

# Technician License Course

## Chapter 5

### Lesson Plan Module 11 – Transmitters, Receivers and Transceivers



## Generalized Transceiver Categories

- Mobile VHF/UHF FM
- Single Band VHF or UHF FM
- Dual Band VHF/UHF FM
- All Band HF and VHF/UHF
- Multimode VHF/UHF CW/SSB/FM
- Handheld (HT)



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## Single-Band Mobile

- Single-band, 2 meter is a good starter radio.
- Operates from 13.8 volts dc, requires external power supply or car battery.
- Requires an external antenna.
- Can be operated mobile or as a base station.
- Limited to frequency modulation (FM) and usually either 2 meters or 70 cm bands.
- Up to approximately 50 watts output.



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## Dual-Band Mobile

- Same as the single-band transceiver but includes additional band(s).
- Most common are 2 meter and 70 cm bands.
- Could add 6 meters, 222 MHz or 1.2 GHz.
- Might have separate antenna connections for each band or a single connection for a dual-band antenna.



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## Multimode Transceiver

- Nearly all HF rigs are multimode.
- VHF multimode operates on FM plus AM/SSB/CW modes.
  - Required for “weak-signal” operation on VHF/UHF
- More features add complexity and cost.
- More flexibility will allow you to explore new modes as you gain experience.



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## Multiband Transceiver

- Covers many bands – usually refers to coverage of HF + VHF/UHF.
- Also covers all modes.
- Frequently 100 watts on HF, some power limitations on high bands (25–50 watts).
- Larger units have internal power supplies, smaller units need external power supply.



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## Handheld (HT) Transceiver

- Small handheld FM units.
- Can be single band or dual band.
- Limited power (usually 5 watts or less).
- Includes power (battery) and antenna in one package.
- Often purchased as a starter rig but low power limits range.



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## Handheld (HT) Transceiver

- Single, dual and multiband versions (with increasing cost and complexity).
  - Some can receive outside the ham bands, such as aircraft, commercial FM broadcast, etc.
- Very portable and self-contained.
  - Internal microphone and speaker.
  - Rubber duck antenna.
  - Battery powered.



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## Handheld (HT) Accessories

- Extra battery packs
  - AA cell pack useful in emergencies
- Drop-in, fast charger
- Extended antenna
- External microphone and speaker
- Headset



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## Side-by-Side

	Single Band	Dual Band	Multimode	Multiband	Handheld
Freq Agility	Limited	Medium	Medium	Full	Limited
Functionality	Limited	Limited	Full	Full	Limited
Ease of Use	Easy	Medium	Medium	Difficult	Easy
Programming	Easy	Easy	Medium	Challenging	Easy/Medium
Power	Low	Low	Medium	High	Low
Cost	Low	Modest	High	High	Low



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## Rig Vocabulary

- We will now go through some jargon and vocabulary specific to the receive and transmit functions and controls of a transceiver.



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## Band and Frequency Selection

- Fundamental to all amateur transceivers
- Can set by VFO (continuously variable) or by keypad “direct” entry
- Memories can generally store:
  - Frequency
  - Mode
  - Filter and similar settings
  - Alphanumeric labels



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## Transmitter Controls and Functions

- Main tuning display (both TX and RX):
  - Controls the frequency selection via the variable frequency oscillator (VFO).
  - Frequency can be set with a knob or keypad or programmed channels.
  - Variable frequency step size (tuning rate, resolution).
  - Rigs can usually store the information for two operating frequencies (VFO A and VFO B).



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## Transmitter Controls and Functions

- Mode selector (both TX and RX for multimode rigs).
  - AM/FM/SSB (LSB or USB)
  - CW
  - Data (RTTY or PSK)
- Could be automatic based on recognized band plan.



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## Transmitter Controls and Functions

- Microphone controls
  - Gain
    - Controls transmitter sensitivity to your voice
  - Speech Compressor or Speech Processor
    - Increases microphone gain at lower sound levels to increase overall signal strength or “punch”
  - Too much gain or compression can cause problems
    - Splatter
    - Over-deviation
    - Over-modulation



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## Transmitter Controls and Functions

- Automatic Level Control (ALC)
  - Automatically limits speech modulation, reducing transmitter over-drive
  - Causes some speech distortion
  - Do NOT use for data modes like PSK
- Also prevents overdrive to external power amplifier



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## Microphones and Keys

- Microphones (mic)
  - Hand mics
  - Desk mics
    - Preamplified desk mics
  - Speaker-mics
  - Headsets or boom-sets
  - Internal mics
- Speak *across* the mic, not into the mic



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## Microphones and Keys

- Transmitter ON/OFF or “keying”
  - Push-to-Talk (PTT)
  - Voice-Operated Transmission (VOX)
    - VOX Gain
    - VOX Delay
    - Anti-VOX
  - Key jack
  - Manually-Operating Transmission (MOX or SEND - varies with manufacturer)



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## Microphones and Keys

- Morse code
  - Straight key
  - Electronic keyer and paddle
  - Semi-automatic (Bug)



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## Receiver Controls and Functions

- AF Gain or Volume
  - Controls the audio level to the speaker or headphones
- RF Gain
  - Controls the gain of the receiver's input amplifiers
- Attenuator
  - Reduces signal at the receiver input



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## Receiver Controls and Functions

- Receive Incremental Tuning (RIT)
  - “Fine tuning”
  - Adjusts receive frequency independent of main VFO
  - Doesn't vary the transmitted frequency
  - Transmitters have a similar function (XIT)



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## Receiver Controls and Functions

- Automatic Gain Control (AGC)
  - Automatically limits the incoming signals during signal (voice) peaks to maintain even volume
  - Keeps strong signals from blasting the listener
  - Different time response settings:
    - Fast setting for CW
    - Slow settings for SSB and AM
    - Not used in FM because amplitude is constant



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## Receiver Controls and Functions

- Squelch
  - Mutes audio to speaker when signal is not present
- Used in FM primarily
  - Open – allows very weak signals to pass through (along with noise)
  - Tight – allows only the strongest signals to pass
- Advance the squelch control until the noise just disappears
  - Also opened by MON (Monitor) control on handhelds



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## Receiver Controls and Functions

- Filters (can be electronic modules or DSP)
  - IF filter
    - Used to narrow the width of signal that is passed.
    - Can attenuate adjacent signals.
  - Notch filter
    - Very narrow filter that can be moved over an interfering signal to attenuate it.



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## Receiver Controls and Functions

- Noise blanker (NB)
  - Removes signal pulses that are frequently associated with random naturally generated noise
  - Can cause problems if strong signals are present
- Noise reduction (NR)
  - DSP function to remove noise from signal
- Noise limiter (NL)
  - Simply limits maximum volume of a noise pulse



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## Receiver Controls and Functions

- Preamplifier
  - Increases sensitivity but can cause overload
- Reception and Transmission Meter
  - In transmit, indicates output power or ALC or other functions as selected by switch setting
  - In receive, indicates signal strength
    - In “S” units S1 through S9 – S9 is strongest
    - Above S9, meter is calibrated in dB (i.e S9+10 dB)



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## Receiver Controls and Functions

- Receivers can be limited to ham bands or can cover other parts of the spectrum.
- General coverage receivers cover a wide area of the spectrum and can be used for shortwave listening (SWL).



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## Data Modes

- Computer-to-computer communication
- Specialized modems
  - Terminal Node Controller (TNC)
  - Multiple Protocol Controller (MPC)
- Computer sound card software
  - Requires radio interface



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# Popular Digital Modes & Systems

- Radioteletype (RTTY)
- PSK31
- MFSK
- Packet Radio and PACTOR
- CW (International Morse)
- Automatic Packet Reporting System (APRS)
- Winlink System



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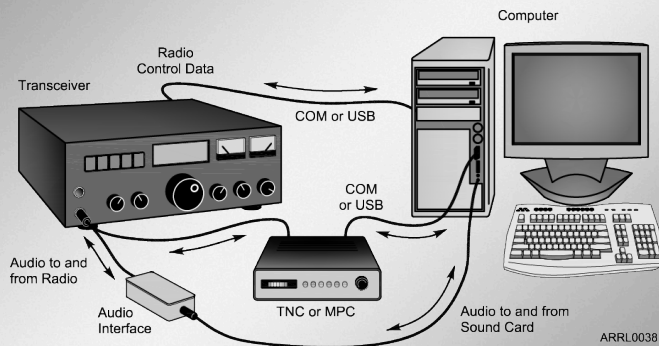
# Popular Digital Modes

- Error detection
  - Yes: Packet radio, MFSK
  - No: RTTY, PSK31
- Error correction
  - MFSK (forward error correction or FEC)
  - Packet radio
    - Checksums and call signs
    - Retransmission or ARQ



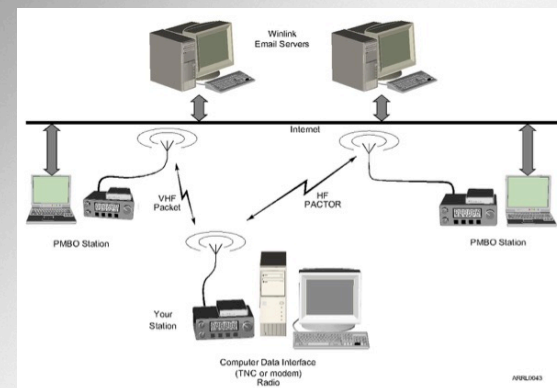
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# Data Station Setup



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# Internet Gateway



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