency Service (RACES).
 - The station must be registered with the EMA organization for area served.
 - The control operator must be enrolled in the EMA organization for area served.
- No additional operator privileges.
 - General class licensees can only use frequencies & emissions normally authorized to Generals.
 - Technician class licensees can only use frequencies & emissions normally authorized to Technicians.

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Operating Standards

Special Operating Rules

- Stations Aboard Ships or Aircraft.
 - The installation must be approved by the master of the vessel or the pilot in command of the aircraft.
 - The installation must be separate from and independent of the ship or aircraft radios.
 - A common antenna is permitted.
 - The installation must not constitute a hazard to life or property. If in an aircraft, no operation during IFR flight unless the installation complies with FAA rules.

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Operating Standards

Special Operating Rules

- Stations Aboard Ships or Aircraft.
 - If in national waters or airspace, that nation's rules apply.
 - If in international waters or airspace, the rules of the nation of registry of the ship or aircraft apply.
 - If a U.S.-registered vessel or aircraft, the control operator must hold an FCC-issued amateur radio license of any class or be an alien authorized for reciprocal operation.


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E1A05 -- Who must be in physical control of the station apparatus of an amateur station aboard any vessel or craft that is documented or registered in the United States?

- A. Only a person with an FCC Marine Radio license grant
- B. Only a person named in an amateur station license grant
-  C. Any person holding an FCC issued amateur license or who is authorized for alien reciprocal operation
- D. Any person named in an amateur station license grant or a person holding an unrestricted Radiotelephone Operator Permit

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E1A08 -- If a station in a message forwarding system inadvertently forwards a message that is in violation of FCC rules, who is primarily accountable for the rules violation?

- A. The control operator of the packet bulletin board station
-  B. The control operator of the originating station
- C. The control operators of all the stations in the system
- D. The control operators of all the stations in the system not authenticating the source from which they accept communications

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E1A10 -- If an amateur station is installed aboard a ship or aircraft, what condition must be met before the station is operated?

- ➔ A. Its operation must be approved by the master of the ship or the pilot in command of the aircraft
- B. The amateur station operator must agree not to transmit when the main radio of the ship or aircraft is in use
- C. The amateur station must have a power supply that is completely independent of the main ship or aircraft power supply
- D. The amateur station must operate only in specific segments of the amateur service HF and VHF bands


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E1A11 -- What licensing is required when operating an amateur station aboard a US-registered vessel in international waters?

- A. Any amateur license with an FCC Marine or Aircraft endorsement
- ➔ B. Any FCC-issued amateur license
- C. Only General class or higher amateur licenses
- D. An unrestricted Radiotelephone Operator Permit


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E1B09 -- Which amateur stations may be operated under RACES rules?

- A. Only those club stations licensed to Amateur Extra class operators
- B. Any FCC-licensed amateur station except a Technician class
-  C. Any FCC-licensed amateur station certified by the responsible civil defense organization for the area served
- D. Only stations meeting the FCC Part 97 technical standards for operation during an emergency

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E1B10 -- What frequencies are authorized to an amateur station operating under RACES rules?

-  A. All amateur service frequencies authorized to the control operator
- B. Specific segments in the amateur service MF, HF, VHF, and UHF bands
- C. Specific local government channels
- D. All these choices are correct

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Station Restrictions

Operating Restrictions

- Under certain conditions, the FCC may restrict the operation of an amateur radio station during certain times or on certain frequencies to reduce interference to other licensed services.
 - The receiver experiencing the interference must be of good engineering design.
 - The amateur station must not have spurious emissions exceeding the prescribed limits.
 - The FCC may impose “quiet hours”. [§97.121(a)]

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Station Restrictions

Operating Restrictions

§ 97.121 Restricted operation.

- (a) If the operation of an amateur station causes general interference to the reception of transmissions from stations operating in the domestic broadcast service when receivers of good engineering design, including adequate selectivity characteristics, are used to receive such transmissions, and this fact is made known to the amateur station licensee, the amateur station shall not be operated during the hours from 8 p.m. to 10:30 p.m., local time, and on Sunday for the additional period from 10:30 a.m. until 1 p.m., local time, upon the frequency or frequencies used when the interference is created.
- (b) In general, such steps as may be necessary to minimize interference to stations operating in other services may be required after investigation by the FCC.

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Station Restrictions

Operating Restrictions

- Spurious Emissions
 - Spurious emissions are signals that are outside of the necessary bandwidth for the mode being used that can be reduced or eliminated without affecting the information being transmitted.
 - Harmonics.
 - "Spurs".
 - Splatter.
 - **ALL** transmissions contain some spurious emissions.

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Station Restrictions

Operating Restrictions

- Spurious emissions must be below limits that are set by FCC rules.
 - For frequencies below 30 MHz, spurious emissions must be at least 43 dB below the average power output of the transmitter. [§97.307(d)]
 - For frequencies in the range of 30-225 MHz, spurious emissions must be at least 60 dB below the average power output of the transmitter. [§97.307(e)]

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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Location.
 - Station that are located in an area of environmental, historical, or cultural significance.
 - Must file Environmental Assessment with FCC.

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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Location.
 - Within 1 mile of an FCC monitoring facility.
 - Facility manager may impose restrictions.

FCC Monitoring Facilities		
Allegan, MI	Grand Island, NE	Powder Springs, GA
Belfast, ME	Kenai, AK	Santa Isabel, PR
Canandaigua, NY	Kingsville, TX	Vero Beach, FL
Douglas, AZ	Laurel, MD	Waipahu, HI
Ferndale, WA	Livermore, CA	

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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.
 - If the top of an antenna structure will be more than 200 ft above ground level, you must notify the FCC & the FAA before installing the antenna structure.
 - You may be denied permission to construct the antenna structure as proposed.
 - If permission is granted for the antenna structure, you may be required to light and/or paint the structure as required by CFR Title 47, Part 17.

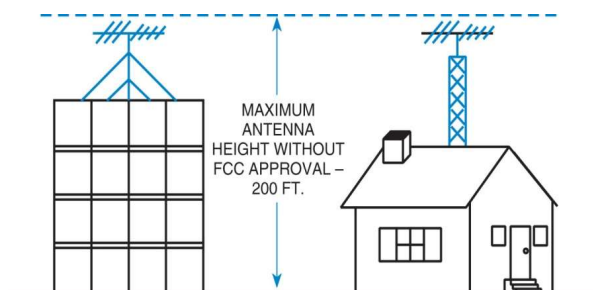
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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.



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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.
 - If the antenna structure will be near a public-use airport, you may have to notify the FCC & FAA before installing the antenna structure.
 - Depends upon:
 - Distance from airport.
 - Type of airport.
 - Longest runway >3200 feet in length.
 - Longest runway <3200 feet in length.
 - Heliport

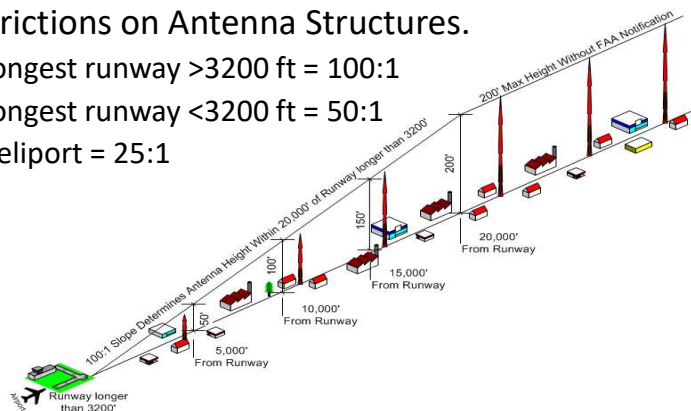
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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.
 - Longest runway >3200 ft = 100:1
 - Longest runway <3200 ft = 50:1
 - Heliport = 25:1



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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.
 - You do **NOT** have to notify the FCC or the FAA if:
 - The top of the antenna structure is <20 ft above ground.
 - The top of the antenna structure is <20 ft above an existing man-made structure.
 - Towers don't count.
 - The antenna structure is shielded by terrain or by taller structures in a congested urban area.
 - Trees don't count.

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Station Restrictions

Station Location and Antenna Structures

- Restrictions on Antenna Structures.
 - Zoning Ordinances
 - The FCC rules require minimum practical regulation to accomplish state or local government's legitimate purpose and must reasonably accommodate amateur communications. [§97.15(b)] (a.k.a. PRB-1)
 - Covenants, Conditions, and Restrictions (CCR's)
 - Are private agreements not covered by FCC rules.
 - Are legally binding contracts.
 - Are common in most sub-divisions.


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E1B01 -- Which of the following constitutes a spurious emission?

- A. An amateur station transmission made without the proper call sign identification
- B. A signal transmitted to prevent its detection by any station other than the intended recipient
- C. Any transmitted signal that unintentionally interferes with another licensed radio station and whose levels exceed 40 dB below the fundamental power level
-  D. An emission outside the signal's necessary bandwidth that can be reduced or eliminated without affecting the information transmitted


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E1B03 -- Within what distance must an amateur station protect an FCC monitoring facility from harmful interference?

-  A. 1 mile
- B. 3 miles
- C. 10 miles
- D. 30 miles


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E1B06 -- Which of the following additional rules apply if you are erecting an amateur station antenna structure at a site at or near a public use airport?

-  A. You may have to notify the Federal Aviation Administration and register it with the FCC as required by Part 17 of the FCC rules
- B. You may have to enter the height above ground in meters, and the latitude and longitude in degrees, minutes, and seconds on the FAA website
- C. You must file an Environmental Impact Statement with the EPA before construction begins
- D. You must obtain a construction permit from the airport zoning authority per Part 119 of the FAA regulations


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E1B07 -- To what type of regulations does PRB-1 apply?

- A. Homeowners associations
- B. FAA tower height limits
-  C. State and local zoning
- D. Use of wireless devices in vehicles


58

E1B08 -- What limitations may the FCC place on an amateur station if its signal causes interference to domestic broadcast reception, assuming that the receivers involved are of good engineering design?

- A. The amateur station must cease operation
- B. The amateur station must cease operation on all frequencies below 30 MHz
- C. The amateur station must cease operation on all frequencies above 30 MHz
-  D. The amateur station must avoid transmitting during certain hours on frequencies that cause the interference

59

E1B11 -- What does PRB-1 require of state and local regulations affecting amateur radio antenna size and structures?

- A. No limitations may be placed on antenna size or placement
-  B. Reasonable accommodations of amateur radio must be made
- C. Such structures must be permitted when use for emergency communications can be demonstrated
- D. Such structures must be permitted if certified by a registered professional engineer

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E1C10 -- What is the maximum mean power level for a spurious emission below 30 MHz with respect to the fundamental emission?

- A. -43 dB
B. -53 dB
C. -63 dB
D. -73 dB

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Station Control

Control Operator

- **EVERY** amateur radio station has a control operator when it is transmitting.
- The control operator is designated by the station owner.
- The control operator is legally responsible for the station operation.
- The control operator must hold an amateur radio license authorized for the frequency in use.

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Station Control

Types of Station Control

- There are 3 types of station control recognized in the FCC Rules:
 - Local control.
 - Remote control.
 - Automatic control.

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Station Control

Local Control

- The control operator is physically at the station and directly manipulates the equipment.
 - By manually moving a dial, or knob.
 - By using a computer program (CAT).
 - Switching from receive to transmit may be by:
 - Manually operating a switch.
 - Voice-operated transmit (VOX).
 - CAT command.
- The most common type of control.

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Station Control

Remote Control

- The control operator is present at a control point which is not at the station location.
- The control point is connected to the station via:
 - Radio (auxiliary station).
 - a.k.a. – Telecommand.
 - Wire or dedicated telephone line.
 - Dial-up or cellular telephone connection.
 - Local-area computer network (LAN).
 - Wide-area computer network (WAN, a.k.a -- Internet).

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Station Control

Remote Control

- Provision must be made to limit transmission time to no more than 3 minutes in case the control link fails. [§97.213]
 - Time-out timer.
 - Also applies to stations operating under automatic control.

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Station Control

Automatic Control

- The control operator is not present at a control point.
 - Repeater Stations.
 - Auxiliary Stations.
 - Beacon Stations.
- The control operator is still legally responsible for station operation.
- No third-party traffic unless RTTY or data.

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Station Control

Automatic Control

- Repeater Stations
 - Automatic control is authorized if a repeater receives and transmits on the following frequencies:

29.5 MHz to 29.7 MHz	420.0 MHz to 431.0 MHz
51.0 MHz to 54.0 MHz	433.0 MHz to 435.0 MHz
144.5 MHz to 145.5 MHz	438.0 MHz to 450.0 MHz
146.0 MHz to 148.0 MHz	902.0 MHz and above
222.15 MHz to 225.0 MHz	

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Station Control

Automatic Control

- Auxiliary Stations
 - An amateur station transmitting communications point-to-point within a system of cooperating amateur stations.
 - One-way communications are authorized.
 - Authorized the same frequencies as repeater stations except no 10m or 6m operations permitted.

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Station Control

Automatic Control

- Beacon Stations
 - Only one signal per band at any one location.
 - 100 Watts PEP maximum power output.
 - Automatic control authorized on following frequencies:

28.200 MHz to 28.300 MHz	222.050 MHz to 222.060 MHz
50.060 MHz to 50.080 MHz	432.300 MHz to 432.400 MHz
144.275 MHz to 144.300 MHz	902.000 MHz and above

- One-way communications are authorized.

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Station Control

Telecommand and One-Way Transmissions

- Telecommand is the use of one-way transmissions to control an object at a distance.
- The following types of amateur radio stations are authorized for one-way transmissions:
 - Space stations.
 - Space telecommand stations.
 - Beacon stations.
 - Stations to control remotely-controlled vehicles.
 - Auxiliary stations.

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Station Control

Telecommand and One-Way Transmissions

- An amateur radio station located within 50 km of the surface of the Earth may be operated by telecommand if:
 - There is a connection that allows the control operator functions to be accomplished, and
 - Provisions are made to limit transmissions to 3 minutes if the control link fails, and
 - The station is protected against making unauthorized transmissions.

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Station Control

Telecommand and One-Way Transmissions

- If an amateur radio station is operated by telecommand, the following must be prominently displayed at the station location:
 - Photocopy of the station licensee's amateur radio license.
 - A notice with the following information:
 - The station licensee's name, address, & telephone number.
 - The name, address, & telephone number of a control operator.

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Station Control

Telecommand and One-Way Transmissions

- If an amateur radio station is used to control a remotely controlled vehicle:
 - The normal identification requirements are waved as long as a label containing the station call sign and the licensee's name and address is attached to the transmitter:
 - The control signals may be encrypted.
 - The transmitter output power may not exceed 1W PEP.

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Station Control

Telemetry.

- Telemetry is the use of one-way transmissions to send information about an object at a distance.
 - e.g. – Measuring status of the batteries of an amateur satellite.
- Telemetry transmissions may be automatic or on request.
- Telemetry transmissions must contain the call sign of the transmitting station.


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E1C05 -- Under what situation may a station transmit third party communications while being automatically controlled?

- A. Never
- ➔ B. Only when transmitting RTTY or data emissions
- C. Only when transmitting SSB or CW
- D. On any mode approved by the National Telecommunication and Information Administration


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E1C08 -- What is the maximum permissible duration of a remotely controlled station's transmissions if its control link malfunctions?

- A. 30 seconds
-  B. 3 minutes
- C. 5 minutes
- D. 10 minutes


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E1D01 -- What is the definition of telemetry?

-  A. One-way transmission of measurements at a distance from the measuring instrument
- B. Two-way transmissions in excess of 1000 feet
- C. Two-way transmissions of data
- D. One-way transmission that initiates, modifies, or terminates the functions of a device at a distance


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E1D04 -- Which of the following is required in the identification transmissions from a balloon-borne telemetry station?

-  A. Call sign
- B. The output power of the balloon transmitter
- C. The station's six-character Maidenhead grid locator
- D. All these choices are correct

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E1D05 -- What must be posted at the location of a station being operated by telecommand on or within 50 kilometers of the Earth's surface?

- A. A photocopy of the station license
- B. A label with the name, address, and telephone number of the station licensee
- C. A label with the name, address, and telephone number of the control operator
-  D. All these choices are correct

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E1D06 -- What is the maximum permitted transmitter output power when operating a model craft by telecommand?

- ➔ A. 1 watt
- B. 2 watts
- C. 5 watts
- D. 100 watts

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E1D12 -- Which of the following amateur stations may transmit one-way communications?

- ➔ A. A space station, beacon station, or telecommand station
- B. A local repeater or linked repeater station
- C. A message forwarding station or automatically controlled digital station
- D. All these choices are correct

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Break



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Amateur Satellite Service



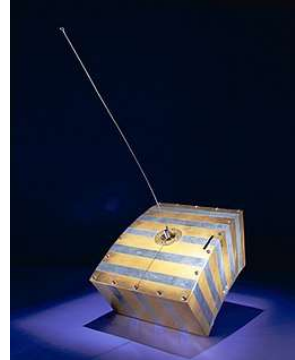
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Amateur Satellite Service

Definitions

- Amateur Satellite Service.
 - A radio communications service using amateur radio stations on satellites.



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Amateur Satellite Service

Definitions

- Earth Station.
 - An amateur radio station located on or within 50km of the Earth's surface used for space communications.
- Space Station
 - An amateur radio station located more than 50km above the Earth's surface.
- Space Telecommand station.
 - An amateur radio station that transmits communications to initiate, modify, or terminate the functions of a space station.

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Amateur Satellite Service

Space Telecommand Stations

- Except for the International Space Station (ISS), local control of a space station is not possible.
- Space telecommand stations control the functions of a satellite.
 - Space stations should be protected from unauthorized control.
 - The encryption of commands is permitted.
 - This is an exception to the prohibition on codes & ciphers to obscure meaning.

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Amateur Satellite Service

Satellite Licensing & Frequency Privileges

- Any class amateur radio operator may be the licensee or the control operator of a space station.
 - The control operator must be designated by the station licensee.
 - The control function must be performed on a frequency available to the class of license held by the control operator.

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Amateur Satellite Service

Satellite Licensing & Frequency Privileges

- Any class amateur radio operator may be the control operator of an earth station.
 - Operations must be performed on a frequency available to the class of license held by the earth station operator.

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Amateur Satellite Service

Satellite Licensing & Frequency Privileges

- Satellite operations authorized on
 - Portions of 40m & 20m.
 - 17m, 15m, 12m, & 10m.
 - Portions of 2m, 70cm, & 13cm.
 - Some microwave bands are also available.
- The telecommand system must include the capability to terminate satellite operation.


90

E1D02 -- Which of the following may transmit encrypted messages?

- A. Telecommand signals to terrestrial repeaters
-  B. Telecommand signals from a space telecommand station
- C. Auxiliary relay links carrying repeater audio
- D. Mesh network backbone nodes


91

E1D03 -- What is a space telecommand station?

- A. An amateur station located on the surface of the Earth for communication with other Earth stations by means of Earth satellites
-  B. An amateur station that transmits communications to initiate, modify, or terminate functions of a space station
- C. An amateur station located in a satellite or a balloon more than 50 kilometers above the surface of the Earth
- D. An amateur station that receives telemetry from a satellite or balloon more than 50 kilometers above the surface of the Earth


92

E1D07 -- Which of the following HF amateur bands include allocations for space stations?

-  A. 40 meters, 20 meters, 15 meters, and 10 meters
- B. 30 meters, 17 meters, and 10 meters
- C. Only 10 meters
- D. Satellite operation is permitted on all HF bands


93

E1D08 -- Which VHF amateur bands have frequencies authorized for space stations?

- A. 6 meters and 2 meters
- B. 6 meters, 2 meters, and 1.25 meters
- C. 2 meters and 1.25 meters
-  D. 2 meters


94

E1D09 -- Which UHF amateur bands have frequencies authorized for space stations?

- A. 70 centimeters only
-  B. 70 centimeters and 13 centimeters
- C. 70 centimeters and 33 centimeters
- D. 33 centimeters and 13 centimeters

95

E1D10 -- Which amateur stations are eligible to be telecommand stations of space stations, subject to the privileges of the class of operator license held by the control operator of the station?

- A. Any amateur station approved by AMSAT
-  B. Any amateur station so designated by the space station licensee
- C. Any amateur station so designated by the ITU
- D. All these choices are correct

96

E1D11 -- Which amateur stations are eligible to operate as Earth stations?

- A. Any amateur licensee who has successfully completed the AMSAT space communications course
- B. Only those of General, Advanced or Amateur Extra class operators
- C. Only those of Amateur Extra class operators
- ➔ D. Any amateur station, subject to the privileges of the class of operator license held by the control operator

97



Volunteer Examiner Program

The Volunteer Examiner Coordinator (VEC)

- An organization that has signed an agreement with the FCC to coordinate amateur radio examinations.
 - Accredits Volunteer Examiners (VEs).
 - Coordinates exam sessions.
 - Maintains records of all exam sessions, including passes & failures.
 - Forwards successful applications to the FCC for processing.

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Volunteer Examiner Program

The Volunteer Examiner (VE)

- A licensed amateur radio operator accredited by a VEC to administer exams.
 - A team of at least 3 VEs is required to administer an exam.



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Volunteer Examiner Program

Accreditation

- The process by which the coordinating VEC determines that an individual is qualified and authorized to serve as a VE.
 - To be accredited as a VE, an individual must:
 - Be at least 18 years of age.
 - Never had their amateur radio license suspended or revoked.
 - Hold an amateur radio operator license of the appropriate class for the elements to be prepared or administered.
 - General, Advanced, or Amateur Extra.

100



Volunteer Examiner Program

Exam Preparation

- The FCC requires all of the VECs to cooperate in maintaining the question pool for each exam element.
 - National Conference of Volunteer Examiner Coordinators (NCVEC)
 - Question Pool Committee (QPC).
 - Question pools are reviewed & revised on a 4-year cycle.

101



Volunteer Examiner Program

Exam Preparation

- Each VEC coordinates the preparation of exams for use by their VE teams.
 - Some VECs provide pre-printed exams.
 - Some VECs provide software that is used to generate the exams.
 - Some VECs allow their teams to manually prepare their own exams using the question pools.

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Volunteer Examiner Program

Exam Preparation

- Each question pool is divided into sections.
 - The section is indicated by the first 3 characters of the question number.
 - The Technician & General question pools each have 35 sections.
 - The Amateur Extra question pool has 50 sections.
- An exam will consist of one question from each section of the question pool.

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Volunteer Examiner Program

Exam Preparation

- Who can prepare an exam element?

VE License Class	Element 2 (Technician)	Element 3 (General)	Element 4 (Extra)
Extra	X	X	X
Advanced	X	X	
General	X		

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Volunteer Examiner Program

Exam Session Administration

- All exam sessions must be coordinated by a VEC.
- All exam sessions must be administered by a team of at least 3 VEs who are accredited by the coordinating VEC.
- The VE team determines when & where examinations will be held.

105



Volunteer Examiner Program

Exam Session Administration

- Who can administer an exam element?

VE License Class	Element 2 (Technician)	Element 3 (General)	Element 4 (Extra)
Extra	X	X	X
Advanced	X	X	
General	X		

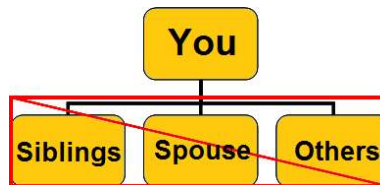
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Volunteer Examiner Program

Exam Session Administration

§97.511(d) -- No VE may administer an examination to his or her spouse, children, grandchildren, stepchildren, parents, grandparents, stepparents, brothers, sisters, stepbrothers, stepsisters, aunts, uncles, nieces, nephews, and in-laws.



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Volunteer Examiner Program

Exam Session Administration

- VECs & VEs may not receive compensation of any kind for their services.
 - The coordinating VEC and the VE team members may be reimbursed by the applicants for certain out-of-pocket expenses related to preparing, processing, administering, and coordinating an examination for an amateur radio license.
 - Any reimbursement is accomplished by means of test fees.

108



Volunteer Examiner Program

Exam Session Administration

- Test Fees
 - A VEC may choose to collect a test fee from the applicants or not.
 - Currently ARRL-VEC charges a fee of \$15.
 - Currently W5YI-VEC charges a fee of \$14.
 - Laurel VEC has never charged a test fee.

109



Volunteer Examiner Program

Exam Session Administration

- During the exam.
 - Each VE on the team is individually responsible for the proper administration & supervision of the exam session.



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Volunteer Examiner Program

Exam Session Administration

- During the exam.
 - All 3 VEs responsible for supervising a candidate taking an exam element **MUST** be **present** & **observing** the candidate during the **entire** time that element is being taken.
 - When it is not possible for the VEs to be present at the examination site, the FCC Rules allow exams to be administered remotely as long as a real-time video link connects the administering VEs with the remote location.
 - Not all VECs allow remote testing.

111



Volunteer Examiner Program

Exam Session Administration

- During the exam.
 - Candidates **MUST** follow all instructions given to them by the VEs.
 - Any candidate failing to comply will have their examination immediately terminated.

112



Volunteer Examiner Program

Exam Session Administration

- During the exam.
 - When an applicant completes an examination, the VE team collects & immediately grades the completed test papers.
 - The VE team immediately informs the applicant of their grade & whether they passed or failed.
 - Some VECs allow the VE team to only report the number of questions answered correctly/incorrectly to the applicant.
 - Some VECs encourage the VE team to review with the applicant any questions missed (if time permits).

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Volunteer Examiner Program

Exam Session Administration

- During the exam.
 - A grade of 74% or greater is required to pass.

Element Nr	License Class	Nr of Questions	Minimum Nr Right	Maximum Nr Wrong
2	Technician	35	26	9
3	General	35	26	9
4	Extra	50	37	13

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Volunteer Examiner Program

Exam Session Administration

- When an applicant passes an application, the VE team will issue a Certificate of Successful Completion of Examination (CSCE).
 - The CSCE will indicate what elements were passed and what class license (if any) the applicant is qualified for.
- When an applicant fails an exam and does not earn a new or upgraded license, the VE team **MUST** return the application form to the applicant.

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Volunteer Examiner Program

Exam Session Administration

- Each VEC has their own unique design CSCE.
 - A CSCE issued by any VEC is accepted by all other VECs.
 - A CSCE is authorization to operate with new privileges.
 - A CSCE is valid for 365 days.

[illegible][illegible]

116



Volunteer Examiner Program

Exam Session Administration

- The FCC can re-administer any exam element to any licensee.
 - FCC can designate a VEC to re-administer the exam.
 - Licensee **MUST** appear or their license will be cancelled or amended.
- If the FCC determines that a VE fraudulently administered or certified an exam, his/her station license can be revoked and/or operator license suspended.

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Volunteer Examiner Program

Exam Session Administration

- After the exam.
 - The VE team forwards all session paperwork and test results to the VEC.
 - The VEC reviews the paperwork & forwards the information on successful candidates to the FCC for processing.


118

E1E01 -- For which types of out-of-pocket expenses do the Part 97 rules state that VEs and VECs may be reimbursed?

-  A. Preparing, processing, administering, and coordinating an examination for an amateur radio operator license
- B. Teaching an amateur operator license examination preparation course
- C. No expenses are authorized for reimbursement
- D. Providing amateur operator license examination preparation training materials


119

E1E02 -- Who is tasked by Part 97 with maintaining the pools of questions for all US amateur license examinations?

- A. The VEs
- B. The FCC
-  C. The VECs
- D. The ARRL


120

E1E03 -- What is a Volunteer Examiner Coordinator?

- A. A person who has volunteered to administer amateur operator license examinations
- B. An organization paid by the volunteer examiner team to publicize and schedule examinations
-  C. An organization that has entered into an agreement with the FCC to coordinate, prepare, and administer amateur operator license examinations
- D. The person who has entered into an agreement with the FCC to be the VE session manager


121

E1E04 -- What is required to be accredited as a Volunteer Examiner?

- A. Each General, Advanced and Amateur Extra class operator is automatically accredited as a VE when the license is granted
- B. The amateur operator applying must pass a VE examination administered by the FCC Enforcement Bureau
- C. The prospective VE must obtain accreditation from the FCC
-  D. A VEC must confirm that the VE applicant meets FCC requirements to serve as an examiner


122

E1E05 -- What must the VE team do with the application form if the examinee does not pass the exam?

- A. Maintain the application form with the VEC s records
-  B. Return the application document to the examinee
- C. Send the application form to the FCC and inform the FCC of the grade
- D. Destroy the application form


123

E1E06 -- Who is responsible for the proper conduct and necessary supervision during an amateur operator license examination session?

- A. The VEC coordinating the session
- B. The designated monitoring VE
-  C. Each administering VE
- D. Only the VE session manager


124

E1E07 -- What should a VE do if a candidate fails to comply with the examiner's instructions during an amateur operator license examination?

- A. Warn the candidate that continued failure to comply will result in termination of the examination
-  B. Immediately terminate the candidate's examination
- C. Allow the candidate to complete the examination, but invalidate the results
- D. Immediately terminate everyone's examination and close the session


125

E1E08 -- To which of the following examinees may a VE not administer an examination?

- A. Employees of the VE
- B. Friends of the VE
-  C. Relatives of the VE as listed in the FCC rules
- D. All of these choices are correct


126

E1E09 -- What may be the penalty for a VE who fraudulently administers or certifies an examination?

-  A. Revocation of the VE's amateur station license grant and the suspension of the VE's amateur operator license grant
- B. A fine of up to \$1,000 per occurrence
- C. A sentence of up to one year in prison
- D. All these choices are correct

127

E1E10 -- What must the administering VEs do after the administration of a successful examination for an amateur operator license?

- A. They must collect and send the documents directly to the FCC
- B. They must collect and submit the documents to the coordinating VEC for grading
-  C. They must submit the application document to the coordinating VEC according to the coordinating VEC instructions
- D. They must return the documents to the applicant for submission to the FCC according to the FCC instructions

128

E1E11 -- What must the VE team do if an examinee scores a passing grade on all examination elements needed for an upgrade or new license?

- A. Photocopy all examination documents and forward them to the FCC for processing
- B. Three VEs must certify that the examinee is qualified for the license grant and that they have complied with the administering VE requirements
- C. Issue the examinee the new or upgrade license
- D. All these choices are correct

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Miscellaneous Rules

Auxiliary Stations

- An auxiliary station is an amateur station transmitting communications point-to-point within a system of cooperating amateur stations.
 - Remote control.
 - Split-site repeaters.
 - Hand-held to mobile "cross-band repeater".

130



Miscellaneous Rules

Auxiliary Stations

- Auxiliary stations are authorized to transmit one-way communications.
- Authorized the same frequencies as repeater stations except no 10m or 6m operations.
- Any class operator license except Novice can be the control operator of an auxiliary station.

131

E1F10 -- Who may be the control operator of an auxiliary station?

- A. Any licensed amateur operator
- ➔ B. Only Technician, General, Advanced, or Amateur Extra Class operators
- C. Only General, Advanced, or Amateur Extra Class operators
- D. Only Amateur Extra Class operators

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Miscellaneous Rules

External Power Amplifiers

- Amplifiers below 144 MHz may require FCC certification before they can be marketed.
 - Must meet spurious emission standards at full power output or 1500 Watts, whichever is less.
 - Must have a maximum gain of 15 dB.
 - Must have no gain between 26 MHz and 28 MHz.

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Miscellaneous Rules

External Power Amplifiers

- Any amateur may build or modify an amplifier for their own personal use without certification.
- Dealer may sell an uncertified amplifier **ONLY** if purchased from an amateur in used condition & sold to another amateur for use in their personal station.


134

E1F03 -- Under what circumstances may a dealer sell an external RF power amplifier capable of operation below 144 MHz if it has not been granted FCC certification?

- A. Gain is less than 23 dB when driven by power of 10 watts or less
- B. The equipment dealer assembled it from a kit
- C. It was manufactured and certificated in a country which has a reciprocal certification agreement with the FCC
-  D. The amplifier is constructed or modified by an amateur radio operator for use at an amateur station

135

E1F11 -- Which of the following best describes one of the standards that must be met by an external RF power amplifier if it is to qualify for a grant of FCC certification?

- A. It must produce full legal output when driven by not more than 5 watts of mean RF input power
- B. It must have received an Underwriters Laboratory certification for electrical safety as well as having met IEEE standard 14.101(B)
- C. It must exhibit a gain of less than 23 dB when driven by 10 watts or less
-  D. It must satisfy the FCC's spurious emission standards when operated at the lesser of 1500 watts or its full output power

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Miscellaneous Rules

70 cm Band Restrictions

- 1965 US-Canada Agreement -- A, B, C, & D lines.



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Miscellaneous Rules

70 cm Band Restrictions

- Line A is a line roughly parallel to and 50 miles south of the US-Canada border.
- Line C is a line roughly parallel to and 50 miles west of the Alaska-Canada border.
- No transmissions allowed between 420 MHz and 430 MHz north of line A or east of line C.

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Miscellaneous Rules

70 cm Band Restrictions

- Frequencies in the range of 421 MHz to 430 MHz are allocated to the Land Mobile Service (LMS) in certain metropolitan areas.
 - Buffalo, NY.
 - Cleveland, OH.
 - Detroit, MI.
- Amateurs must not cause interference to LMS stations within 50 miles of these locations.

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Miscellaneous Rules

70 cm Band Restrictions

- The US Military has an increasing number of radar installations operating in the 70 cm band.
- Amateur stations must cease operations or change frequencies to avoid interfering with these installations.
 - Many 70 cm repeaters have had to change frequencies.


140

E1B04 -- What must the control operator of a repeater operating in the 70-centimeter band do if a radiolocation system experiences interference from that repeater?

- A. Reduce the repeater antenna HAAT (Height Above Average Terrain)
- B. File an FAA NOTAM (Notice to Air Missions) with the repeater system's ERP, call sign, and six-character grid locator
-  C. Cease operation or make changes to the repeater that mitigate the interference
- D. All these choices are correct

141

E1F04 -- Which of the following geographic descriptions approximately describes "Line A"?

-  A. A line roughly parallel to and south of the border between the US and Canada
- B. A line roughly parallel to and west of the U.S. Atlantic coastline
- C. A line roughly parallel to and north of the border between the US and Mexico
- D. A line roughly parallel to and east of the US Pacific coastline

142

E1F05 -- Amateur stations may not transmit in which of the following frequency segments if they are located in the contiguous 48 states and north of Line A?

- A. 440 MHz - 450 MHz
- B. 53 MHz - 54 MHz
- C. 222 MHz - 223 MHz
- ➔ D. 420 MHz - 430 MHz

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Miscellaneous Rules

National Quiet Zones

- National Radio Quiet Zone (NRQZ).
 - Area in portions of Maryland, Virginia, & West Virginia near the National Radio Astronomy Observatory in Green Bank, WV, & also near the Naval Research Laboratory at Sugar Grove, WV.
 - Must get permission from the National Radio Astronomy Observatory before operating an automatically-controlled beacon.
 - Details in §97.121.

144



Station Restrictions

National Quiet Zones

- Additional restrictions in certain other geographic locations.
 - e.g. - White Sands, NM

145

E1B05 -- What is the National Radio Quiet Zone?

- A. An area surrounding the FCC monitoring station in Laurel, Maryland
- B. An area in New Mexico surrounding the White Sands Test Area
- ➔ C. An area surrounding the National Radio Astronomy Observatory
- D. An area in Florida surrounding Cape Canaveral

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Miscellaneous Rules

Business Payment and Rebroadcasting

- You **CANNOT**
 - Accept payment for communications services.
 - Exception #1 – Control operator of a club station sending regularly-scheduled amateur radio bulletins or code practice.
 - Must send bulletins or code practice at least 40 hours per week.
 - Must transmit on at least 6 MF or HF bands.
 - Operating schedule must be published at least 30 days in advance.
 - Exception #2 – School teacher operating incidental to classroom instruction.

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Miscellaneous Rules

Business Payment and Rebroadcasting

- You **CANNOT**
 - Use amateur radio for you or your employer's business.
 - Exception – You **CAN** operate on behalf of your employer in support of an emergency preparedness or disaster readiness test or drill.
 - Tests cannot be more than 1 hour per week.
 - Not more than twice a year, a test can last up to 72 hours.
 - Time limits do not apply to government-sponsored tests or drills.

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Miscellaneous Rules

Business Payment and Rebroadcasting

- You **CAN** send message to a business **IF** neither you nor your employer has a pecuniary interest in the communications.
- You can send messages to a foreign country **ONLY** if of a personal nature or incidental to purposes of amateur radio. **Therefore, no business communications of any type.**

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Miscellaneous Rules

Business Payment and Rebroadcasting

- You cannot rebroadcast transmissions of any non-amateur station using automatic control.
- You cannot routinely rebroadcast propagation bulletins or weather forecasts from non-amateur stations.
 - The occasional rebroadcast of weather and propagation forecasts is permitted in support of an exercise or other operating activity.


150

E1C02 -- Which of the following apply to communications transmitted to amateur stations in foreign countries?

- A. Third party traffic must be limited to that intended for the exclusive use of government and non-Government Organization (NGOs) involved in emergency relief activities
- B. All transmissions must be in English
-  C. Communications must be limited to those incidental to the purpose of the amateur service and remarks of a personal nature
- D. All these choices are correct

151

E1F07 -- When may an amateur station send a message to a business?

- A. When the pecuniary interest of the amateur or his or her employer is less than \$25
- B. When the pecuniary interest of the amateur or his or her employer is less than \$50
- C. At no time
-  D. When neither the amateur nor their employer has a pecuniary interest in the communications

152

E1F08 -- Which of the following types of amateur station communications are prohibited?

- A. Communications transmitted for hire or material compensation, except as otherwise provided in the rules
- B. Communications that have a political content, except as allowed by the Fairness Doctrine
- C. Communications that have a religious content
- D. Communications in a language other than English

153



Miscellaneous Rules

Spread Spectrum Operation

- A transmission technique that spreads the signal over a wide bandwidth.
 - a.k.a. – Bandwidth-expansion modulation.
- Spreading a little power over a wide bandwidth minimizes interference.

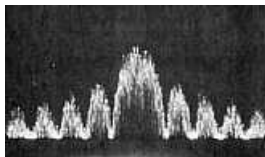
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Miscellaneous Rules

Spread Spectrum Operation

- Direct Sequence modulates carrier with high-speed code sequence.
- Frequency Hopping changes frequency in step with a code sequence.



Direct Sequence
Spread Spectrum Signal



Frequency Hopping
Spread Spectrum Signal

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Miscellaneous Rules

Spread Spectrum Operation

- Only above 222 MHz.
- Maximum power 10 Watts PEP.
- Can communicate with stations located in:
 - Any area regulated by the FCC.
 - Any nation which allows spread spectrum operation.
- Must not be used to obscure the meaning of the communications.

156

E1F01 -- On what frequencies are spread spectrum transmissions permitted?

- A. Only on amateur frequencies above 50 MHz
- ➔ B. Only on amateur frequencies above 222 MHz
- C. Only on amateur frequencies above 420 MHz
- D. Only on amateur frequencies above 144 MHz

157



Miscellaneous Rules

Non-US Operating Agreements

- European Conference of Postal and Telecommunications Administrations (CEPT)
 - Allows US amateurs to operate in most European countries and their overseas territories.
- Must have in their possession:
 - Copy of FCC Public Notice DA 16-1048.
 - Proof of US citizenship.
 - Evidence of FCC license grant.

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Miscellaneous Rules

Non-US Operating Agreements

- International Amateur Radio Permit
 - Allows US amateurs to operate in some Central American & South American countries.

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Miscellaneous Rules

Non-US Operating Agreements

- ITU Reciprocal Permit
 - An agreement between the US and a country that does not participate in either CEPT or IARP.

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Miscellaneous Rules

Non-US Operating Agreements

- Foreign amateurs operating in the US will have Extra class privileges if they hold a full-privilege license in their home country.
 - Privileges will not exceed those available to U.S. Amateur Extra Class licensees.


161

E1C04 -- What is an IARP?

- ➔ A. A permit that allows US amateurs to operate in certain countries of the Americas
- B. The internal amateur radio practices policy of the FCC
- C. An indication of increased antenna reflected power
- D. A forecast of intermittent aurora radio propagation


162

E1C06 -- Which of the following is required in order to operate in accordance with CEPT rules in foreign countries where permitted?

- A. You must identify in the official language of the country in which you are operating
- B. The U.S. embassy must approve of your operation
-  C. You must bring a copy of FCC Public Notice DA 16-1048
- D. You must append "/CEPT" to your call sign

163

E1C11 -- Which of the following operating arrangements allows an FCC-licensed US citizen to operate in many European countries, and amateurs from many European countries to operate in the US?

-  A. CEPT
- B. IARP
- C. ITU reciprocal license
- D. All these choices are correct

164

E1F02 -- What privileges are authorized in the US to persons holding an amateur service license granted by the government of Canada?

- A. None, they must obtain a US license
- B. Full privileges of the General class license on the 80-, 40-, 20-, 15-, and 10-meter bands
- C. The operating terms and conditions of the Canadian amateur service license, not to exceed US Amateur Extra class license privileges
- D. Full privileges, up to and including those of the Amateur Extra class license, on the 80-, 40-, 20-, 15-, and 10-meter bands

165



Miscellaneous Rules

Special Temporary Authority (STA)

- Temporary permission to use modes or frequencies not normally allowed by the FCC Rules & Regulations.
- Provides authorization for experimental communications for a limited period of time, normally less than 6 months.

166

E1F06 -- Under what circumstances might the FCC issue a Special Temporary Authority (STA) to an amateur station?

- ➔ A. To provide for experimental amateur communications
- B. To allow use of a special event call sign
- C. To allow a VE group with less than three VEs to administer examinations in a remote, sparsely populated area
- D. To allow a licensee who has passed an upgrade exam to operate with upgraded privileges while waiting for posting on the FCC database

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Questions?



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Amateur Extra Class

Next Week

Chapter 4

Electrical Principles