Technician Licensing Class

Station equipment, common transmitter and receiver problems, antenna measurements and troubleshooting, basic repair and testing

T7A - T7D

Valid
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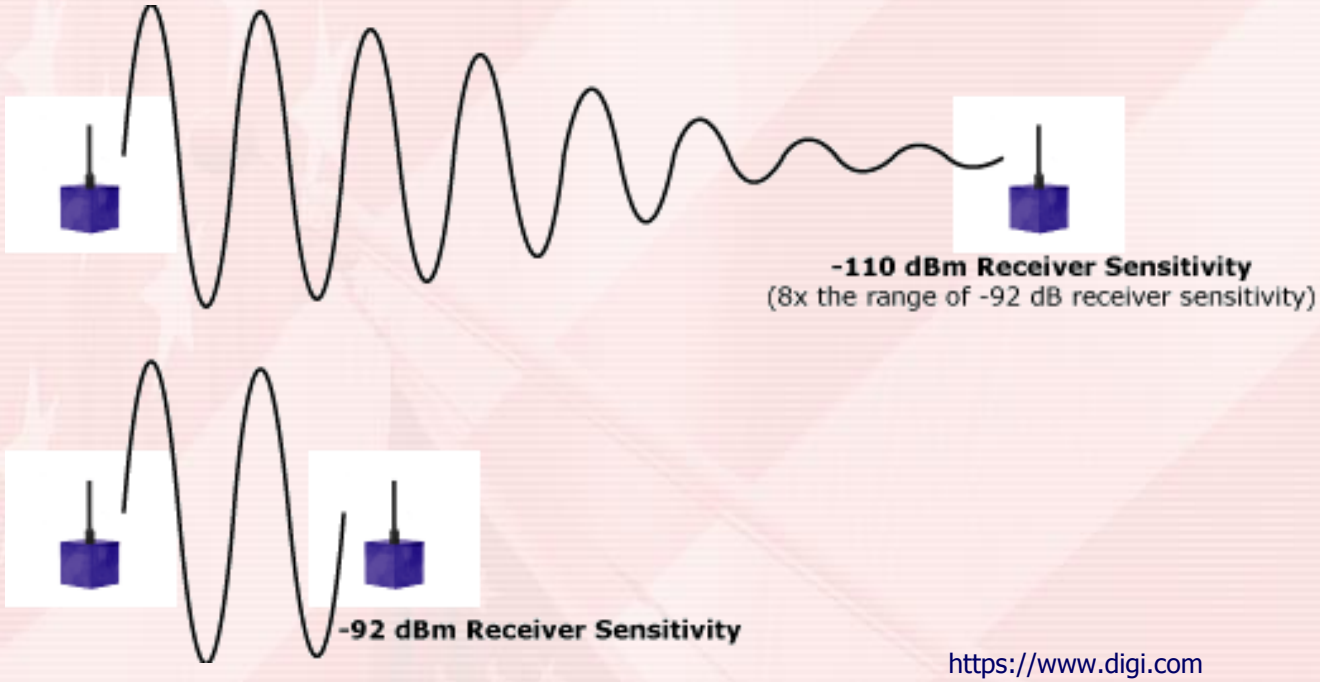
Developed by Bob Bytheway, K3DIO, and
updated to 2018 Question Pool by NQ4K for Sterling Park Amateur Radio Club

T 7 A
Topics

- Station equipment:
  - receivers;
  - transmitters;
  - transceivers;
  - modulation;
  - transverters;
  - transmit and receive amplifiers

T 7 A

- The term **sensitivity** describes the ability of a receiver to detect the presence of a signal. T7A01



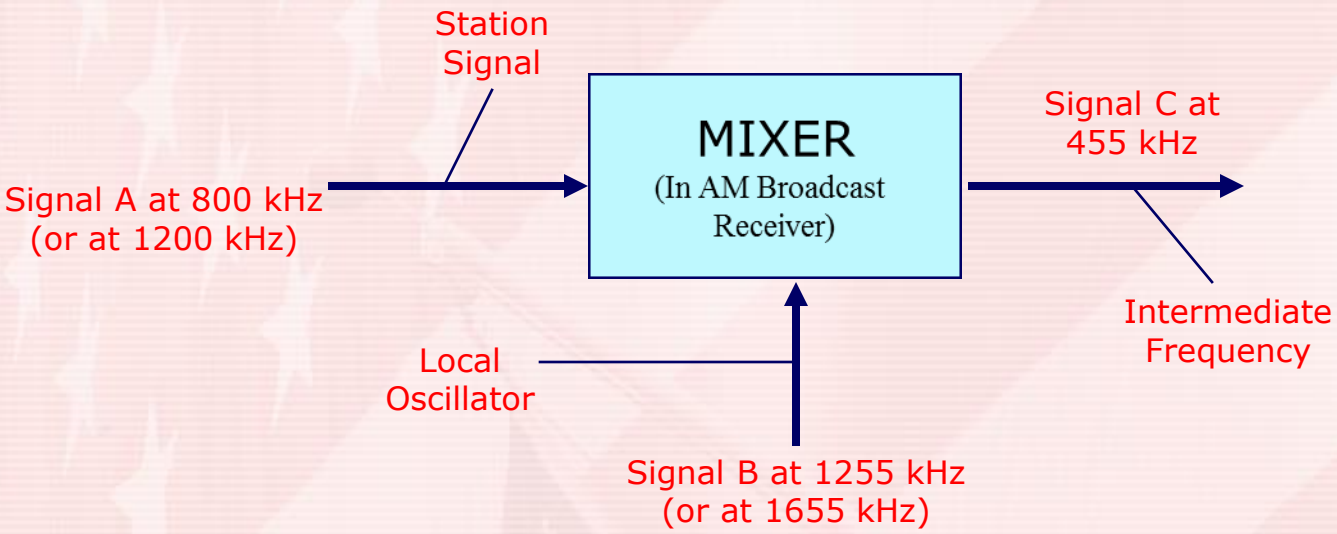
https://www.digi.com

T 7 A

- A **transceiver** is a unit combining the functions of a transmitter and receiver. T7A02

T 7 A

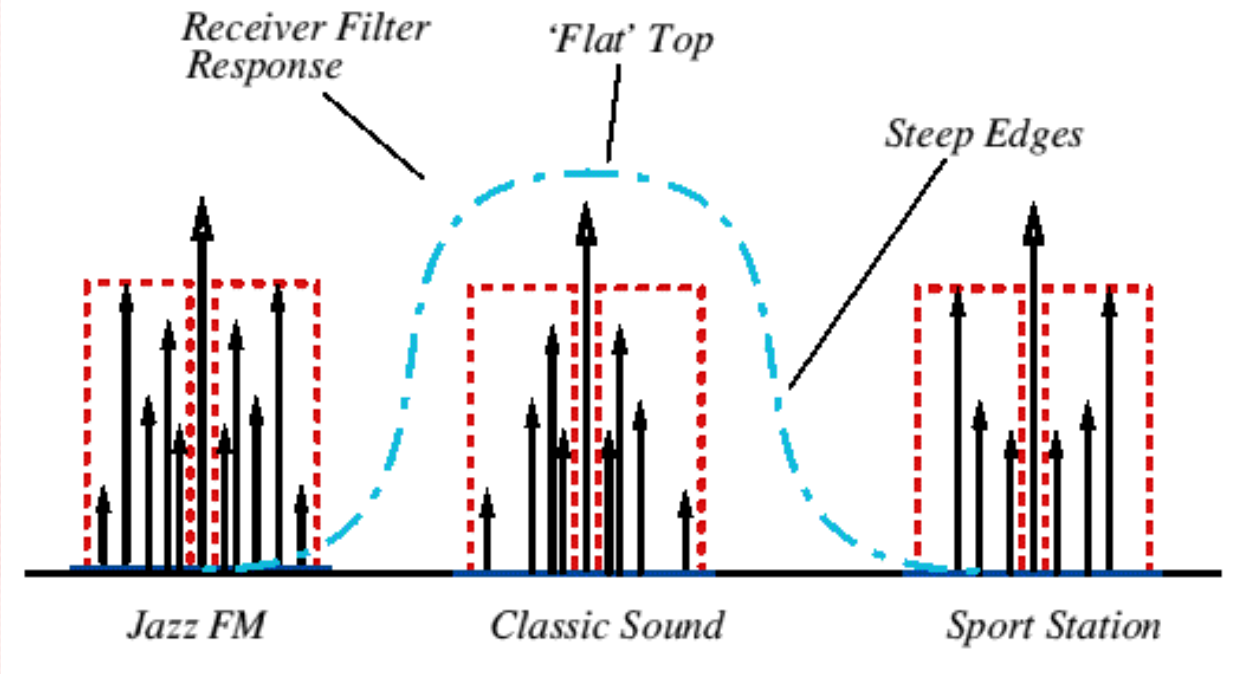
- A **mixer** is used to convert a radio signal from one frequency to another. T7A03



Block Diagram of an AM Broadcast Receiver Mixer

T 7 A

- The term that describes the ability of a receiver to discriminate between multiple signals is called **selectivity**. T7A04



T 7 A

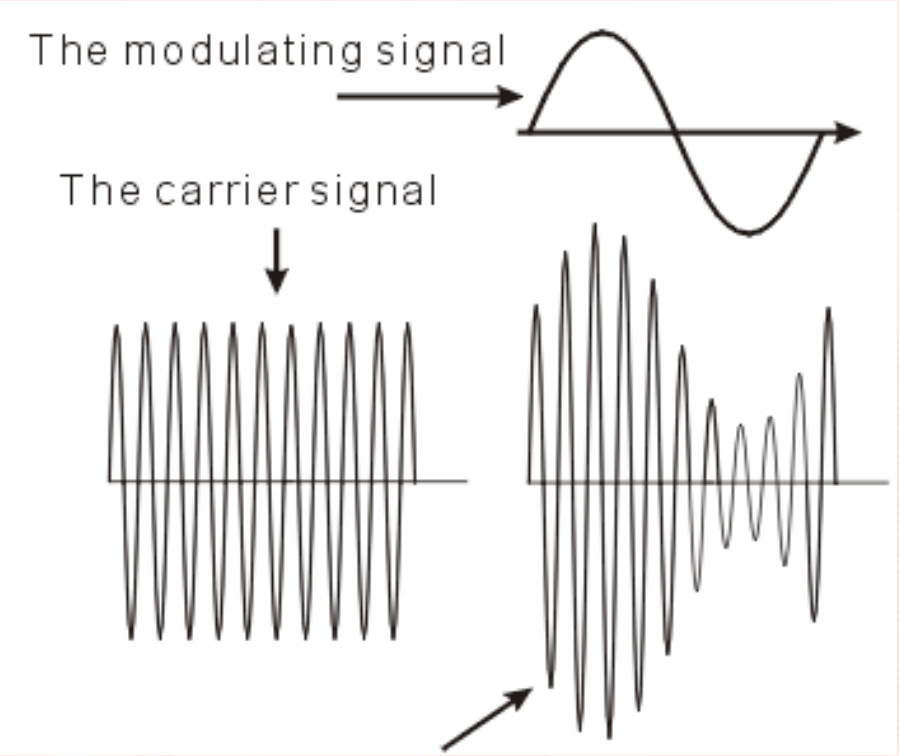
- The name of a circuit that generates a signal of a desired frequency is called an oscillator. T7A05

- A transverter converts the RF input and output of a transceiver to another band. T7A06

- The Push-To-Talk (or PPT) function switches between receive and transmit. T7A07

T 7 A

- Modulation describes combining speech with an RF carrier signal. T7A08

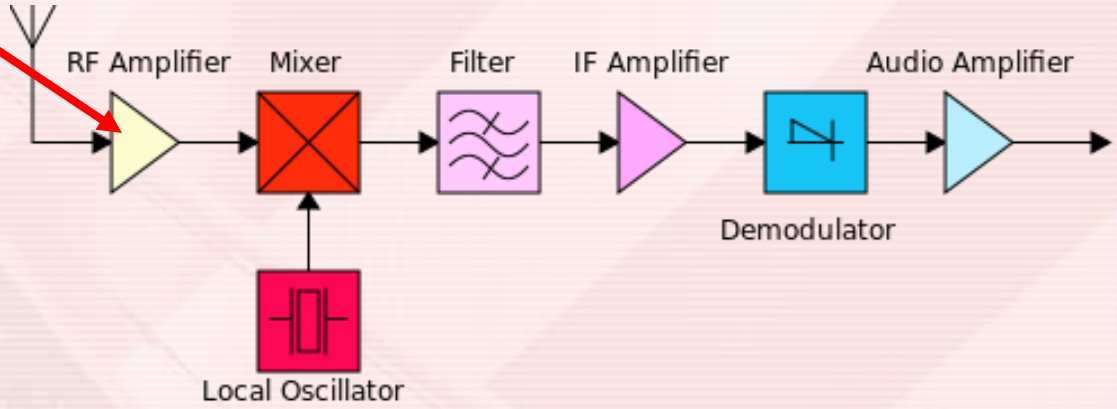


Amplitude-modulated signal

T 7 A

- An RF power amplifier will increase the low-power output from a handheld transceiver. T7A10

- The RF preamplifier is installed between the antenna and the receiver. T7A11



T 7 A

- The SSB/CW-FM switch on a VHF power amplifier sets the amplifier for proper operation in the selected mode.

T7A09

T 7 B
Topics

- Common transmitter and receiver problems:
  - symptoms of overload and overdrive;
  - distortion;
  - causes of interference;
  - interference and consumer electronics;
  - part 15 devices;
  - over-modulation;
  - RF feedback;
  - off frequency signals

T 7 B

- Talk farther away from the microphone if you are told your FM handheld or mobile transceiver is over-deviating. T7B01

- If a broadcast AM or FM radio receives an amateur radio transmission unintentionally, the receiver is unable to reject strong signals from outside the AM or FM band. T7B02

T 7 B

- Causes of radio frequency interference:
  - Fundamental overload;
  - Harmonics;
  - Spurious emissions;
    - All of these choices are correct. T7B03

T 7 B

- To reduce or eliminate interference by an amateur transmitter to a nearby telephone, put a RF filter on the telephone. T7B04

- Overload of a non-amateur radio or TV receiver by an amateur signal can be reduced or eliminated by blocking the amateur signal with a filter at the antenna input of the affected receiver. T7B05

T 7 B

- If a neighbor tells you that your station's transmissions are interfering with their radio or TV reception, make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel. T7B06

- You can reduce overload to a VHF transceiver from a nearby FM broadcast station by using a band-reject filter. T7B07

T 7 B

- If something in a neighbor's home is causing harmful interference to your amateur station:
  - Work with your neighbor to identify the offending device;
  - Politely inform your neighbor about the rules that prohibit the use of devices which cause interference;
  - Check your station and make sure it meets the standards of good amateur practice;
    - ✓ All these choices are correct. T7B08

T 7 B

- A Part 15 device is an unlicensed device that may emit low powered radio signals on frequencies used by a licensed service. T7B09

- Possible problems if you receive a report that your audio signal through the repeater is distorted or unintelligible.
  - Your transmitter may be slightly off frequency;
  - Your batteries may be running low;
  - You could be in a bad location;
    - ✓ All of these choices are correct. T7B10

T 7 B

- Reports of garbled, distorted, or unintelligible voice transmissions are symptoms of RF feedback in a transmitter or receiver. T7B11

- Be sure all TV coaxial connectors are installed properly as the first step to resolve cable TV interference from your ham radio transmission. T7B12

T 7 C
Topics

- Antenna measurements and troubleshooting:
  - measuring SWR;
  - dummy loads;
  - coaxial cables;
  - causes of feed line failures

T 7 C

- The primary purpose of a dummy load is to prevent the radiation of signals over the air when making tests. T7C01
- The instrument to use to determine if an antenna is resonant at the desired frequency is an antenna analyzer. T7C02

Comet CAA-500

MFJ-269 SWR Analyzer

T 7 C

- In general terms, standing wave ratio (SWR) is a measure of how well a load is matched to a transmission line. T7C03

MFJ-822

Daiwa CN-801H

T 7 C

- The reading of 1 to 1 on an SWR meter indicates a perfect impedance match between the antenna and the feed line. T7C04

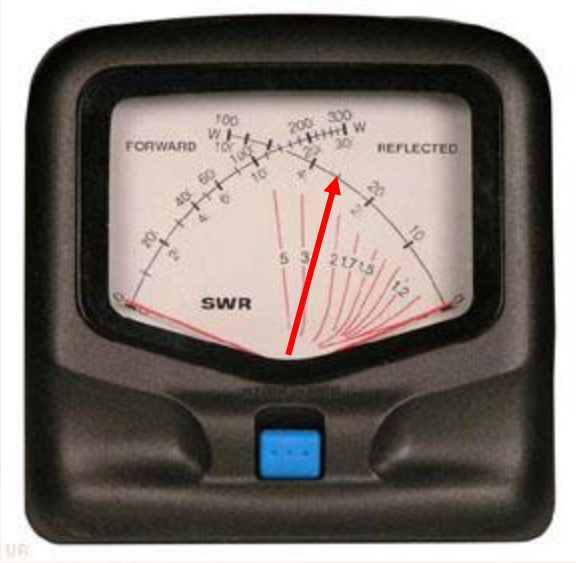
SWR Reading	Antenna Condition
1:1	Perfectly Matched
1.5:1	Good Match
2:1	Fair Match
3:1	Poor Match
4:1	Something definitely wrong

Comet CMX-200

T 7 C

- Most solid-state amateur radio transmitters reduce output power as SWR increases to protect the output amplifier transistors . T7C05

Meter indicating high SWR



T 7 C

- An SWR reading of 4:1 indicates an impedance mismatch. T7C06

Some HF rigs have the SWR meter built in. This station show the rig with external SWR meter.

Kenwood TS-440SAT & Bird RF Watt meter

T 7 C

- The power lost in a feed line is converted to heat. T7C07

- A directional wattmeter is an instrument other than an SWR meter you could be use to determine if a feed line and antenna are properly matched. T7C08

Single needle dual meters

T 7 C

- The most common cause for failure of coaxial cables is moisture contamination. T7C09
- The outer jacket of coaxial cable should be resistant to ultraviolet light which can damage the jacket and allow water to enter the cable. T7C10
- A disadvantage of air core coaxial cable when compared to foam or solid dielectric types is that it requires special techniques to prevent water absorption. T7C11

Large coax, with hollow center conductor, low loss

T 7 C

- A dummy load consists of a non-inductive resistor and a heat sink. T7C12

T 7 D
Topics

- Basic repair and testing:
  - soldering;
  - using basic test instruments;
  - connecting a voltmeter, ammeter, or ohmmeter

T 7 D

- The instrument used to measure electric potential or electromotive force is the voltmeter. T7D01
- The correct way to connect a voltmeter to a circuit is in parallel with the circuit. T7D02
- An ammeter is usually connected to a circuit in series with the circuit. T7D03

T 7 D

- The instrument used to measure electric current is an ammeter. T7D04
- The instrument used to measure resistance is the ohmmeter. T7D05
- Measuring voltage when using the resistance setting might damage a multimeter. T7D06

T 7 D

- Voltage and resistance measurements are commonly made using a multimeter. T7D07

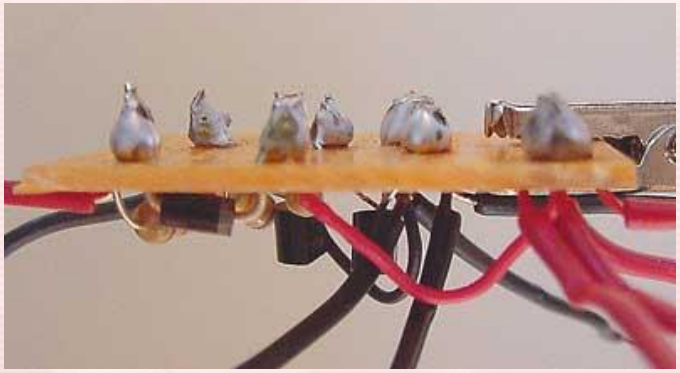
Analog Multimeter

Digital Multimeter

D 7 D

- Rosin-core solder is the best type of solder for radio and electronic use. T7D08

- A grainy or dull surface is the characteristic appearance of a cold solder joint. T7D09



T 7 D

- When an ohmmeter, connected across an unpowered circuit, initially indicates a low resistance and then shows increasing resistance with time indicates the circuit contains a large capacitor. T7D10

- Take precautions when measuring circuit resistance to ensure that the circuit is not powered. T7D11

- When measuring high voltages with a voltmeter ensure the voltmeter and leads are rated for use at the voltages being measured. T7D12

Element 2 Technician Class Question Pool

T 7 A – T 7 D

T7A01 Which term describes the ability of a receiver to detect the presence of a signal?

A. Linearity

B. Sensitivity

C. Selectivity

D. Total Harmonic Distortion

T7A02 What is a transceiver?

A. A type of antenna switch

B. A unit combining the functions of a transmitter and receiver

C. A component in a repeater which filters out unwanted interference

D. A type of antenna matching network

T7A03 Which of the following is used to convert a radio signal from one frequency to another?

A. Phase splitter

B. Mixer

C. Inverter

D. Amplifier

T7A04 Which term describes the ability of a receiver to discriminate between multiple signals?

A. Discrimination ratio

B. Sensitivity

C. Selectivity

D. Harmonic Distortion

T7A05 What is the name of a circuit that generates a signal at a specific frequency?

A. Reactance modulator

B. Product detector

C. Low-pass filter

D. Oscillator

T7A06 What device converts the RF input and output of a transceiver to another band?

A. High-pass filter

B. Low-pass filter

C. Transverter

D. Phase converter

T7A07 What is meant by “PTT”?

A. Pre-transmission tuning to reduce transmitter harmonic emission

B. Precise tone transmissions used to limit repeater access to only certain signals

C. A primary transformer tuner use to match antennas

D. The push to talk function which switches between receive and transmit

T7A08 Which of the following describes combining speech with an RF carrier signal?

A. Impedance matching

B. Oscillation

C. Modulation

D. Low-pass filtering

T7A09 What is the function of the SSB/CW-FM switch on a VHF power amplifier?

A. Change the mode of the transmitted signal

B. Set the amplifier for proper operation in the selected mode

C. Change the frequency range of the amplifier to operate in the proper portion of the band

D. Reduce the received signal noise

T7A10 What device increases the low-power output from a handheld transceiver?

A. A voltage divider

B. An RF power amplifier

C. An impedance network

D. All of these choices is correct

T7A11 Where is an RF preamplifier installed?

A. Between the antenna and the receiver

B. At the output of the transmitter's power amplifier

C. Between transmitter and antenna tuner

D. At the receiver's audio output

T7B01 What can you do if you are told your FM handheld or mobile transceiver is over-deviating?

A. Talk louder into the microphone

B. Let the transceiver cool off

C. Change to a higher power level

D. Talk farther away from the microphone

T7B02 What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

A. The receiver is unable to reject strong signals outside the AM or FM band

B. The microphone gain of the transmitter is turned up too high

C. The audio amplifier of the transmitter is overloaded

D. The deviation of an FM transmitter is set too low

T7B03 Which of the following can cause radio frequency interference?

A. Fundamental overload

B. Harmonics

C. Spurious emissions

D. All of these choices are correct

T7B04 Which of the following is a way to reduce or eliminate interference from an amateur transmitter to a nearby telephone?

A. Put a filter on the amateur transmitter

B. Reduce the microphone gain

C. Reduce the SWR on the transmitter transmission line

D. Put an RF filter on the telephone

T7B05 How can overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

A. Block the amateur signal with a filter at the antenna input of the affected receiver

B. Block the interfering signal with a filter on the amateur transmitter

C. Switch the transmitter from FM to SSB

D. Switch the transmitter to a narrow-band mode

T7B06 Which of the following actions should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

A. Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel

B. Immediately turn off your transmitter and contact the nearest FCC office for assistance

C. Tell them that your license gives you the right to transmit and nothing can be done to reduce the interference

D. Install a harmonic doubler on the output of your transmitter and tune it until the interference is eliminated

T7B07 Which of the following can reduce overload to a VHF transceiver from a nearby FM broadcast station?

A. RF preamplifier

B. Double-shielded coaxial cable

C. Using headphones instead of the speaker

D. Band-reject filter

T7B08 What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

A. Work with your neighbor to identify the offending device

B. Politely inform your neighbor about the rules that prohibit the use of devices which cause interference

C. Check your station and make sure it meets the standards of good amateur practice

D. All of these choices are correct

T7B09 What is a Part 15 device?

A. An unlicensed device that may emit low powered radio signals on frequencies used by a licensed service

B. A type of amateur radio that can legally be used in the citizen's band

C. A device for long distance communications using special codes sanctioned by the International Amateur Radio Union

D. A type of test set used to determine whether a transmitter is in compliance with FCC regulation 91.15

T7B10 What might be the problem if you receive a report that your audio signal through the repeater is distorted or unintelligible?

A. Your transmitter may be slightly off frequency

B. Your batteries may be running low

C. You could be in a bad location

D. All of these choices are correct

T7B11 What is a symptom of RF feedback in a transmitter or transceiver?

A. Excessive SWR at the antenna connection

B. The transmitter will not stay on the desired frequency

C. Reports of garbled, distorted, or unintelligible transmissions

D. Frequent blowing of power supply fuses

T7B12 What might be the first step to resolve cable TV interference from your ham radio transmission?

A. Add a low pass filter to the TV antenna input

B. Add a high pass filter to the TV antenna input

C. Add a preamplifier to the TV antenna input

D. Be sure all TV coaxial connectors are installed properly

T7C01 What is the primary purpose of a dummy load?

A. To prevent the radiation of signals when making tests

B. To prevent over-modulation of your transmitter

C. To improve the radiation from your antenna

D. To improve the signal to noise ratio of your receiver

T7C02 Which of the following instruments can be used to determine if an antenna is resonant at the desired operating frequency?

A. A VTVM

B. An antenna analyzer

C. A “Q” meter

D. A frequency counter

T7C03 What, in general terms, is standing wave ratio (SWR)?

A. A measure of how well a load is matched to a transmission line

B. The ratio of high to low impedance in a feedline

C. The transmitter efficiency ratio

D. An indication of the quality of your station's ground connection

T7C04 What reading on an SWR meter indicates a perfect impedance match between the antenna and the feedline?

A. 2 to 1

B. 1 to 3

C. 1 to 1

D. 10 to 1

T7C05 Why do most solid-state amateur radio transmitters reduce output power as SWR increases?

A. To protect the output amplifier transistors

B. To comply with FCC rules on spectral purity

C. Because power supplies cannot supply enough current at high SWR

D. To improve the impedance match to the feed line

T7C06 What does an SWR reading of 4:1 mean?

A. Loss of -4 dB

B. Good impedance match

C. Gain of +4 dB

D. Impedance mismatch

T7C07 What happens to power lost in a feed line?

A. It increases the SWR

B. It comes back into your transmitter and could cause damage

C. It is converted into heat

D. It can cause distortion of your signal

T7C08 What instrument other than an SWR meter could you use to determine if a feed line and antenna are properly matched?

A. Voltmeter
B. Ohmmeter
C. Iambic pentameter
D. Directional wattmeter

T7C09 Which of the following is the most common cause for failure of coaxial cables?

A. Moisture contamination

B. Gamma rays

C. The velocity factor exceeds 1.0

D. Overloading

T7C10 Why should the outer jacket of coaxial cable be resistant to ultraviolet light?

A. Ultraviolet resistant jackets prevent harmonic radiation

B. Ultraviolet light can increase losses in the cable's jacket

C. Ultraviolet and RF signals can mix together, causing interference

D. Ultraviolet light can damage the jacket and allow water to enter the cable

T7C11 What is a disadvantage of air core coaxial cable when compared to foam or solid dielectric types?

A. It has more loss per foot

B. It cannot be used for VHF or UHF antennas

C. It requires special techniques to prevent water absorption

D. It cannot be used at below freezing temperatures

T7C12 What does a dummy load consist of ?

A. A high-gain amplifier and a TR switch

B. A non-inductive resistor and a heat sink

C. A low voltage power supply and a DC relay

D. A 50 ohm reactance used to terminate a transmission line

T7D01 Which instrument would you use to measure electric potential or electromotive force?

A. An ammeter

B. A voltmeter

C. A wavemeter

D. An ohmmeter

T7D02 What is the correct way to connect a voltmeter to a circuit?

A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit

T7D03 How is a simple ammeter connected to a circuit?

A. In series with the circuit

B. In parallel with the circuit

C. In quadrature with the circuit

D. In phase with the circuit

T7D04 Which instrument is used to measure electric current?

A. An ohmmeter
B. A wavemeter
C. A voltmeter
D. An ammeter

T7D05 What instrument is used to measure resistance?

A. An oscilloscope

B. A spectrum analyzer

C. A noise bridge

D. An ohmmeter

T7D06 Which of the following might damage a multimeter?

A. Measuring a voltage too small for the chosen scale

B. Leaving the meter in the milliamps position overnight

C. Attempting to measure voltage when using the resistance setting

D. Not allowing it to warm up properly

T7D07 Which of the following measurements are commonly made using a multimeter?

A. SWR and RF power

B. Signal strength and noise

C. Impedance and reactance

D. Voltage and resistance

T7D08 Which of the following types of solder is best for radio and electronic use?

A. Acid-core solder

B. Silver solder

C. Rosin-core solder

D. Aluminum solder

T7D09 What is the characteristic appearance of a "cold" solder joint?

A. Dark black spots

B. A bright or shiny surface

C. A grainy or dull surface

D. A greenish tint

T7D10

What is probably happening when an ohmmeter, connected across an unpowered circuit, initially indicates a low resistance and then shows increasing resistance with time?

A. The ohmmeter is defective

B. The circuit contains a large capacitor

C. The circuit contains a large inductor

D. The circuit is a relaxation oscillator

T7D11 Which of the following precautions should be taken when measuring circuit resistance with an ohmmeter?

A. Ensure that the applied voltages are correct

B. Ensure that the circuit is not powered

C. Ensure that the circuit is grounded

D. Ensure that the circuit is operating at the correct frequency

T7D12 Which of the following precautions should be taken when measuring high voltage with a voltmeter?

A. Ensure that the voltmeter has very low impedance

B. Ensure that the voltmeter and leads are rated for use at the voltage to be measured

C. Ensure that the circuit is grounded through the voltmeter

D. Ensure that the voltmeter is set to the correct frequency