
Lesson 4: Frequencies & Privileges

Preparation for Amateur Radio Technician Class Exam

Topics

- Frequency limits
- Frequencies and Wavelengths
- Band Sharing
- Operating Guidelines
- Emission Types
- Technician Frequency Privileges
- Exam Questions for this section

Reading

- Chapter 1 – 1.14-1.16, 1.18-1.21
- Chapter 2 – 2.5-2.9

Review questions

- What is the ITU and what do they do?
- What ITU region is the USA in?
- What is a radio frequency?
- What is a frequency band?
- What are the four license classes in the USA?

Frequency Limits

- When operating in ITU Region 2, we are limited to certain frequencies of certain bands, according to license class
 - Some frequencies are in the VHF band
 - Some frequencies are in the UHF band
 - VHF = very high frequency
 - UHF = ultra high frequency
- Remember:
 - A shorter wavelength equals a higher frequency
 - Longer wavelengths travel further
 - This is why the 2 meter band is so popular – it is almost the longest wavelength a Technician can use

VHF Frequency Limits

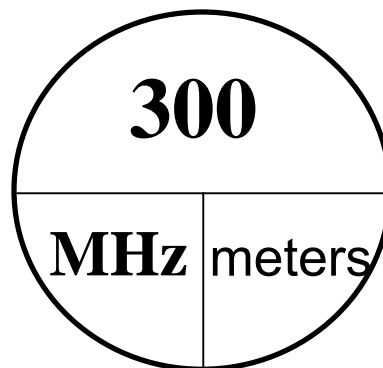
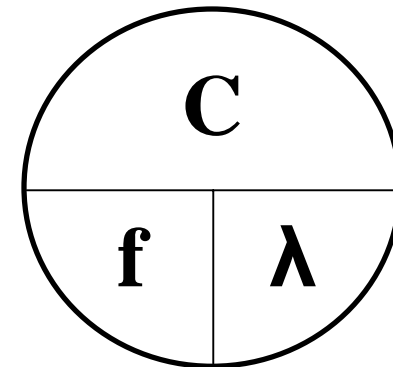
VHF Band	Frequency limits
6 meter	50-54 MHz
2 meters	144-148 MHz
1.25 meters	219-220 MHz
1.25 meters	222-225 MHz

UHF Frequency Limits

UHF Band	Frequency limits
70 centimeters	420-450 MHz
33 centimeters	902-928 MHz
23 centimeters	1240-1300 MHz
13 centimeters	2300-2310 MHz
13 centimeters	2390-2450 MHz

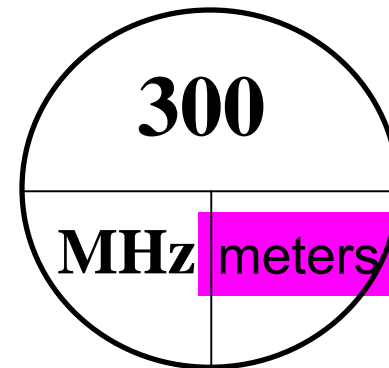
Frequencies and Wavelengths

- Remember: Frequency and wavelength are related by this formula:
 - Speed of light (m/s) = frequency (Hz) X wavelength (m)
 - $C = f \lambda$
- Speed of light =
 - 300,000,000 meters per second
 - 300×10^6 m/s
- Megahertz =
 - Hertz $\times 10^6$



Frequencies and Wavelengths

- So given a frequency, we can find the wavelength band it belongs to
- Cover the cell for the quantity you don't know (wavelength or meters):
- This tells us that to find the wavelength, we divide speed of light by frequency



Frequencies and Wavelengths

- 28.4 MHz is what wavelength?
 - $300 / 28.4 \text{ MHz} = \text{wavelength}$
 - $300 / 28.4 = 10.56 \text{ meters}$
- What is the ham radio band for that wavelength?
 - 10 meters

Frequencies and Wavelengths

- 283.50 MHz is what wavelength?
 - $300 / 283.5 \text{ MHz} = \text{wavelength}$
 - $300 / 283.5 = 1.058 \text{ meters}$
- What is the ham radio band for that wavelength?
 - 1.25 meters (because that is the closest band; there isn't a 1 meter band)

Band Sharing

- Some of the amateur radio bands are allocated exclusively for amateur radio
 - No one else may use that band
- Other bands are shared
 - A shared band has a primary service and a secondary service
 - A secondary service must not cause harmful interference to, and must accept interference from, stations in a primary service

Band Sharing

- For example, if you cause interference to a radiolocation service outside the US – a primary user of their frequency – you must stop transmitting on that frequency or take other steps to avoid the interference
- On the other hand, all hams have equal rights to the amateur radio bands
 - Higher classes of license grant you rights to more bands, but you still have to share equally with all other ham radio operators

Band Sharing

- All UHF bands and bands with higher frequencies have sharing arrangements
 - If you want to use these frequencies, check the ARRL FCC rule book to be sure you are operating legally
- For example, one rule says that “No amateur station shall transmit north of Line A in the 420-430 MHz segment.”
 - This is in the 70 centimeter band
 - Line A starts about 50 miles south of the Canada/ US border

Operating Guidelines

➤ Review:

- You may talk to all amateur stations at any time, unless prohibited by either government
- A reciprocal operating authority allows you to operate your radio in another country

Operating Guidelines

- In an emergency – communication needs in connection with the immediate safety of human life and immediate protection of property when normal communications systems are not available – you can do anything you need to do to communicate
 - This includes:
 - Operating on bands that you do not normally have access to because of your class of license
 - Frequencies outside the amateur bands
 - Communicating with other radio services – police, fire, civil defense, etc.
- Just be sure it is really an emergency!

Operating Guidelines

- You may not broadcast communications
 - Broadcasting means transmission of information intended for reception of the general public
- The only one-way communications allowed are with beacon or radio control operation, such as:
 - Controlling model craft
 - Adjusting a repeater remotely
 - Also, the broadcast of Morse Code practice is allowed
- You may not transmit music of any form
 - Unless you have permission to rebroadcast space shuttle transmissions that include incidental music

Operating Guidelines

- You may not use obscene or indecent language
- You may not use codes or ciphers to obscure meaning
- You may not cause harmful interference to other communications of any type
- You may not transmit false or deceptive signals

Operating Guidelines

- Communications must be non-commercial
 - Personal communications only, without business reasons
 - You may not accept any kind of compensation for the use of your station at any time, including passing messages for third parties
- Exceptions:
 - You may notify other hams about the sale of ham gear using your radio
 - Teachers may use amateur radios in the classroom as part of their classroom instruction
 - You may call for pizza or to get a tow-truck when your car breaks down

Operating Guidelines

- You must identify all of your communications with your call sign, with these exceptions:
 - When controlling model craft
 - When sent from a space station
- Except for these cases, unidentified communications are not allowed

Emission Types

- An emission is any RF signal from a transmitter
- There are a number of emission types defined by the FCC
 - **CW** Pulse
 - **Data** RTTY
 - **Image** SS
 - **MCW** Test
 - **Phone**

Emission Types

- CW = Morse Code
- Data = telemetry, telecommand, computer
- Image = Television, fax
- Phone = voice

Emission Types

- A steady radio frequency signal is unmodulated
 - It is called a test emission
 - It conveys no information
- To convey information, we have to modulate the signal
 - A transmitter combines a radio signal with some kind of information signal
 - The signals are later split apart by the receiver (demodulated)

Emission Types

➤ CW

- The simplest modulation
- On/off signals in a pattern
- On can be long (dah) or short (dit)

- Geri = dah dah dit dit dit dah dit dit dit

- - . . . - . . .

Emission Types

➤ There are several phone (voice) transmissions:

- AM, SSB, FM

➤ AM

- Amplitude Modulation
- It is as if two copies of the signal are produced
 - One above the carrier frequency – upper sideband
 - One below the carrier frequency – lower sideband

Emission Types

➤ SSB

- In single-side band, we split the AM signal in two and just broadcast one side of it, without the carrier
 - This saves a lot of bandwidth!
- By convention, amateurs use:
 - Upper sideband for 10-meter phone operation
 - Upper sideband on VHF and UHF bands

Emission Types

➤ FM

- Frequency Modulation
- FM phone is the most common mode used by Technician class radio operators
- Almost all VHF and UHF repeaters use FM phone
- A good FM phone signal will quiet any background noise, so is called “full quieting”

Emission Types

➤ Packet

- A commonly used data transmission mode
 - Transmitting information between computers using amateur radio as the connection
- Designed as a link between two stations
- When two stations are connected, one station is transmitting to the other, and the receiving station acknowledges receipt of the data

Technician Frequency Privileges

- 50 MHz and up – all privileges on all frequencies allocated to the amateur service
 - That is 6 meter and above (shorter wavelengths), or in the VHF, UHF, and microwave bands
 - You are allowed up to 1500 watts PEP on these bands
- See page 2.6 in the book for a lot more details!
For example:
 - Point-to-point digital message forwarding is allowed in 219 MHz - 220 MHz frequency range

Technician Frequency Privileges

- Technicians with Morse Code credit get a few extra privileges in the HF bands (10 meter and below), but only at 200 watts PEP output
- For example:
 - 80-meter band in ITU Region 2, 3675 - 3725 kHz, CW only
 - 10-meter band in ITU Region 2, 28.100 - 28.500 MHz, varies depending on frequency
 - 10-meter band, 28.3 to 28.5 MHz, CW and single-sideband phone
 - 7100 to 7150 kHz in ITU Region 2, CW only

Exam Questions

- The following slides contain questions from the exam pool that are covered in this section of the notes

T1B01

- T1B01 What are the frequency limits of the 6-meter band in ITU Region 2?
- A. 52.0 - 54.5 MHz
 - B. 50.0 - 54.0 MHz
 - C. 50.1 - 52.1 MHz
 - D. 50.0 - 56.0 MHz

T1B02

- T1B02 What are the frequency limits of the 2-meter band in ITU Region 2?
- A. 144.0 - 148.0 MHz
 - B. 145.0 - 149.5 MHz
 - C. 144.1 - 146.5 MHz
 - D. 144.0 - 146.0 MHz

T1B03

- T1B03 What are the frequency limits of the 1.25-meter band in ITU Region 2?
- A. 225.0 - 230.5 MHz
 - B. 222.0 - 225.0 MHz
 - C. 224.1 - 225.1 MHz
 - D. 220.0 - 226.0 MHz

T1B04

- T1B04 What are the frequency limits of the 70-centimeter band in ITU Region 2?
- A. 430.0 - 440.0 MHz
 - B. 430.0 - 450.0 MHz
 - C. 420.0 - 450.0 MHz
 - D. 432.0 - 435.0 MHz

T1B05

- T1B05 What are the frequency limits of the 33-centimeter band in ITU Region 2?
- A. 903 - 927 MHz
 - B. 905 - 925 MHz
 - C. 900 - 930 MHz
 - D. 902 - 928 MHz

T1B06

- T1B06 What are the frequency limits of the 23-centimeter band in ITU Region 2?
- A. 1260 - 1270 MHz
 - B. 1240 - 1300 MHz
 - C. 1270 - 1295 MHz
 - D. 1240 - 1246 MHz

T1B07

- T1B07 What are the frequency limits of the 13-centimeter band in ITU Region 2?
- A. 2300 - 2310 MHz and 2390 - 2450 MHz
 - B. 2300 - 2350 MHz and 2400 - 2450 MHz
 - C. 2350 - 2380 MHz and 2390 - 2450 MHz
 - D. 2300 - 2350 MHz and 2380 - 2450 MHz

T1B08

- T1B08 If the FCC rules say that the amateur service is a secondary user of a frequency band, and another service is a primary user, what does this mean?
- A. Nothing special; all users of a frequency band have equal rights to operate
 - B. Amateurs are only allowed to use the frequency band during emergencies
 - C. Amateurs are allowed to use the frequency band only if they do not cause harmful interference to primary users
 - D. Amateurs must increase transmitter power to overcome any interference caused by primary users

T1B09

- T1B09 What rule applies if two amateur stations want to use the same frequency?
 - A. The station operator with a lesser class of license must yield the frequency to a higher-class licensee
 - B. The station operator with a lower power output must yield the frequency to the station with a higher power output
 - C. Both station operators have an equal right to operate on the frequency
 - D. Station operators in ITU Regions 1 and 3 must yield the frequency to stations in ITU Region 2

T1B10

- T1B10 If you are operating on 28.400 MHz, in what amateur band are you operating?
- A. 80 meters
 - B. 40 meters
 - C. 15 meters
 - D. 10 meters

T1B11

- T1B11 If you are operating on 223.50 MHz, in what amateur band are you operating?
- A. 15 meters
 - B. 10 meters
 - C. 2 meters
 - D. 1.25 meters

T1B13

- T1B13 If you are operating FM phone on the 23-cm band and learn that you are interfering with a radiolocation station outside the US, what must you do?
- A. Stop operating or take steps to eliminate this harmful interference
 - B. Nothing, because this band is allocated exclusively to the amateur service
 - C. Establish contact with the radiolocation station and ask them to change frequency
 - D. Change to CW mode, because this would not likely cause interference

T1B15

- T1B15 What are the frequency limits for the amateur radio service for stations located north of Line A in the 70-cm band?
- A. 430 - 450 MHz
 - B. 420 - 450 MHz
 - C. 432 - 450 MHz
 - D. 440 - 450 MHz

T1A04

- T1A04 When is an amateur station authorized to transmit information to the general public?
- A. Never
 - B. Only when the operator is being paid
 - C. Only when the broadcast transmission lasts less than 1 hour
 - D. Only when the broadcast transmission lasts longer than 15 minutes

T1A05

- T1A05 When is an amateur station authorized to transmit music?
- A. Amateurs may not transmit music, except as an incidental part of an authorized rebroadcast of space shuttle communications
 - B. Only when the music produces no spurious emissions
 - C. Only when the music is used to jam an illegal transmission
 - D. Only when the music is above 1280 MHz, and the music is a live performance

T1A06

- T1A06 When is the transmission of codes or ciphers allowed to hide the meaning of a message transmitted by an amateur station?
 - A. Only during contests
 - B. Only during nationally declared emergencies
 - C. Codes and ciphers may not be used to obscure the meaning of a message, although there are special exceptions
 - D. Only when frequencies above 1280 MHz are used

T1A07

- T1A07 Which of the following one-way communications may NOT be transmitted in the amateur service?
- A. Telecommand to model craft
 - B. Broadcasts intended for reception by the general public
 - C. Brief transmissions to make adjustments to the station
 - D. Morse code practice

T1A10

- T1A10 When may false or deceptive signals or communications be transmitted by an amateur station?
 - A. Never
 - B. When operating a beacon transmitter in a "fox hunt" exercise
 - C. When playing a harmless "practical joke"
 - D. When you need to hide the meaning of a message for secrecy

T1A11

- T1A11 When may an amateur station transmit unidentified communications?
- A. Only during brief tests not meant as messages
 - B. Only when they do not interfere with others
 - C. Only when sent from a space station or to control a model craft
 - D. Only during two-way or third-party communications

T1A12

- T1A12 What is an amateur communication called that does NOT have the required station identification?
- A. Unidentified communications or signals
 - B. Reluctance modulation
 - C. Test emission
 - D. Tactical communication

T1A13

- T1A13 What is a transmission called that disturbs other communications?
- A. Interrupted CW
 - B. Harmful interference
 - C. Transponder signals
 - D. Unidentified transmissions

T1A14

- T1A14 What does the term broadcasting mean?
- A. Transmissions intended for reception by the general public, either direct or relayed
 - B. Retransmission by automatic means of programs or signals from non-amateur stations
 - C. One-way radio communications, regardless of purpose or content
 - D. One-way or two-way radio communications between two or more stations

T1A15

- T1A15 Why is indecent and obscene language prohibited in the Amateur Service?
 - A. Because it is offensive to some individuals
 - B. Because young children may intercept amateur communications with readily available receiving equipment
 - C. Because such language is specifically prohibited by FCC Rules
 - D. All of these choices are correct

T1A16

- T1A16 Which of the following is a prohibited amateur radio transmission?
- A. Using an autopatch to seek emergency assistance
 - B. Using an autopatch to pick up business messages
 - C. Using an autopatch to call for a tow truck
 - D. Using an autopatch to call home to say you are running late

T1C09

- T1C09 Under what conditions are amateur stations allowed to communicate with stations operating in other radio services?
 - A. Never; amateur stations are only permitted to communicate with other amateur stations
 - B. When authorized by the FCC or in an emergency
 - C. When communicating with stations in the Citizens Radio Service
 - D. When a commercial broadcast station is using Amateur Radio frequencies for newsgathering during a natural disaster

T5C02

- T5C02 What is one example of one-way communication that Technician class control operators are permitted by FCC rules?
 - A. Transmission for radio control of model craft
 - B. Use of amateur television for surveillance purposes
 - C. Retransmitting National Weather Service broadcasts
 - D. Use of amateur radio as a wireless microphone for a public address system

T2B13

- T2B13 What name does the FCC use for voice emissions?
- A. RTTY
 - B. Data
 - C. CW
 - D. Phone

T2B03

- T2B03 What name does the FCC use for telemetry, telecommand or computer communications emissions?
- A. CW
 - B. Image
 - C. Data
 - D. RTTY

T2B14

- T2B14 What emission privilege is permitted a Technician class operator in the 219 MHz - 220 MHz frequency range?
- A. Slow-scan television
 - B. Point-to-point digital message forwarding
 - C. FM voice
 - D. Fast-scan television

T2B01

- T2B01 What are the frequency limits of the 80-meter band in ITU Region 2 for Technician class licensees who have passed a Morse code exam?
- A. 3500 - 4000 kHz
 - B. 3675 - 3725 kHz
 - C. 7100 - 7150 kHz
 - D. 7000 - 7300 kHz

T2B02

- T2B02 What are the frequency limits of the 10-meter band in ITU Region 2 for Technician class licensees who have passed a Morse code exam?
- A. 28.000 - 28.500 MHz
 - B. 28.100 - 29.500 MHz
 - C. 28.100 - 28.500 MHz
 - D. 29.100 - 29.500 MHz

T2B05

- T2B05 What emission types are Technician control operators who have passed a Morse code exam allowed to use from 7100 to 7150 kHz in ITU Region 2?
- A. CW and data
 - B. Phone
 - C. Data only
 - D. CW only

T2B06

- T2B06 What emission types are Technician control operators who have passed a Morse code exam allowed to use on frequencies from 28.3 to 28.5 MHz?
- A. All authorized amateur emission privileges
 - B. CW and data
 - C. CW and single-sideband phone
 - D. Data and phone

T2B07

- T2B07 What emission types are Technician control operators allowed to use on the amateur 1.25-meter band in ITU Region 2?
- A. Only CW and phone
 - B. Only CW and data
 - C. Only data and phone
 - D. All amateur emission privileges authorized for use on the band

T2B12

- T2B12 What is the most transmitter power a Technician control operator with telegraphy credit may use on the 10-meter band?
- A. 5 watts PEP output
 - B. 25 watts PEP output
 - C. 200 watts PEP output
 - D. 1500 watts PEP output

T2A13

- T2A13 What is the basic principle of radio communications?
- A. A radio wave is combined with an information signal and is transmitted; a receiver separates the two
 - B. A transmitter separates information to be received from a radio wave
 - C. A DC generator combines some type of information into a carrier wave so that it may travel through space
 - D. The peak-to-peak voltage of a transmitter is varied by the sidetone and modulated by the receiver

T2B04

- T2B04 What does "connected" mean in a packet-radio link?
- A. A telephone link is working between two stations
 - B. A message has reached an amateur station for local delivery
 - C. A transmitting station is sending data to only one receiving station; it replies that the data is being received correctly
 - D. A transmitting and receiving station are using a digipeater, so no other contacts can take place until they are finished

T2B08

- T2B08 What term describes the process of combining an information signal with a radio signal?
- A. Superposition
 - B. Modulation
 - C. Demodulation
 - D. Phase-inversion

T2B09

- T2B09 What is the name of the voice emission most used on VHF/UHF repeaters?
- A. Single-sideband phone
 - B. Pulse-modulated phone
 - C. Slow-scan phone
 - D. Frequency-modulated phone

T2B10

- T2B10 What does the term "phone transmissions" usually mean?
- A. The use of telephones to set up an amateur contact
 - B. A phone patch between amateur radio and the telephone system
 - C. AM, FM or SSB voice transmissions by radiotelephony
 - D. Placing the telephone handset near a transceiver's microphone and speaker to relay a telephone call

T2B11

- T2B11 Which sideband is commonly used for 10-meter phone operation?
- A. Upper sideband
 - B. Lower sideband
 - C. Amplitude-compandored sideband
 - D. Double sideband

T2B15

- T2B15 Which sideband is normally used for VHF/UHF SSB communications?
- A. Upper sideband
 - B. Lower sideband
 - C. Double sideband
 - D. Double sideband, suppressed carrier

T2B16

- T2B16 Which of the following descriptions is used to describe a good signal through a repeater?
- A. Full quieting
 - B. Over deviation
 - C. Breaking up
 - D. Readability zero

T2B17

- [T2B17 - THIS QUESTION HAS BEEN FORMALLY WITHDRAWN BY THE QPC. IT WILL NOT BE USED ON TESTS.]