Repeaters — Your Friends in High Places

Mobile radios and handheld transceivers seem cool, until you find out that these little rigs generally have a range of only a few miles. The truth is, you can use a handheld or mobile radio to talk to people tens or thousands of miles away with the help of a device known as a repeater. When you get down to the basics, a repeater isn't complicated. It simply repeats. It listens for signals on one frequency, known as the input, and repeats whatever it hears on a different frequency, known as the output all at the same time.

A repeater's receiver is extremely sensitive, and is usually connected to an antenna installed on a tall support tower. In many cases, repeaters and their antennas occupy tall buildings, hills, or even mountaintops. With such a sensitive receiver and tall antenna, a repeater's "big ears" can hear signals over a wide area, including weak ones from handheld transceivers. A friend a couple of miles away may not be able to hear your little handheld radio, but a repeater can hear you very well, even though it may be several miles away or more.

Repeaters expand the coverage area of VHF and UHF stations when low power, distance, or obstructions prevent communication.



Stations not in line of sight or out of range

Remote fixed

Aside from the distance, maybe there's a mountain between the two of you as well. That obstacle makes direct radio communication impossible, but a repeater in the right location will relay your signals around or over that mountain.

And when a repeater repeats your signal, it does it with a big voice. A handheld transceiver may transmit with just 5 watts of power, but a repeater transmits with much greater power — sometimes hundreds of watts. All that power is applied to the same tall, powerful antenna that heard your signal, and the antenna sends that energy over a huge area.

Think of it this way: You started with a little handheld radio, but when you're talking through a repeater, you're effectively controlling that much bigger radio every time you squeeze your handheld's push-to-talk switch. When you speak, your voice is heard over many square miles. When your friend responds, you hear their voice even though they may be far away, and possibly using a tiny handheld of their own.



Types of Repeaters

Most amateur repeaters operate on the 2-meter band (146 - 148 MHz) and the 70-centimeter band (430 -450 MHz). That's one reason why dual-band transceivers are so popular — they'll work on both bands. You'll also find repeaters on frequencies as low as the 10-meter band (between 29.500 and 29.700 MHz) and as high as the microwave bands. No matter what frequencies they use, all repeaters function the same way.

Some repeaters are connected to the internet, enabling you to speak with other amateurs across the globe. Repeaters may also be linked to each other, so that a conversation taking place through one repeater is heard on several repeaters at the same time.

Analog FM repeaters are most popular by far, but you will also find digital repeaters using systems such as DMR (digital mobile radio), D-STAR, and System Fusion (the latter handles conventional FM as well as C4FM digital transmissions, hence the "fusion"). They operate somewhat differently and offer different features, but like their analog cousins, they repeat signals.

Finding Repeaters

Repeaters are almost everywhere. There are more than 20,000 repeaters in the United States alone. Many are operated by groups or clubs, because it can be expensive to maintain repeater equipment and pay rent for a space on a tower, or atop a building.

The best way to find repeaters in your area is to pick up a copy of the ARRL Repeater Directory (arrl.org/shop) or, if you own an iOS or Android smartphone, subscribe to the RFinder app. Regardless of whether you use the app or the book, you'll be able to look up your local repeaters and see their input and output frequencies. You'll also find out whether they are analog FM repeaters, or one of the varieties of digital machines.



Know the Tones

Most analog repeaters use a system called Continuous Tone Coded Squelch, or CTCSS, to prevent interference. CTCSS tones are at low audio frequencies — you won't hear them, because repeaters sharply reduce low-frequency audio after they process the tones.

If you're trying to use a repeater that requires a CTCSS tone, it won't respond unless your transmission is accompanied by the correct tone. Tones for specific repeaters are listed in the ARRL Repeater Directory and the RFinder app. Consult your transceiver's manual to learn how to program your radio for the proper tone.