**What is a Repeater?**
A duplex repeater, in concept, is not really a complicated device. It's a 'duplexed' two-way radio set that listens on one frequency, then re-transmits what it hears on another; at exactly the same time. These systems are usually located in places of high elevation (on mountains and tall buildings) and are equipped with large - efficient antennas, extremely low loss feedlines, and a transmitter and receiver that is very durable and rated for continuous duty. The end result? People using a repeater get much greater range from their radio equipment than would be possible talking simplex. This is how an individual with a portable walkie-talkie (handheld) transceiver can communicate with people many miles away with good clarity. Repeaters are used in Commercial (Business)Communications, Emergency Communications (either by 'hams' or by Federal or Local Government agencies), and even Pleasure Communications. These machines might have multiple sources of power, including batteries for when commercial power is lost. Repeaters can be built that are extremely power efficient, and may run exclusively from batteries; recharged by solar, wind or water power.

**What is Simplex?**
Simplex is point to point communications without the use of a repeater. Simplex operation utilizes the same frequency for receive and transmit. I.E. Portable to Portable or Mobile to Mobile
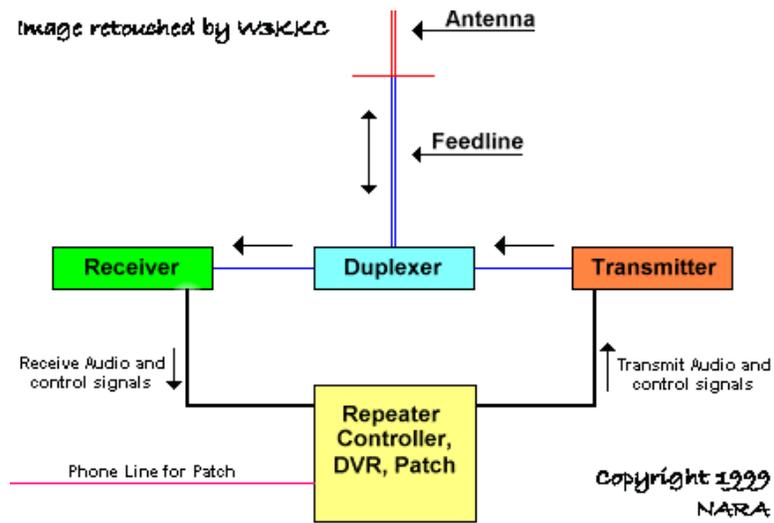
**What is Duplex?**
The simple explanation of full duplex operation is like the telephone, where both people can talk at the same time. In contrast, a pair of handhelds operate in half-duplex mode because only one person can talk at a time. Since the 'repeater' listens and talks at the same time in relaying your message, it operates in full duplex mode.

**How does a Repeater work?**
At first glance, a repeater might appear complicated, but if we take it apart, piece by piece, it's really not really so difficult to understand. A basic repeater consists of several individual pieces that, when connected, form a functional system. Here's a simple block diagram of a repeater:

Image retouched by W3KKC

Antenna

Feedline

Receiver    Duplexer    Transmitter

Receive Audio and control signals

Transmit Audio and control signals

Repeater Controller, DVR, Patch

Phone Line for Patch

Copyright 1999 NARA

**Antenna -**
Most repeaters likely use one antenna. The antenna serves both the transmit and receive RF (Radio Frequency) signals that are going in to and out of the repeater. It's generally a high performance, durable, and rather efficient antenna located as high on a tower or structure as we can get it.  Antenna systems of this type can easily cost $500 or more.

**Feedline -**
The feedline on most repeaters is just a piece of standard coax cable.

**Duplexer -**
This device serves a critical role in a repeater, it prevents the receiver and transmitter from 'hearing' one another by the isolation it provides.

A duplexer is a device that is referred to by several different names like cavities or cans.  A duplexer has the shape of tall canisters and is designed to pass a very narrow range of frequencies and to reject others.  There is some loss to the system because of the duplexer, however, the advantage of being able to use a single antenna usually outweigh the drawbacks.

Most repeater installations use the same antenna for transmit and receive. Without having an offset the repeater would simply hear itself when it was transmitting on the same frequency it was listening on. Even with the offset, the two frequencies are close enough that some isolation is required.  Again, this isolation is afforded by the Duplexer.

**Receiver -**
Receives the incoming signal. This receiver is generally a very sensitive and selective one which helps weaker stations to be heard better by the repeater.  It's also where CTCSS (Continuous Tone Coded Squelch System) or "PL" decoding takes place.

**Transmitter -**
Most machines have a transmitter composed of an 'exciter' and a power amplifier. The exciter modulates the audio at the proper transmit frequency, and the power amplifier simply boosts its level so the signal will travel further.

**The "Station" -**
The term "Station" is used to describe a stationary two way radio set; which includes the transmitter, receiver and sometimes the control circuitry.  A 'Repeater Station' is a station designed to be used as a duplex repeater.

**Controller -**
This is the brain of the repeater. It handles station identification (through either CW or voice), activates the transmitter at the appropriate times, controls the autopatch, and sometimes does many other things. Some machines also have a DVR (Digital Voice Recorder) for announcements and messages.  The controller is a little computer that's programmed and optimized to control a repeater.  The various models of controllers have different useful features like speed-dial for phone patches, a voice clock, facilities to control a remote base or linking, etc. The controller gives the repeater its 'personality'. Whenever you're using a repeater, you're interacting with its controller.

**What is a Phone Patch or Autopatch?  AKA "Patch"**
Many repeaters have a feature that allows you to place a telephone call from or to your radio

**DVR** -
A DVR is a Digital Voice Recorder, it modern terms "voice mail".

**What is CTCSS or a PL Tone?**
PL, an acronym for Private Line, is Motorola's proprietary name for a communications industry signaling scheme call the Continuous Tone Coded Squelch System, or CTCSS.  It is used to prevent a repeater from responding to unwanted signals or interference. Tone Squelch is an electronic means of allowing a repeater to respond only to stations that encode or send the proper tone. Any station may be set up to transmit this unique low frequency tone that allows the repeater to operate.  If a repeater is "In PL" that means it requires a CTCSS tone to activate the repeater.  In days of old, repeaters that used PL were considered to be closed or private.  This is no longer the case as PL operation has become more the rule instead of the exception.  CTCSS is often referred to as PL, Channel Guard, Call Guard, Quiet Channel, and others.