Technician Licensing Class

Multi-Mode Radio

Excitement

Presented by
ELEMENT 2 SUB-ELEMENTS
(Groupings)

• About Ham Radio
• Call Signs
• Control
• Mind the Rules
• Tech Frequencies
• Your First Radio
• Going On The Air!
• Repeaters
• Emergency!
• Weak Signal Propagation
ELEMENT 2 SUB-ELEMENTS (Groupings)

- Talk to Outer Space!
- Your Computer Goes Ham Digital!
- Multi-Mode Radio Excitement
- Run Some Interference Protection
- Electrons - Go With the Flow!
- It’s the Law, per Mr. Ohm!
- Go Picture These!
- Antennas
- Feed Me with Some Good Coax!
- Safety First!
A multi-mode VHF transceiver is most useful for VHF weak-signal communication.
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- **T8A5** CW is the type of emission that has the narrowest bandwidth.
- **T8A11** 150 Hz is the approximate maximum bandwidth required to transmit a CW signal.

![Bandwidths of various emissions](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW</td>
<td>500 Hz</td>
</tr>
<tr>
<td>SSB</td>
<td>2 - 3 kHz</td>
</tr>
<tr>
<td>FM</td>
<td>5 - 15 kHz</td>
</tr>
<tr>
<td>UHF Fast-Scan TV</td>
<td>~ 6 MHz</td>
</tr>
</tbody>
</table>
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- T7A5 The function of block 1, if figure T4 is a simple CW transmitter is an oscillator.

Figure T4
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- **T4210** 500 Hz is an appropriate receive filter to select in order to minimize noise and interference for CW reception.
  - Bandwidth filters vary for the mode being received.
- **T7A2** The type of receiver shown in Figure T6 is a single-conversion superheterodyne.

![Diagram of a single-conversion superheterodyne receiver]

- Single-conversion superhet has only one IF amplifier.
The function of a product detector is to detect CW and SSB signals.

- Block 1 as a product detector will detect CW and SSB.

A Product detector is necessary in a simple Morse code (CW) and single-sideband (SSB) receiver.
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- T8A1 Single sideband is a form of amplitude modulation.

Carrier only CW

Tones produce both side bands or AM

Remove one sideband and suppress carrier becomes SSB
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- T8A8 3 kHz is the approximate bandwidth of a single sideband voice signal.

SSB signals are Amplitude Modulated (AM) with the carrier and one sideband suppressed.
**Multi-Mode Radio Excitement**

- **T7A8** A circuit that combines a speech signal and an RF carrier is a modulator.
- **T7A3** The function of a mixer in a superheterodyne receiver is to shift the incoming signal to an intermediate frequency.

**Block Diagram of an AM Broadcast Receiver Mixer**

- **Signal A** at 800 kHz (or at 1200 kHz)
- **Local Oscillator**
- **Signal B** at 1255 kHz (or at 1655 kHz)
- **Intermediate Frequency**
- **Signal C** at 455 kHz

**MIXER**
(In AM Broadcast Receiver)
The advantage of having multiple receive bandwidth choices on a multimode transceiver will permit noise or interference reduction by selecting a bandwidth matching the mode.

2400 Hz is an appropriate receive filter to select in order to minimize noise and interference for SSB reception.
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- **T4B6** The receiver RIT or clarifier controls could be used if the voice pitch of a single-sideband signal seems too high or low.

- **T4B7** The term "RIT" means **Receiver Incremental Tuning**.

  Set knob to neutral, press RIT button to turn on function, and then adjust slightly for proper SSB voice reception

  RIT adjusts voice pitch, not the frequency of received station.
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- **T7A13** An RF preamplifier is installed between the antenna and receiver.
- **T7B2** In reference to a receiver, interference by very strong signals causes fundamental overload.

- **T7A12** Selectivity is the term that describes the ability of a receiver to discriminate between multiple signals.

Good TV reception.  
Front end overloaded TV reception
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- T2B5 The amplitude of the modulating signal determines the amount of deviation of an FM signal.
- T2B6 When the deviation of an FM transmitter is increased its signal occupies more bandwidth.
- T7A4 The circuit pictured in Figure T7, if block 1 is a frequency discriminator, is an FM receiver.

![Figure T7 Diagram]

Figure T7
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- **T7A11** A discriminator demodulates FM signals.
- **T8A10** The typical bandwidth of analog fast-scan TV transmissions on the 70 cm band about 6 MHz.

![Image of a man operating a small handheld monitor]

Amateur TV signals can be received on a variety of equipment – even a small hand-held monitor.
Element 2 Technician Class Question Pool

Multi-Mode Radio Excitement

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T7A09 Which of the following devices is most useful for VHF weak-signal communication?

A. A quarter-wave vertical antenna
B. A multi-mode VHF transceiver
C. An omni-directional antenna
D. A mobile VHF FM transceiver
T8A05

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

A. FM voice  
B. SSB voice  
C. CW  
D. Slow-scan TV
What is the approximate maximum bandwidth required to transmit a CW signal?

A. 2.4 kHz
B. 150 Hz
C. 1000 Hz
D. 15 kHz
What is the function of block 1 if figure T4 is a simple CW transmitter?

A. Reactance modulator  
B. Product detector  
C. Low-pass filter  
D. Oscillator
Which of the following is an appropriate receive filter to select in order to minimize noise and interference for CW reception?

A. 500 Hz
B. 1000 Hz
C. 2400 Hz
D. 5000 Hz
What type of receiver is shown in Figure T6?

A. Direct conversion
B. Super-regenerative
C. Single-conversion superheterodyne
D. Dual-conversion superheterodyne
What is the function of a product detector?

A. Detect phase modulated signals
B. Demodulate FM signals
C. Detect CW and SSB signals
D. Combine speech and RF signals
Which of the following is a form of amplitude modulation?

A. Spread-spectrum
B. Packet radio
C. Single sideband
D. Phase shift keying
What is the approximate bandwidth of a single sideband voice signal?

A. 1 kHz
B. 3 kHz
C. 6 kHz
D. 15 kHz
Which of the following circuits combines a speech signal and an RF carrier?

A. Beat frequency oscillator  
B. Discriminator  
C. Modulator  
D. Noise blanker
What is the function of a mixer in a superheterodyne receiver?

A. To reject signals outside of the desired passband
B. To combine signals from several stations together
C. To shift the incoming signal to an intermediate frequency
D. To connect the receiver with an auxiliary device, such as a TNC
What is the advantage of having multiple receive bandwidth choices on a multimode transceiver?

A. Permits monitoring several modes at once
B. Permits noise or interference reduction by selecting a bandwidth matching the mode
C. Increases the number of frequencies that can be stored in memory
D. Increases the amount of offset between receive and transmit frequencies
Which of the following is an appropriate receive filter to select in order to minimize noise and interference for SSB reception?

A. 500 Hz
B. 1000 Hz
C. 2400 Hz
D. 5000 Hz
Which of the following controls could be used if the voice pitch of a single-sideband signal seems too high or low?

A. The AGC or limiter
B. The bandwidth selection
C. The tone squelch
D. The receiver RIT or clarifier
What does the term “RIT” mean?

A. Receiver Input Tone  
B. Receiver Incremental Tuning  
C. Rectifier Inverter Test  
D. Remote Input Transmitter
Which term describes the ability of a receiver to discriminate between multiple signals?

A. Tuning rate
B. Sensitivity
C. Selectivity
D. Noise floor
What is meant by fundamental overload in reference to a receiver?

A. Too much voltage from the power supply
B. Too much current from the power supply
C. Interference caused by very strong signals
D. Interference caused by turning the volume up too high
Where is an RF preamplifier installed?

A. Between the antenna and receiver
B. At the output of the transmitter’s power amplifier
C. Between a transmitter and antenna tuner
D. At the receiver’s audio output
What determines the amount of deviation of an FM signal?

A. Both the frequency and amplitude of the modulating signal
B. The frequency of the modulating signal
C. The amplitude of the modulating signal
D. The relative phase of the modulating signal and the carrier
What happens when the deviation of an FM transmitter is increased?

A. Its signal occupies more bandwidth
B. Its output power increases
C. Its output power and bandwidth increases
D. Asymmetric modulation occurs
What circuit is pictured in Figure T7, if block 1 is a frequency discriminator?

A. A double-conversion receiver  
B. A regenerative receiver  
C. A superheterodyne receiver  
D. An FM receiver
T7A11 Which of the following circuits demodulates FM signals?

A. Limiter  
B. Discriminator  
C. Product detector  
D. Phase inverter
What is the typical bandwidth of analog fast-scan TV transmissions on the 70 cm band?

A. More than 10 MHz
B. About 6 MHz
C. About 3 MHz
D. About 1 MHz