

How Are You Controlling Your Repeater?

Since 2-meters is the most popular amateur band, it isn't surprising that ARRL staff, directors and officers are often asked questions relating to the control and operation of repeaters. Many popular multiband VHF/UHF transceivers have the capability to operate as crossband repeaters. The rules for control and operation of repeaters are somewhat complex and sometimes misunderstood.

Q: How does the FCC define a repeater station?

A: A repeater station is defined by the FCC as "an amateur station that simultaneously retransmits the transmission of another amateur station on a different channel or channels [97.3(a)]." Only repeaters, some types of auxiliary stations, and space stations may automatically retransmit the radio signals of other amateur stations [97.113(f)]. A repeater normally consists of a receiver, a transmitter, an antenna, and a repeater controller (which controls the retransmission and various other functions). Many repeaters also use a duplexer that allows the use of a single antenna for simultaneous transmitting and receiving.

Q: What are the different types of control and how do they relate to the operation of repeaters?

A: Any station may be operated under *local* or *remote control* [97.109(b), (c)]. Only certain types of stations may be operated under *automatic control*, including repeaters [97.109(d)].

Q: What is local control?

A: Local control is used when the control operator is physically located at the repeater site and is actually monitoring and controlling the repeater's operation whenever it's on. This is the simplest form of control, and is typical where the repeater is located at the licensee's home or place of business. Local control is defined by the FCC as "the use of a control operator who directly manipulates the operating adjustments in the station to achieve compliance with FCC rules." It's not always practical for the repeater licensee to be at the control point of the repeater or other amateur station 100% of the time, so the FCC allows other types of control.

Q: How can repeaters operate under remote control?

A: Remote control (also known as "tele-

command"), is used when the repeater is located away from the licensee, such as on a tall building, a tower or a mountain. The FCC defines it as "the use of a control operator who indirectly manipulates the operating adjustments in the station through a control link to achieve compliance with the FCC Rules [97.3(a)]." Under remote control, the licensee has implemented a means by which the repeater's control operator(s) can monitor and control its operation by some form of control link from one or more distant locations. They have been given access to the remote control system, and also been given the "secret" codes used to control the repeater's various functions.

Another FCC definition applies in remote control situations. Telecommand is defined by the FCC as "a one-way transmission to initiate, modify or terminate functions of a device at a distance [97.3(a)]." Remote control (telecommand) links can take any of three basic types:

(1) *A dedicated wireline from the remote control point(s) to the repeater site.* It is expensive to have a wireline link from one specific location to another, but it is very secure!

(2) *A nonpublished telephone line into the repeater site.* "Wrong numbers" can sometimes cause problems for the controller, however.

Note that in both cases above, the control link must be available 100% of the time! Therefore, a telephone control line can not also be used for an autopatch. This is because if the autopatch is in use, the telephone line is busy; in which case the control operator could not gain access to the repeater's control system if needed.

(3) *A radio control link using auxiliary stations, operated by designated control operators and transmitting on authorized auxiliary frequencies above 222.15 MHz.* As in the cases above, this control link must be available to the control operator(s) 100% of the time, so it cannot be used for any other purpose. The frequency and control codes should not be published and should be known only by the licensee and control operators. Only the area frequency coordinator should know the frequency.

Q: Aren't repeaters required to have a three minute time-out timer in the event of a repeater malfunction?

A: Yes, and that's where telecommand applies to remote control of a repeater.

The rules contain several requirements

for remote control and telecommand operation:

(1) Provisions must be incorporated to limit transmissions to no more than three minutes if the control link fails. The three minute timer shuts off the repeater in the event of a malfunction to prevent possible damage to the transmitter and possible interference [97.213(b)].

(2) Safeguards must be in place to protect the station from unauthorized transmissions, whether deliberate or accidental. Some remote station licensees incorporate the use of DTMF tones or CTCSS systems to limit access to the control system to only those people who know the codes. You, as the licensee, are responsible for all transmissions from your remote station, just as you are responsible for your home station [97.213(c)].

(3) A photocopy of the station license and a label with the name, address, and telephone number of the station licensee and at least one designated control operator must be posted in a conspicuous place at the repeater station location [97.213(d)].

(4) Control (or telecommand) links may be wire (a telephone or fiber optic line, for example) or radio. The FCC says that if a radio link is used, the station where the control commands are performed is an auxiliary station [97.213(a)] and an auxiliary station is "an amateur station transmitting communications point-to-point within a system of cooperating amateur stations" [97.3(a)]. All auxiliary operations must be conducted on appropriate frequencies above 222.15 MHz.

Q: What is automatic control and does it mean that no repeater control operator is necessary?

A: Not entirely. Automatic control is used when no control operator is available to "babysit" the repeater. It is defined by the FCC as "the use of devices and procedures for control of a station when it is transmitting so that compliance with the FCC Rules is achieved without the control operator being present at a control point. [97.3(a)]." Repeater must have a control link which allows the repeater to be disabled by remote control if necessary. Note that such a controller cannot detect and correct improper use of the repeater. *Although no control operator is required to be present at a control point while the repeater is operating under automatic control, it is still the station licensee's responsibility to see*

that the repeater operates properly at all times [97.103(a)].

Q: How can I make my station into a crossband repeater?

A: Modern dualband or triband VHF/UHF rigs often have the capability of crossband operation. When operating in this mode, the users may call them “crossband repeaters.” Actually they are often “remote bases,” such as when they are used to allow an operator with a hand-held radio to access a repeater from a location where he or she would normally not be able to do so.

A “crossband repeater” (or “portable remote base”) operation is okay as long as several conditions are met:

(1) The user communicates with his crossband rig via the UHF side. Since this serves as the control and voice uplink, it is a form of auxiliary operation and must be conducted on authorized auxiliary frequencies above 222.15 MHz. Since the operator is the control operator, that person must actually be able to control the station! That person must be able to turn it off locally or remotely if a problem develops. If it can't be controlled, it's not legal [97.7, 97.201, 97.213]!

(2) If the control link fails, the remote station must shut down within three minutes, which means a 3-minute timer is required [97.213].

(3) The unattended station must be identified on all frequencies on which it transmits. Since this is a type of remote base, the users who identify over the UHF uplink to the dualband radio also serve to identify the VHF output of the mobile rig. In the other direction, however, there is no way for the control operator to identify the UHF downlink from the mobile remote base, so some form of automatic identification must be employed [97.119]. Unfortunately, few manufacturers include the capabilities listed above in their rigs. Hence, to be fully legal, some form of add-on controller may be necessary.

Another use for crossband operation is to link together two existing repeaters on different bands, usually done on a temporary basis during an emergency, a drill or a special event. The rules above apply.

In both examples cited above, the control requirement can be satisfied by having a control operator at the station, thus making it a locally controlled station. Although this may not always be convenient, it is a way to satisfy all of the station control requirements.

Q: Should I contact my frequency coordinator even if my crossband repeater is temporary?

A: Yes, because you might be transmitting on a repeater input (or a link or control frequency for some unknown repeater) and you could unknowingly cause interference. Contact your local frequency coordinator for a recommendation as to what frequencies to use. Many coordinators have set aside frequency pairs that are designated

specifically for temporary, portable or emergency repeaters. For the name and address of your frequency coordinator, see the latest edition of *The ARRL Repeater Directory* or check the listing on the ARRL Web page at: <http://www.arrl.org/field/regulations/freqcoord.html>.

Q: What are ancillary functions?

A: They are user functions. The FCC makes a distinction between functions which the repeater users can perform on the repeater input (activating a crossband link, getting a weather or time-of-day report, or making a phone call via the autopatch, for example), and those primary control functions reserved exclusively for the control operators in effecting basic control of the station. The rules state that “*ancillary* (which also means “secondary”) *functions*” of a repeater that are available to users on the input channel are not considered remotely controlled functions of the station” [97.205(e)]. These “user” functions are conducted on the repeater’s input frequency. However, the *primary control functions* (turning the repeater on or off, for example) must be performed via the repeater’s primary control system which is separate from the input frequency. By the way, there is nothing to prevent implementing some form of “emergency backup” means to shut down a repeater via its regular input frequency, as long as the turn-on function can only be performed via the primary control system.

Q: Are “closed” repeaters legal?

A: Yes. The FCC even says so in Part 97 in stating “...Limiting the use of a repeater to only certain users is permissible” [97.205(e)]. Just because a repeater may use some form of coded access, such as CTCSS, does not necessarily mean that it is a “closed” repeater. Many “open” repeaters employ coded access to eliminate or reduce various types of interference, *not* to restrict who is welcome to use the machine.

Also, there is no FCC rule that requires a repeater’s licensee or sponsor to build a repeater or allow use by other operators. A repeater is *not* a public utility—you don’t have a “right” to use it. If you use that station in a manner that the owner finds objectionable, for whatever reason, that person has every right to revoke your privilege of using it!

Q: What other Part 97 rules concerning repeaters should I be aware of?

A: Amateurs should know that:

(1) Novices can’t operate as repeater stations [97.205(a)].

(2) Repeater may operate on any frequency authorized to the Amateur Radio Service above 29.5 MHz except for 50.0 - 51.0, 144.0 - 144.5, 145.5 - 146.0, 222.0 - 222.15, 431 - 433 and 435 - 438 MHz [97.205(b)]. Note that these frequencies include *both* the input *and* output frequencies of all repeaters [97.205(b)].

(3) Two repeater licensees must work together to solve an interference problem between the repeaters, unless one repeater is coordinated and the other is not. The licensee of an uncoordinated repeater bears the primary responsibility for solving an interference problem. This is the FCC’s way of recognizing and encouraging repeater sponsors’ participation in local or regional frequency coordination programs [97.205(c)].

(4) If the control operator is someone other than the licensee, *both* are equally responsible for the proper operation of the station [97.103(a)].

(5) The licensee and control operator(s) of a repeater that inadvertently retransmits communications that violate the rules in Part 97 are not normally held accountable for the violative communications [97.205(g)]. However, they will be held accountable if they become aware of the illegal communications and allow them to continue, because they are no longer “inadvertent.” They must make an effort to prevent such communications from continuing.

Q: Are the rules for simplex repeaters the same as duplex repeaters?

A: A “simplex repeater” is *not* a repeater according to the FCC. It does not *simultaneously* retransmit the signals of another station and it might not retransmit the signals on a *different* channel or channels, as specified in the FCC’s definition of a repeater. Since it isn’t a repeater, such a device *cannot* be operated under automatic control. If a control operator is present and controlling the device, either by local or remote control, then it can be used, but it cannot be left unattended! On the other hand, it is not limited by the other repeater rules, such as specific repeater frequency limitations. Auxiliary stations must control the simplex repeater and control must be conducted on frequencies authorized for auxiliary operation (above 222.15 MHz, except 431 to 433 and 435 to 438 MHz).

Special thanks to Gary Hendrickson, W3DTN, chairman of the Mid-Atlantic Repeater Council’s Open Band Planning Committee, for his assistance with this column. As the T-MARC coordinator for 25 years, Gary is a recognized expert in the field of repeater coordination and complex repeater operations.

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Strays

RADIO REUNION

◇ A group of World War II Merchant Marine radio operators are holding their ninth annual reunion in May 2000 in San Diego, California. The group, composed of men who trained on Hoffman Island, New York in 1944-45, is named “The Hoffman Island Radio Association.” Call Bill Yerger at 607-776-4965 for information or visit their Web page at <http://www.usmm.org/hoffman.html>.

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