Technician License Course

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Chapter 3

Lesson Plan Module - 7

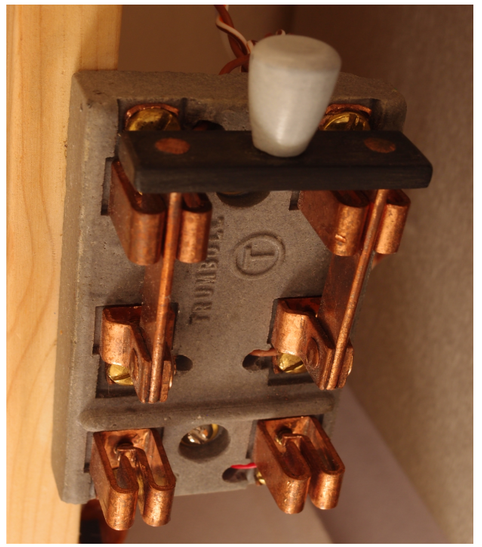
Types of Radio Circuits

The Basic Transceiver

RECEIVER
(RX)

TRANSMITTER
(TX)

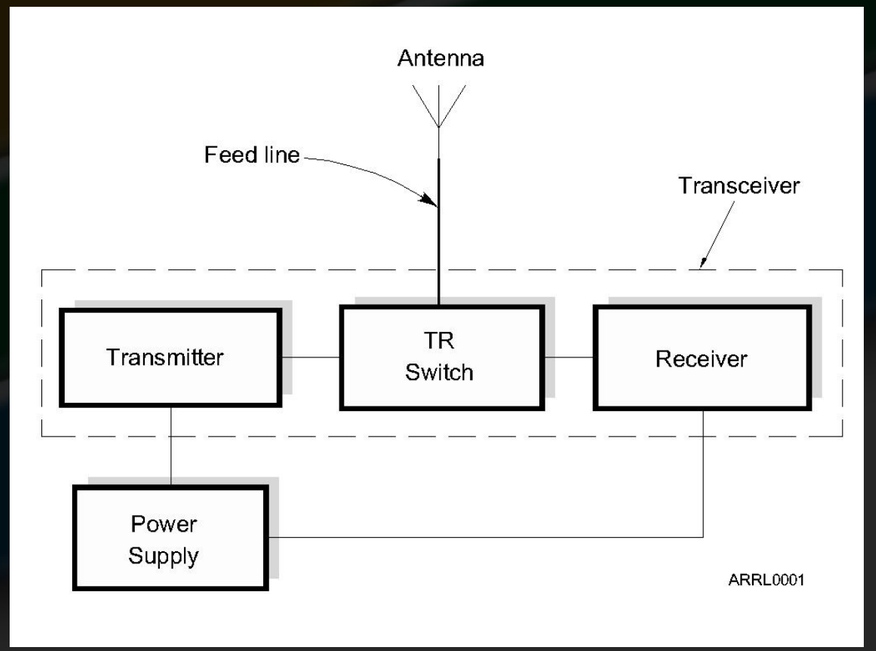
ANTENNA
(TR)
SWITCH




VAN - 350
VOX
F. GAIN
REC.
TUNE-CW
14.05
3700
14.10
3750
14.15
3800
200
250
300
288
286
290
USB
LSB
PA
PLATE
PA
LOAD
PA
GRID
COARSE
FINE
BAND
21
14
7
3.5
MIC. GAIN
CAR. BAL.

The Basic Transceiver

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

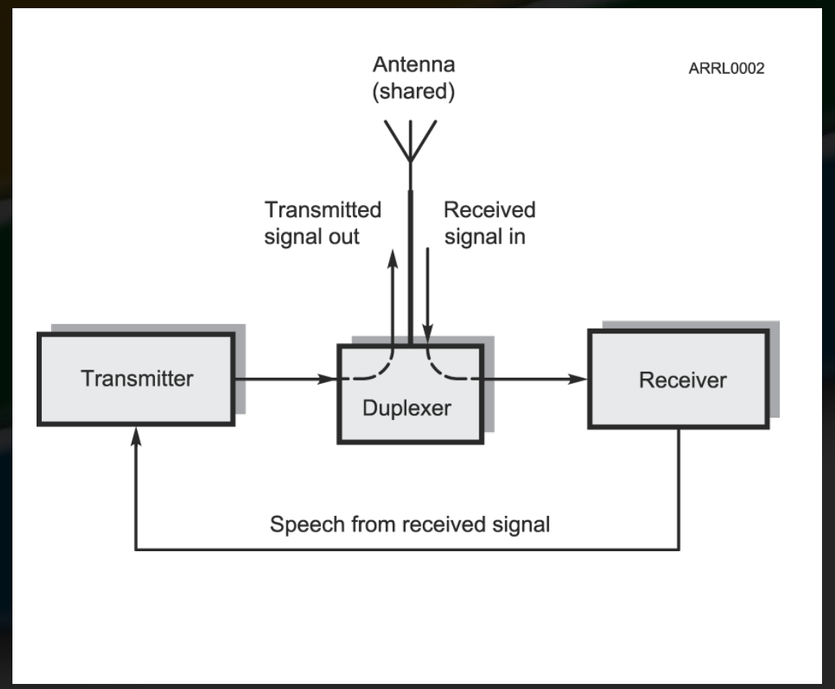


Transmit/Receive (TR) Switch

- 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 telephone.

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




MODEL:SGQ-150D
TX: 173.475
RX: 168.275
QC PASS
RX
ANT
TX
chinaxinlun.en.alibaba.com

DUPLEXER

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.

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.).

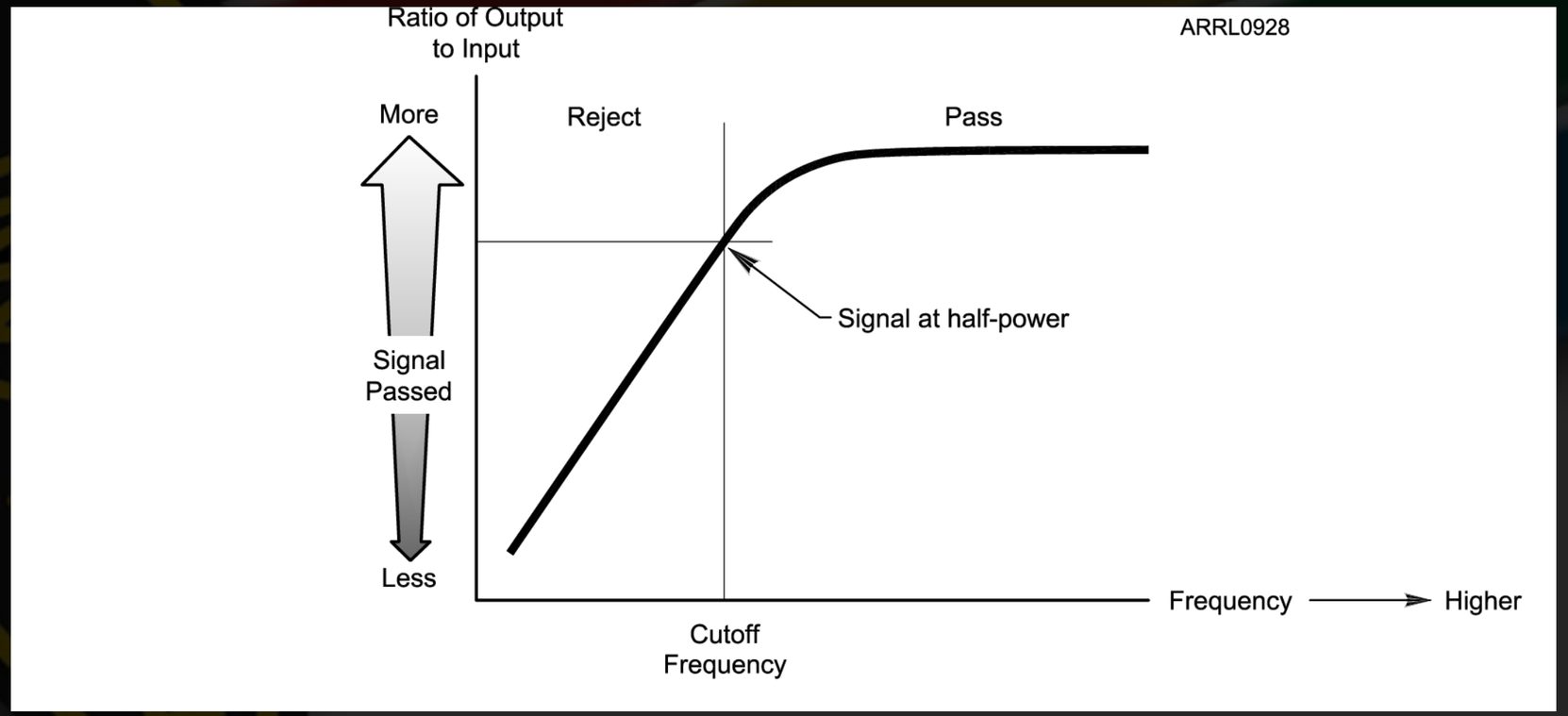
What Happens During Radio Communication? (Review)

- 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.

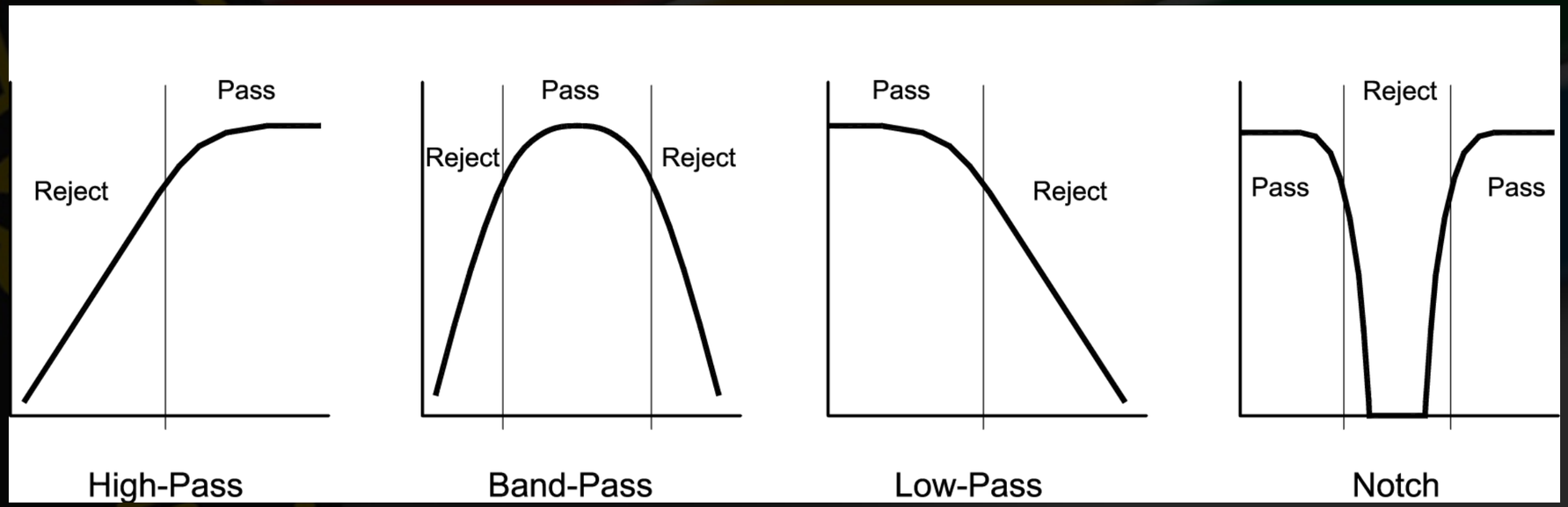
Filters

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

Sample Plot of Filter Frequency Response



Types of Filters



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

Adding Information - Modulation

- Modulator and demodulator circuits
  - Modulators add information to an RF signal, demodulators recover the information
- A circuit that generates an RF signal and adds the modulation to that signal is often called an exciter.

Adding Information - Modulation

- A circuit that generates an RF signal and adds the modulation to that signal is often called an *exciter*.
- In a transmitter, the exciter circuit is often followed by a *mixer* circuit that converts the modulated RF signal to the desired output frequency, and then a *power amplifier* circuit that boosts the output of the transmitter to the desired output power level.

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

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

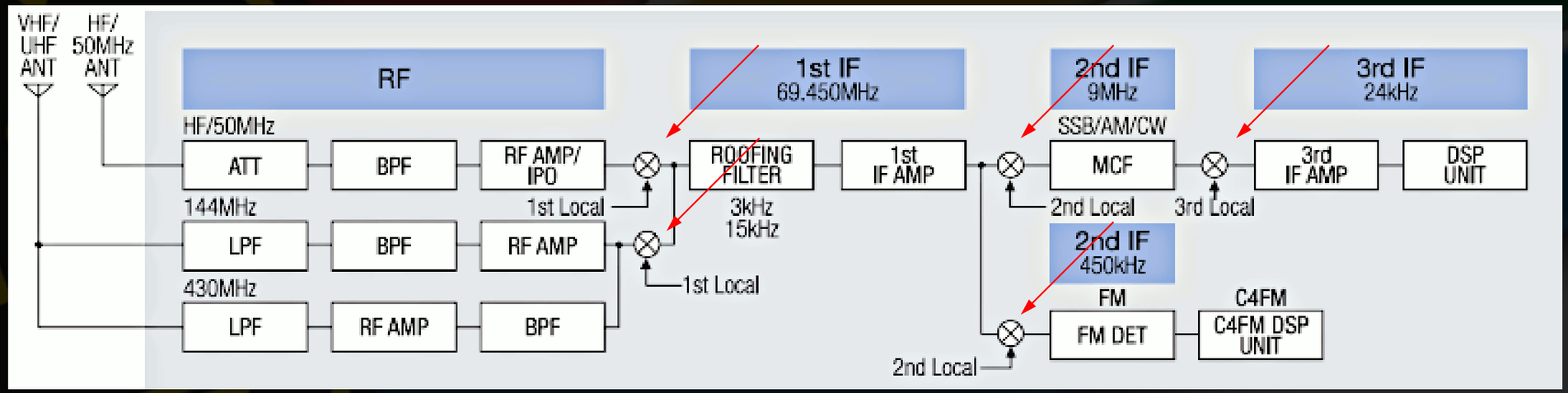
Why use a transverter?

Transverter

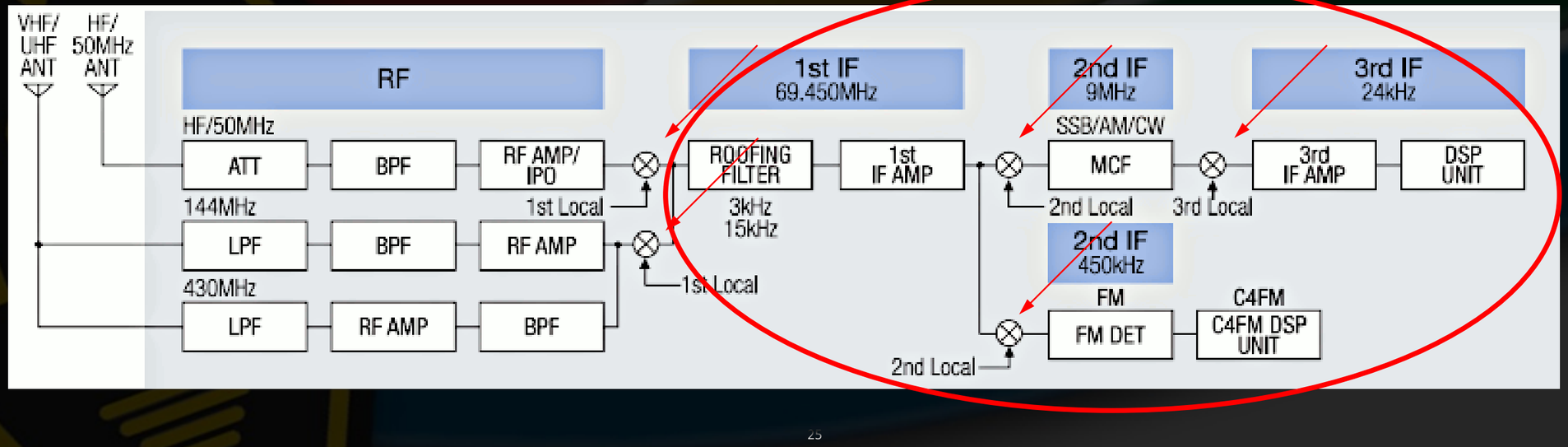
Changing Frequency - Mixers

- 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

FT-991A Receiver Block Diagram

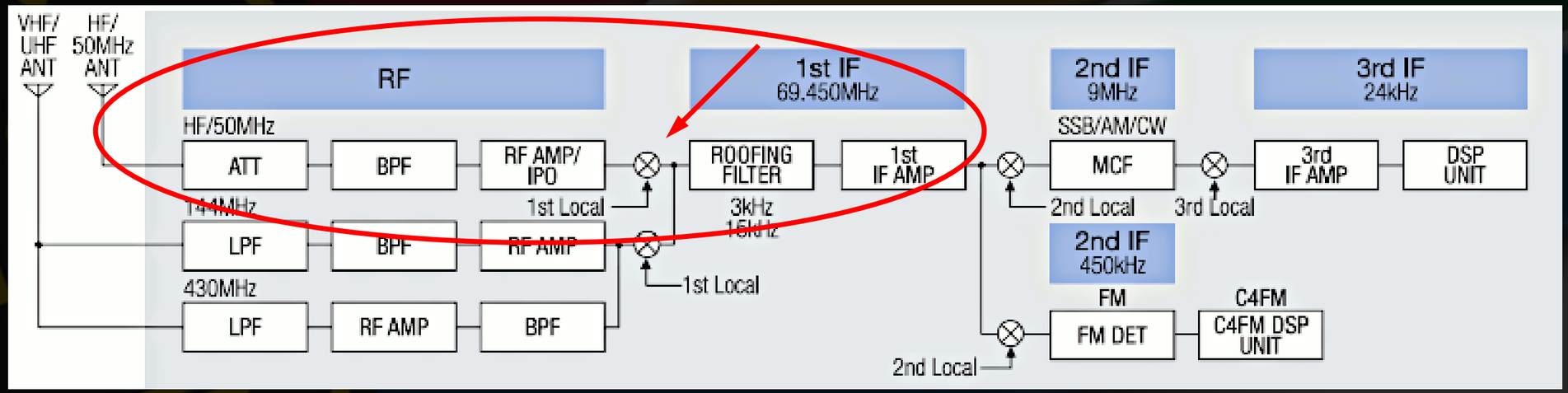


FT-991A Receiver Block Diagram



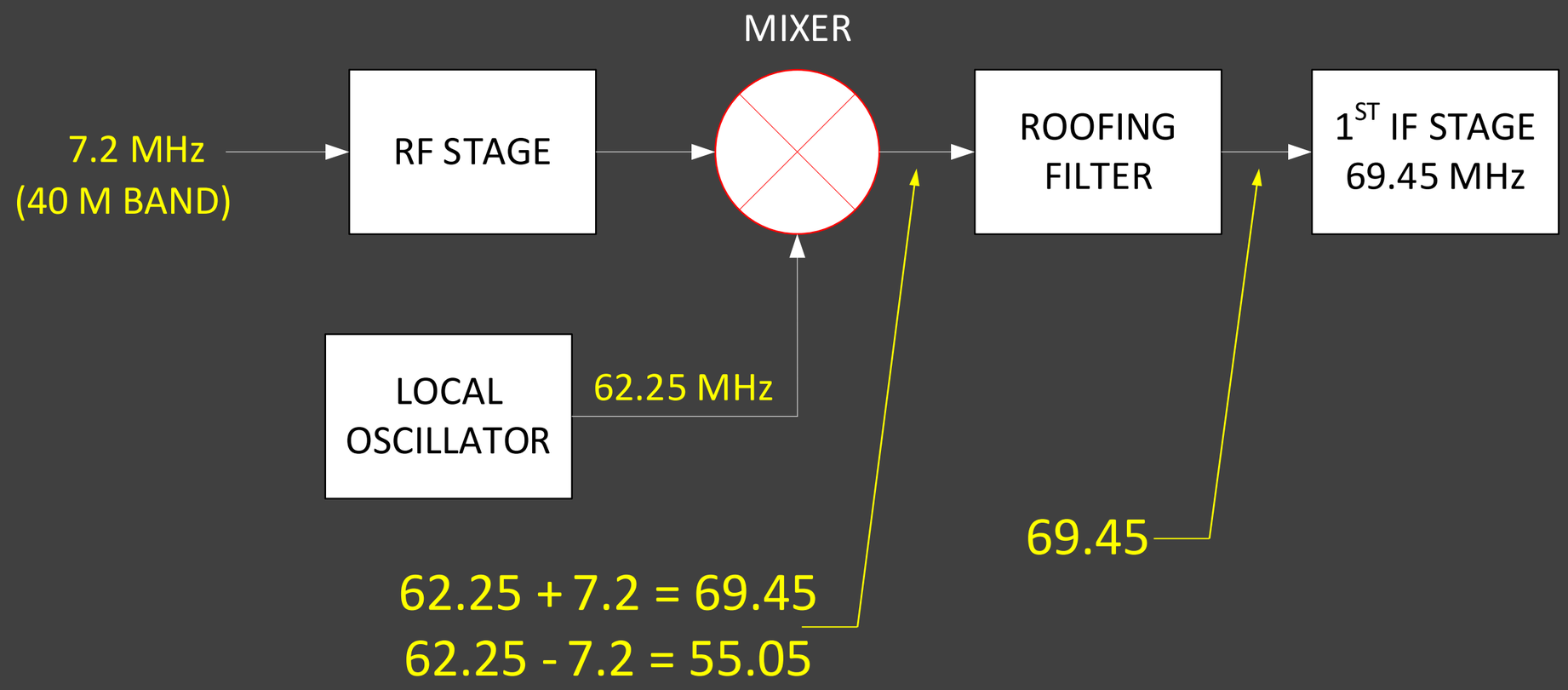
90% of the circuitry is shared no matter which band you are operating on.

FT-991A Receiver Block Diagram



Right now, let's focus in on just one of these mixers to get an idea of how it works.

Yaesu FT-991A Receiver (partial block diagram)



•What you <u>do</u> have to remember:

- An *oscillator* is a circuit for *producing* an RF (or AF) *signal*.
- A *mixer* is a circuit that produces signals at the *sum and difference* of the two input frequencies. It is *used to change the frequency* of a radio frequency signal.

Oscillators and mixers are circuits inside every radio. If you go down to your local ham radio store and tell them you want to buy a mixer or oscillator, they'll look at you funny.

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 (the preamplifier is added between antenna and receiver)

Practice Questions

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

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

Repeater station

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

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

Sensitivity

What is a transceiver?

What is a transceiver?

A unit combining the functions of a transmitter and a receiver

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

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

Mixer

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

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

Selectivity

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

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

Oscillator

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

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

Transverter

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

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

Modulation

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

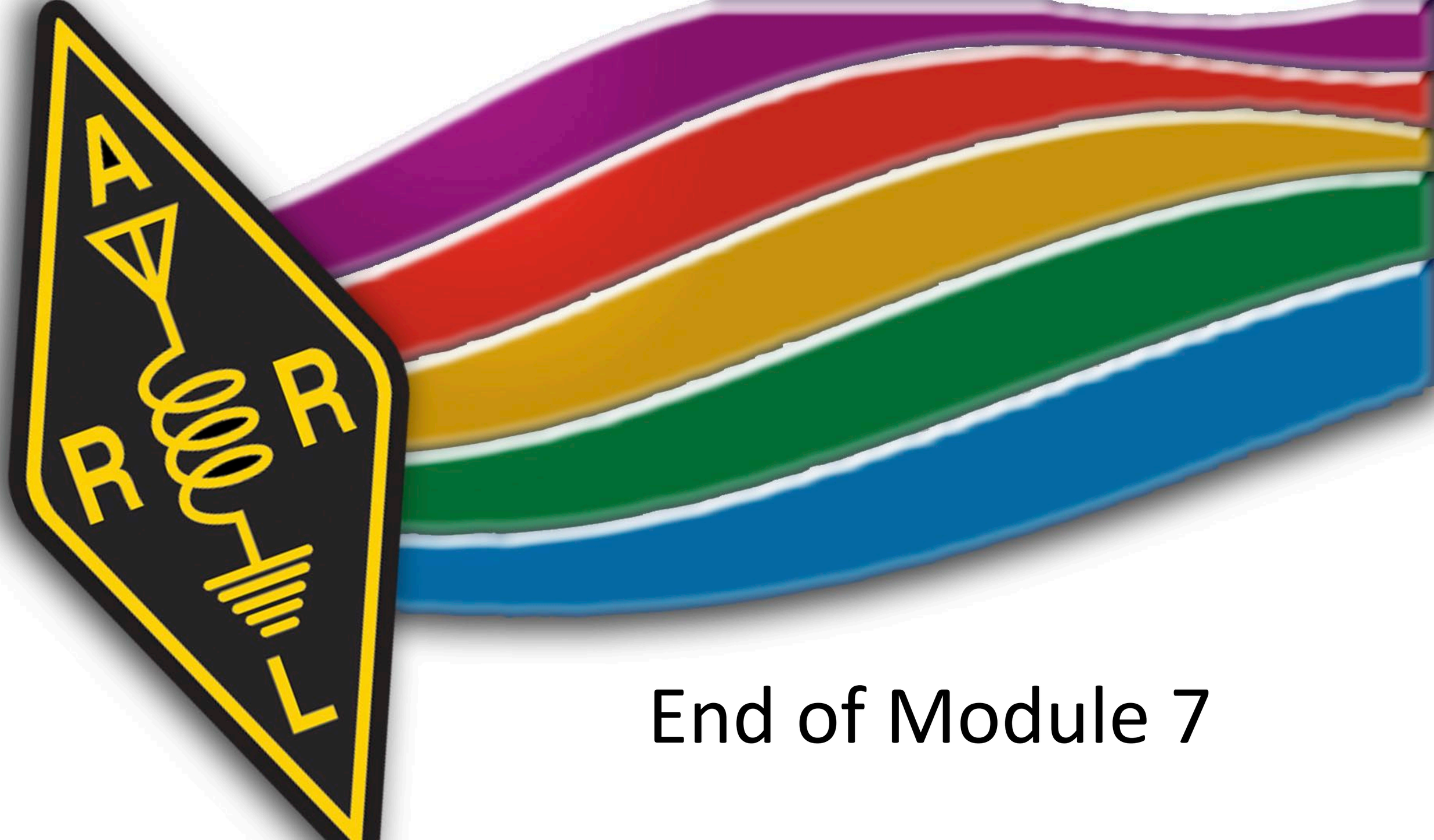
What device increases the low-power output from a handheld transceiver?

An RF power amplifier

Where is an RF preamplifier installed?

Where is an RF preamplifier installed?

Between the antenna and receiver



End of Module 7