Technician License Course
Chapter 3

Lesson Plan Module 7 –
Types of Radio Circuits

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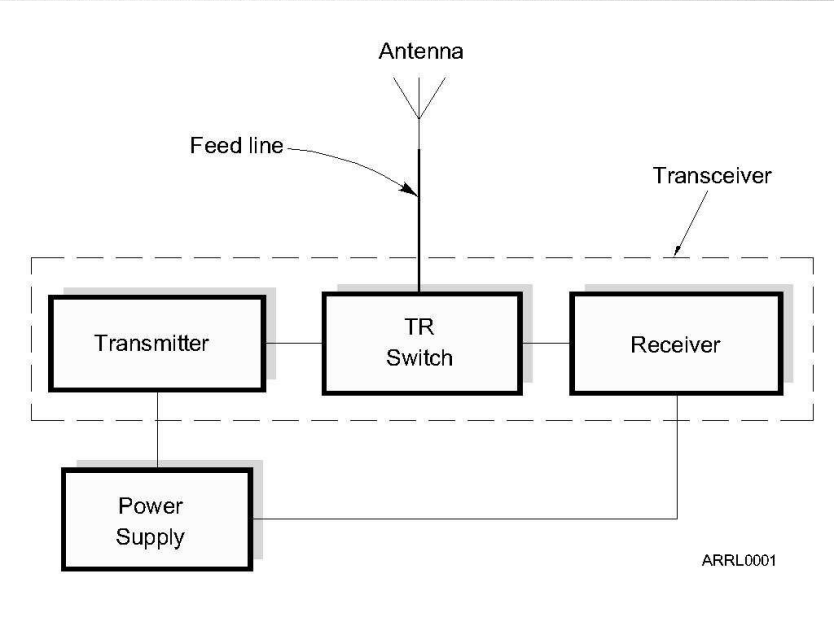
The Basic Transceiver

- Combination of "transmitter" and "receiver"
  - Abbreviated "XCVR" (X = trans)
  - Antenna switched between transmitter and receiver by the TR switch



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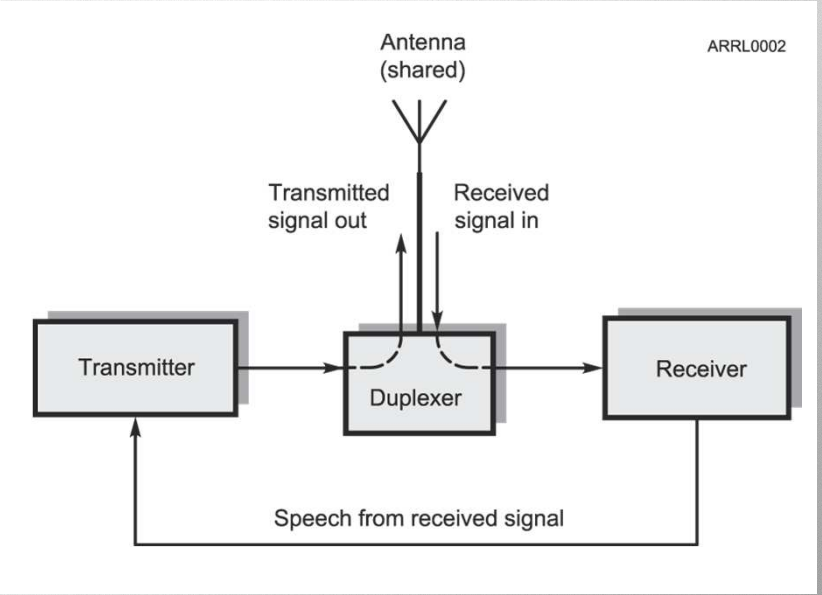
Transmit/Receive (TR) Switch

- TR switch allows a single antenna to be switched to the transmitter when sending and to the receiver when receiving.
  - In a transceiver, the TR switch is inside the unit and operates automatically.
  - Transceivers cannot transmit and receive at the same time like a repeater.

The Basic Repeater

- Relays signals from low-power stations over a wide area
  - Simultaneously re-transmits received signal on the same band
  - TR switch replaced with duplexer which allows antenna to be shared without switching



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What Happens During Radio Communication? (Review)

- Transmitting (sending a signal):
  - Information (voice, data, video, commands, etc.) is converted to electronic form.
  - The information in electronic form is added to a radio wave.
  - The radio wave carrying the information is sent from the station antenna into space.

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What Happens During Radio Communication? (Review)

- Receiving:
  - The radio wave carrying the information is intercepted by the receiving station's antenna.
  - The receiver extracts the information from the received wave.
  - The information is then presented to the user in a format that can be understood (sound, picture, words on a computer screen, response to a command, etc.).

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What Happens During Radio Communication? (Review)

- Adding and extracting the information can be simple or complex.
- This makes ham radio fun…learning all about how radios work.
- Don’t be intimidated. You will be required to only know the basics, but you can learn as much about the “art and science” of radio as you want.

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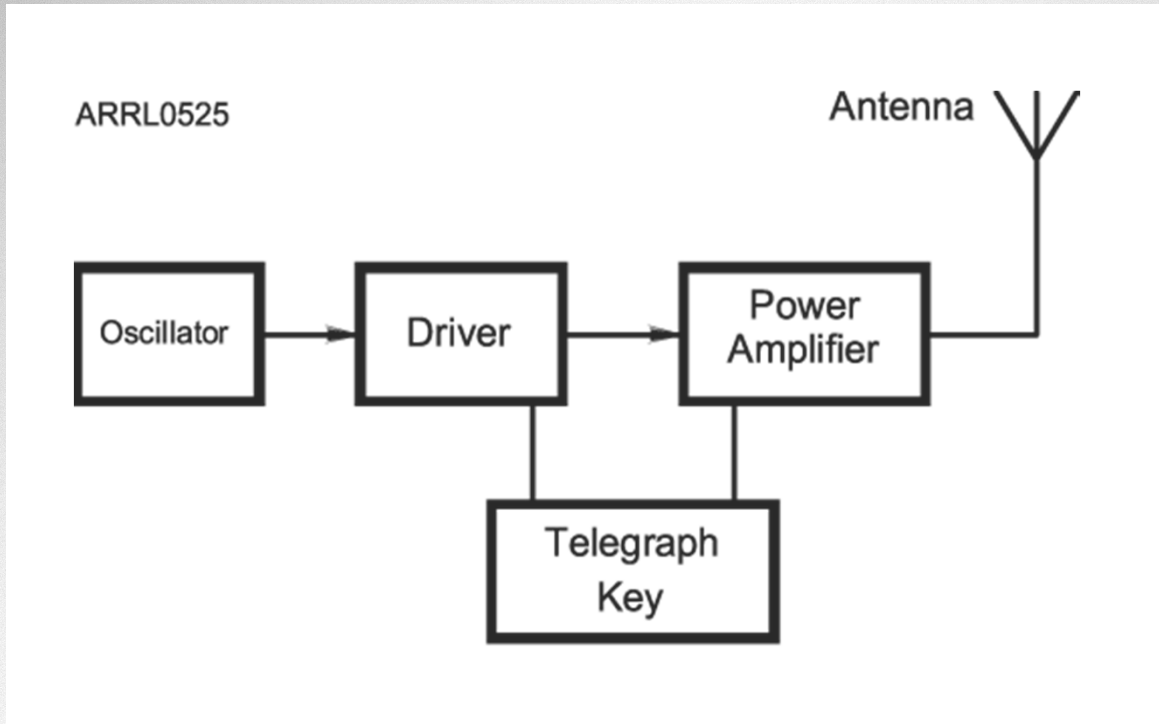
Simple Morse (CW) Transmitter Block Diagram



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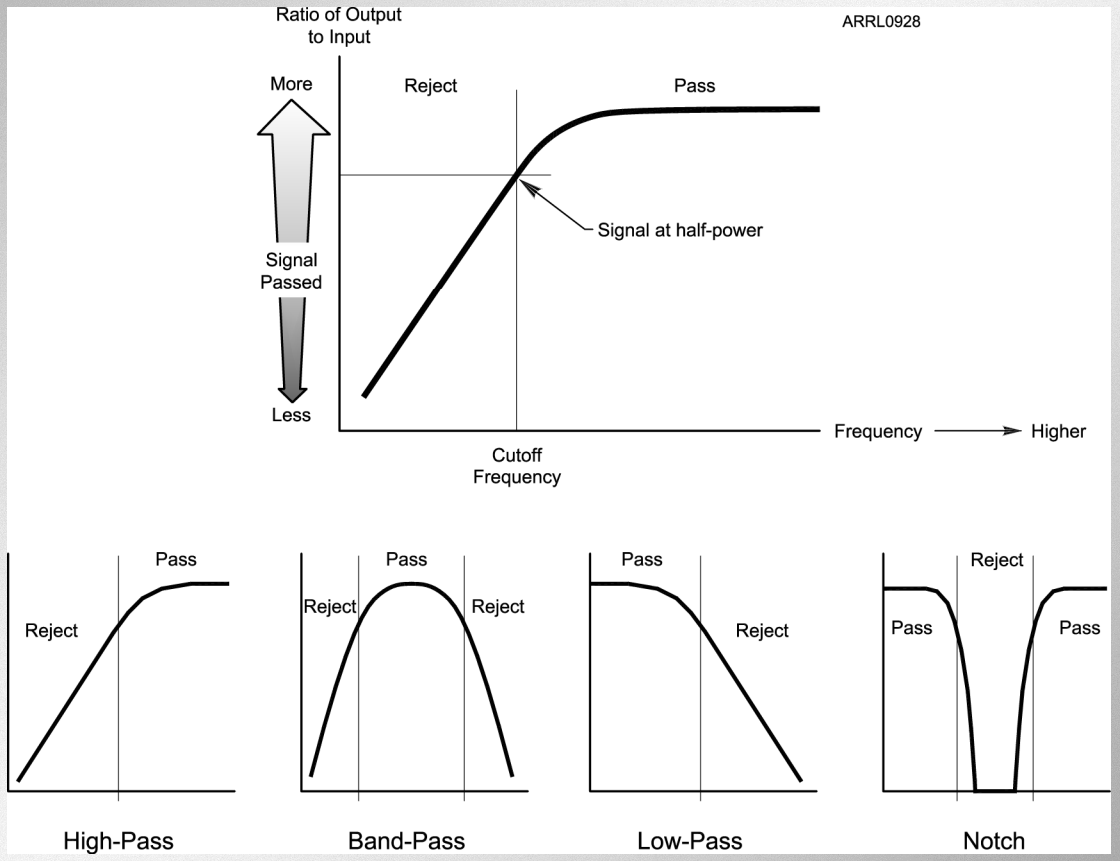
Filters

- Circuits that act on signals differently according their frequency.
- Filters can reject, enhance, or modify signals.

Types of Filters



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Adding Information - Modulation

- When we add some information to the radio wave (the *carrier*), we *modulate* the wave.
  - Morse code (CW), speech, data
- Different modulation techniques vary different properties of the wave to add the information:
  - Amplitude, frequency, or phase
- Modulator and demodulator circuits
  - Modulators add information to an RF signal, demodulators recover the information

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Changing Frequency - Mixers

- Signal frequencies can be changed by combining with another signal, called *mixing*
  - Also referred to as *heterodyning*
- Two signals are combined in a *mixer*
  - Generates *mixing product* signals
  - Sum and difference of the input signals
  - Shifts frequency by adding or subtracting
- Different than a *multiplier* which multiplies a signal's frequency by some integer, usually 2 or 3

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Sensitivity and Selectivity

- Two essential tasks for a receiver:
  - Hear a signal and hear only one signal
- *Sensitivity* is a measure of how well the receiver can detect weak signals
- *Selectivity* is a measure of the receiver's ability to discriminate between signals
- *Preamplifiers* make a receiver more sensitive
  - Preamplifiers added between antenna and receiver

Transverter

- Short for “transceiving converter” (XVTR)
- Converts a transceiver to operate on another band
  - Usually to a higher frequency
  - External mixers shift frequency
- Typical examples
  - HF SSB/CW at 28 MHz converted to/from 222 MHz
  - VHF SSB/CW at 144 MHz converted to/from 10 GHz

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Practice Questions

What type of amateur station simultaneously retransmits the signal of another amateur station on a different channel or channels?

A. Beacon station

B. Earth station

C. Repeater station

D. Message forwarding station

FCC Rule: [97.3(a)(40)] T1F09 HRLM (2-12)

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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

T7A01 HRLM (3-18)

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

T7A01 HRLM (3-18)

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What is a transceiver?

A. A type of antenna switch

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

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

D. A type of antenna matching network

T7A02 HRLM (2-12)

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What is a transceiver?

A. A type of antenna switch

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

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

D. A type of antenna matching network

T7A02 HRLM (2-12)

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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

T7A03 HRLM (3-18)

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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

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

A. Discrimination ratio

B. Sensitivity

C. Selectivity

D. Harmonic Distortion

T7A04 HRLM (3-18)

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

A. Discrimination ratio

B. Sensitivity

C. Selectivity

D. Harmonic Distortion

T7A04 HRLM (3-18)

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What is the name of a circuit that generates a signal of a desired frequency?

A. Reactance modulator

B. Product detector

C. Low-pass filter

D. Oscillator

T7A05 HRLM (3-16)

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What is the name of a circuit that generates a signal of a desired frequency?

A. Reactance modulator

B. Product detector

C. Low-pass filter

D. Oscillator

T7A05 HRLM (3-16)

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What device takes the output of a low-powered 28 MHz SSB exciter and produces a 222 MHz output signal?

A. High-pass filter

B. Low-pass filter

C. Transverter

D. Phase converter

T7A06 HRLM (3-19)

What device takes the output of a low-powered 28 MHz SSB exciter and produces a 222 MHz output signal?

A. High-pass filter

B. Low-pass filter

C. Transverter

D. Phase converter

T7A06 HRLM (3-19)

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

A. Impedance matching

B. Oscillation

C. Modulation

D. Low-pass filtering

T7A08 HRLM (3-17)

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

A. Impedance matching

B. Oscillation

C. Modulation

D. Low-pass filtering

T7A08 HRLM (3-17)

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 are correct

T7A10 HRLM (5-8)

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 are correct

T7A10 HRLM (5-8)

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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

T7A11 HRLM (3-18)

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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

T7A11 HRLM (3-18)

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