Specialized Modes

There are some specialized modes of communication that may be useful in emergencies if the necessary equipment and trained operators are available. These modes are primarily used in the Amateur Radio Service, and may not be authorized in certain other radio services. Always be familiar with the FCC rules for each radio service used, especially before using any unusual modes of communications.

Packet Radio

Packet radio provides a somewhat secure method of transmitting/receiving data. "Somewhat" in that not just anyone with a scanner can listen to the information, but not really "secure" in that anyone with a receiver, TNC, and computer can read the information being passed.

Packet increases the accuracy of the information by having it written rather than transmitted by voice. While the transmission time is a bit long, the accuracy and increased confidentiality make it a good choice for certain emergency activities. HF packet is generally 300 baud; although 9600 baud is possible at VHF and UHF with some equipment, 1200 baud is still very common. These speeds require long transmission times and heavy equipment duty cycles.

How Does Packet Work?

A packet radio station consists of a computer, Terminal Node Controller (TNC), a radio, and some cables connecting all of the parts. Some of the TNCs use standard computer serial cables while others may have special requirements (see the TNC manufacturer's instructions). The connection between TNC and radio will have ground, transmit audio, receive audio, and push-to-talk (PTT) lines. Specialized cables are typically required for different brands of radios (although some brands use compatible cables). Generally a packet station will be established by one operator providing at least the TNC, radio, and matching cables.

The computer will be loaded with one of many programs that will control the TNC. Some programs simply make the computer function as a dumb terminal. With these, if you try to make the computer do anything else it may lock up and do nothing at all. Ask a person with full packet training before you try to get the computer to multi-task.

Some terms you will need to know and understand are:

- Packet - the name of the piece of data sent from your computer to another. It has a header with the call of your station and the call of the station you are talking with (plus a little other information) followed by what you typed in.
- TNC - Terminal Node Controller. The device that acts as an interface between the computer and the radio. It normally includes a modem and will have a micro-processor included.
- Digi-Peater - a relay station between stations that cannot hear each other
- Packet Bulletin Board Systems (BBS) - a local collection point for messages between users. Usually linked to other BBSs to exchange messages.

- Cluster - Similar to a BBS but normally without the links to other BBSs/Clusters.
- Keyboard-to-Keyboard - Connection used to talk to other amateurs directly. Normally you will be talking with a single station or to a cluster.

Other Useful Information About the TNC:

TNC state - Status of the TNC at that instant. Some of the status names are:

- Disconnected - Idle state where the TNC will monitor activity on the frequency and display that information on your computer.
- Connected - The state where the TNC has established contact with another station and is ready to exchange information. When you are connected, the channel activity no longer will be displayed on your computer (there are ways around this but don't worry about them).
- Converse Mode - once the TNC connects to another TNC it will normally enter converse mode so that anything you type in at your computer is transmitted to the other computer each time you press the Enter key.

Commands - Instructions to the TNC telling it what you wish it to do. These common commands can be abbreviated by using just the first one or two letters (indicated by the capital letters in the commands shown below). The most common commands are:

- MYcall - Definition of the call to be used by the TNC.
- Connect - Request to connect to another computer.
- Disconnect - Request to sever connection with another computer
- Send - Request to send a message to another user. This will be used when you have connected to a BBS (bulletin board) or cluster (interconnection among multiple users).
- Read - Read a received message from the cluster/BBS.
- CHeck - Normally set to zero for emergency communications work (keeps the TNC from automatically disconnecting if the activity is low).

Status Lights: Status lights may vary by manufacturer. The most common are:

- PWR - Power on indicator
- CON - Connect indicator
- STA - Data from the computer is ready to send but has not been sent yet.
- PTT - On when PTT line is active (transmitting).
- DCD - Incoming data indicator. The information available after this light goes out will only be displayed if the information was for your station.

What Will I Do?

The packet station should be set up by an experienced packet operator (usually the person who owns the equipment), but if you are part of the setup team, you may be asked to help set up the station. Some prepared locations (such as a state or major city EOC) may have a dedicated packet station already on-site which may need to be set up for operation. Such stations should have setup instructions. Most cables will be labeled with information telling you where each is to be connected.

To set up a packet station, you will set up the equipment per the instructions and:

- Power up the computer
- Load the communications program
- Power up the TNC. The software used will determine whether the TNC will need to be powered up before the communications program is loaded (read the setup instructions).
- Power up the radio
- Follow any prepared directions about operating the packet station.

You are now ready to operate; i.e., send and receive messages as required by your location.

Do not adjust, play with, or fiddle with any piece of equipment in use for an event, during that event, unless it is malfunctioning and you know what to do about it.

Automatic Position Reporting System (APRS)

Automatic Position Reporting System is a specialized form of packet radio in which location data is sent over the radio using the packet communications protocol.

Location data may be entered manually, but most commonly it is taken directly from a GPS unit. Location data for many stations may be collected by one or more stations where it can be displayed graphically on a map or used for other data processing by a computer. This system is generally used to keep track of the location of mobile or portable stations.

An APRS station may be configured to transmit its location only manually or automatically at specified time intervals. More elaborate systems provide a capability to control the transmitting of location information by distance moved or by various combinations of distance and time so the station would report its location more often when moving than when stationary.

APRS usually is conducted on packet frequencies, but properly configured it can be used over a normal voice communications frequency without creating undue interference. To use APRS on a voice frequency, the mobile system normally is configured to only transmit the location data at the end of a manual transmission and only if a reasonable time and/or distance have elapsed from the last transmission. When configured this way, the APRS data burst is very similar to the “courtesy beep” used on many amateur repeaters. If the APRS signal must be relayed by a digipeater, a local digipeater should be configured to receive the APRS signal on the voice frequency and relay it on a packet frequency.

In addition to the location data, the APRS version of the packet protocol allows for a short status message to be included.

Amateur Television (ATV)

Fast-scan TV (FSTV), also referred to as amateur television (ATV), uses a transmission format fully compatible with video equipment designed for the home consumer market. The video is amplitude modulated and the audio is frequency modulated. Simply stated, the ATV picture display has full motion with simultaneous sound, can be in full color, and has excellent detail.

Because the signals occupy several megahertz of bandwidth, the FCC does not permit ATV on bands below 420 MHz. with most activity being between 420 and 440 MHz.

How Does ATV Work?

ATV will normally use a high quality video camera that is capable of recording the image and passing the image to a transmitter at the same time. The transmitter (usually operating on amateur frequencies equivalent to cable channels 58 or 60) then broadcasts the signal for reception.

ATV Pitfalls? ATV is not yet commonly used in most areas, but it has been used by the California RACES during many events and emergencies. They have identified several potential problem areas and found effective techniques to avoid those problems. The material here is largely based on the experience of California RACES units using ATV.

When our served agencies have seen full color live action pictures during forest fires they have been very enthusiastic that command officers are able to see what is happening rather than relying on someone's verbal description. Accurate command decisions are much easier to make with that type of information. This enthusiasm sometimes extends to requests that are inappropriate for amateur radio.

One problem comes when a served agency asks us to use ATV for surveillance or for evidence gathering. Both of these activities are outside the realm of amateur radio. However, if the primary use of our pictures is for public safety, then the fact that evidence may be gathered as a byproduct is acceptable.

Amateur radio transmissions (including ATV) must not be conducted *for the purpose of* newsgathering or public broadcast. News media may quote from or rebroadcast material (including audio and video) that was transmitted by amateur radio for legitimate purposes (such as public safety) but we cannot conduct amateur communications specifically for them.

Suggested ATV Policies

The role for ATV is to document an event and present it to the public safety officials at the incident command post.

ATV crews are expected to take a low key, passive, observer role. ATV crews are expressly forbidden from staging pictures or inciting a crowd to act up for the camera.

ATV crews must keep safety foremost in their minds. ATV lends itself to exposing its crews to dangerous situations such as fires, floods, and riots. Therefore added attention to safety is essential.

ATV crews should operate with two people. One person will do the photography and the second person will watch for possible hazards, handle voice communications, and provide for the safety of both operators.

The time and date should be displayed continuously for the recording tape and the benefit of public service officials.

ATV Techniques - The following will help you to provide good quality ATV pictures for your served agencies.

Hold the camera steady. Whenever possible, use a tripod or brace yourself against something solid.

Use wide-angle shots when "panning." This allows those watching to identify objects rather than just seeing a blur.

Pan slowly. Momentarily cover the lens with your hand if you must pan quickly.

Use wide-angle when walking with the camera.

Use telephoto only with a tripod and then only if explicitly instructed to.

Remember you are operating with a live microphone and everything you say is being recorded (and may also be being rebroadcast live)!

Slow Scan Television (SSTV)

SSTV uses a special format to send TV-like images one frame at a time. FSTV sends many frames per second, SSTV takes several seconds per frame.

SSTV may be used to send a single still picture or a series of still pictures. The effect is like a slide show rather than a moving picture.

SSTV requires much less bandwidth so the SSTV can be transmitted on bands where FSTV is not authorized. SSTV generally can be transmitted over any sort of connection (such as telephone) that can support voice traffic.

Citizens Band Radio Service

The Citizens Band Radio Service, more commonly known as Citizens Band or CB, is a low power personal communications service using AM and SSB modulation on 40 specified frequencies (channels) in the 11m band from 26.965MHz to 27.405MHz.

Several of the available CB channels are unofficially designated for different uses. In most cases, these practices simply reflect local usage in much the same way that amateur radio band plans reflect the commonly accepted behavior of the radio community. Complying with such usage limitations is good manners, but generally not required by regulation. The one exception is that CB channel 9 (27.065MHz) is formally designated by FCC regulation exclusively for emergency and traveler assistance communications.

Using CB Radio for Emergency Communications

CB has been the radio service most widely available to the public, although FRS is rapidly catching up. This is its greatest strength and its greatest weakness in emergency communications.

The equipment is inexpensive and readily available. Often vehicles from volunteer agencies that don't have a "communications system" will still be equipped with a CB radio.

Any adult can be shown how to operate a CB radio in just a few minutes. Of course this does not make the person a trained emergency communicator, but it may well be sufficient for tasks where the use of the radio is secondary to the main mission, such as keeping track of a van being used to deliver supplies to several shelters.

Although today fewer people have CB radios set up in their homes than in the past, there are still a tremendous number of cars with CB radios.

CB radio is recognized as *the* one way to establish communications with over-the-road truckers. Most major truck lines have text-only satellite communications systems in all their OTR trucks, but access to these systems is generally not available except through the specific company dispatcher. CB radio is the most practical method for providing information to truckers within or entering a community or an area. This can be a critical function in the response phase of a major disaster when large quantities of supplies are being brought into the area (often including unsolicited donations that do not have any specific location for delivery in the area).

CB also reaches a large portion of the travelling public on most major highways. This can be useful for encouraging travelers to bypass an area experiencing an emergency and to direct evacuees to emergency shelter locations.

CB radio may provide at least a partial substitute when telephone service is knocked out in a community. Many people have CB radios or would be able to access a CB radio at a neighbor. While this certainly is not a perfect solution, it does provide a way for the public to call for emergency services (fire/police/EMS) if telephone service is unavailable. These are among the same sort of calls *REACT* was originally founded to handle. Generally CB channel 9 is most appropriate for these purposes.

CB radio is likely to experience interference. The wide availability of CB radio does increase the likelihood of pranksters and malicious interference compared to other radio services. CB rules compliance is noticeably less than is typical in most licensed radio services. Propagation characteristics of the 11m radio signals sometimes will result in receiving signals from distant stations.

Because of the wide access by the public, CB is generally not appropriate for traffic of a sensitive or confidential nature.

Monitoring and Using CB Channel 9:

Monitoring CB channel 9 was the original goal of *REACT* when it was founded in 1962 and to this day it remains one of the goals of *REACT* International. Throughout the United States and Canada, CB channel 9 is reserved for requesting and providing traveler assistance and reporting emergencies. Although individual licenses are no longer required to operate a CB radio, the FCC regulations still apply. Basically, CB channel 9 may be used to request road service, directions, or any information needed by a traveler to reach their destination or to report any emergency, unsafe, or hazardous situation where assistance is needed.

Monitoring was *REACT*'s original goal and it remains one of the community service programs most widely associated with *REACT*. Some Teams focus primarily on monitoring, while other Teams have their primary focus on other areas of emergency communications. All Teams and *REACT* members are encouraged to participate in various community service communications activities, such as reporting roadside emergencies and hazards when travelling, and assisting with communications support for various community service projects.

REACT members are not required to monitor CB channel 9, but are encouraged to do so. Monitoring does not need to be a burdensome activity. You will find it easy to turn on the CB radio, set it on channel 9, and go about your regular activities. Obviously this is not as effective as actually listening to the radio, but you will still be able to hear and respond to nearby calls for assistance. Depending on your situation you may need to turn up the squelch on the radio when leaving the radio set on CB channel 9; this will block most of the noise, but it will also block any weak calls. The best monitoring is performed by actually listening to the radio with the squelch set all the way off or at the level where it just barely blocks the background noise, but this is not always reasonable or even possible.

How to Call for Assistance on CB Channel 9:

Call the local *REACT* Team (if known), identify yourself, and indicate what sort of assistance you need. Typical calls might be, "*Any REACT station, this is Bill Smith; I need road directions*," or, "*This is John Doe calling any REACT station; I have an emergency.*" *REACT* members should identify themselves by their Team name and unit number, such as "*Any REACT base, this is [team] REACT Unit 299....*"

Keep calm. Don't babble or try to give the monitor all the information in one breath; rather try to give the monitor all available information in a logical manner. Be sure to give the exact location and an accurate description of the problem.

If you do not get an answer when you call on CB channel 9, stay calm. Try two or three more times. Each time state the problem and the complete location as accurately as possible. Remember, a monitor may be hearing you and just not be able to reach you with an answer.

In an emergency, if you do not get any answer, transmit the information blind at least twice. Be sure you give the location well enough that someone outside the local area could notify the proper authorities. There are many documented cases where no local monitor heard a call, but a monitor hundreds of miles away copied the information and notified the proper authorities. When transmitting blind, be sure to include the city and state.

If you don't get any answer on channel 9, try another channel. It is always best to try CB channel 9 first. You may not get an answer, but you can be reasonably sure that if you do get an answer it will be a trained monitor who will get the necessary information and report it to the proper authorities promptly.

One final point to remember: the more reason there is for you to be excited, the more important it is for you to remain calm.

How to Answer a Call for Assistance on CB Channel 9:

Keep calm*!* Answer the call by saying something like "*Go ahead, [caller's name or handle]; this is [team] REACT Unit 299*." Again, the more reason there is to be excited, the more important it is for you to be calm. If the caller is excited, your calm professional voice and attitude may help to calm them down enough for you to get the needed information. Identifying yourself as a *REACT* monitor may also help calm the caller.

Get all the information that is available, and *write it down* as you get it. Don't worry about spelling, but be sure the information is accurate and that you can read it. Then pass the information to the proper authorities.

Find out if the caller is still at the scene of the problem. Ask the caller to stay on channel 9 in case more information is needed. Be particularly careful to get an accurate location.

If you have any doubt about the validity of a call, report it to the authorities anyway but also report your reasons for doubting it. Leave any response decision up to the appropriate authorities.

Remember when passing calls to the police, fire department, or EMS, you must direct your call to the correct agency. In many communities it is better to call the response agency directly rather than use 911 because the 911 system will automatically show the address you are calling from and you may be switched to the agency covering where you live rather than the agency where the emergency is located. In all cases, clearly identify yourself as a *REACT* member relaying information from a CB call.

Keep a list of emergency telephone numbers at your station.

DOs and DON'Ts on CB Channel 9

- DO answer all calls for emergencies and travelers assistance.
- DO switch non-emergencies to another channel.
- DO ignore non-emergency users on Channel 9 as much as possible.
- DON'T use Channel 9 for non-emergency communications.
- DON'T argue with others on the channel.
- DON'T use the radio when the telephone is readily available.
- NEVER go to the scene of an emergency to "help" unless you are specifically requested to do so by the authorities.

Family Radio Service (FRS)

The Family Radio Service is a low-power, unlicensed, personal communications, voice radio service using FM on fourteen specified UHF simplex frequencies. FRS channels 1 through 7 are the same frequencies as the seven GMRS interstitial channels at 462MHz. These channels are available to both unlicensed FRS users and licensed GMRS users. FRS and GMRS users may freely communicate with each other on these seven channels. FRS channels 8 through 14 are the corresponding 467MHz channels, spaced between the standard GMRS repeater input frequencies. These channels are not authorized for GMRS use.

FRS is used much like Citizens Band, but has technical characteristics more like GMRS and amateur UHF.

Fully featured FRS radios are readily available at low cost. A "fully featured" FRS radio offers all 14 channels and all 38 standard CTCSS tones.

Some manufacturers offer FRS radios with fewer channels, fewer tones, or even no CTCSS. These radios are not as flexible in use as the fully featured radios and generally cost very nearly the same price. While the fully featured radios are generally appropriate for experienced radio operators, the simplicity of a radio with the channel and tone set by internal controls and only a volume knob and push-to-talk switch on the outside may be better for some purposes.

Some manufacturers also offer FRS radios with additional features such as DCS or a range sensing transponder system that sounds an alert when the unit moves out of range of a matching unit. Some of these features may be very useful for specific purposes, but keep in mind that these features are generally proprietary and only work with other radios of the same model or the same manufacturer.

All FRS radios have a maximum 500mW (½ watt) output and a permanently attached antenna. Most are small handheld radios.

As of this writing, no FRS channels are officially designated for any specific purposes or usage, but FRS Channel 1 with no tone squelch is widely accepted as a "calling channel." The FCC was briefly considering making this official, but decided not to designate any official emergency or calling channel on FRS.

The concept of a calling channel is that users would normally keep the radio on this channel while not communicating with anyone in particular.

The calling channel is where you would most likely initiate a call if you did not know (or did not care) who would answer. It is used for both general calling and for emergencies when you don't have a particular station to call.

The calling channel is *not* appropriate as the published or designated channel for a specific station in a specific location. For example, the calling channel would *not* be a good choice of channel for a Park Ranger station to advertise as the channel to use to call them for assistance within the park. But it would be the logical channel for an injured hiker to use to call for help if there was no specific channel publicized for emergencies in that park.

FRS channels 1 through 7 are shared with the GMRS radio service.

- FRS users are limited to the 500mW legal output of an FRS radio. Licensed GMRS stations are authorized to use a maximum of 5W ERP on these interstitial channels. GMRS users on these channels may communicate with unlicensed FRS users, but the GMRS users must identify with their callsign and comply with all GMRS regulations.
- These channels are at narrow spacing between the GMRS channels used for simplex and repeater outputs. They are subject to adjacent channel interference from higher powered GMRS stations, especially if located close to a repeater with its output on the adjacent channel.

FRS channels 8 through 14 are *not* available to GMRS or any other non-FRS stations. These channels are located at narrow spacing between the standard GMRS repeater *input* frequencies.

- Use of these channels may cause interference to adjacent channel GMRS repeaters. Such interference, from a legal FRS radio, is almost always the fault of poor equipment at the GMRS repeater.
- Interference to a GMRS repeater by a legal FRS radio generally will only occur when transmitting on the adjacent channel while using the same CTCSS tone used by that specific repeater and when transmitting from a location near the repeater.
- It is common courtesy and good operating practice to avoid the use of channel and tone combinations in locations where it is know that the combination causes interference. Although interference to GMRS repeaters by legal FRS radios is almost always the fault of the GMRS equipment, the legal responsibility for preventing such interference between any unlicensed station and any licensed station always rests with the unlicensed station. Thus it is the FRS user who must avoid interfering with a licensed GMRS repeater.

FRS Channels and Frequencies

CH	Frequency	Usage Notes
1	462.5625	FRS & GMRS (FRS Calling Channel)
2	462.5875	FRS & GMRS
3	462.6125	FRS & GMRS
4	462.6375	FRS & GMRS
5	462.6625	FRS & GMRS
6	462.6875	FRS & GMRS
7	462.7125	FRS & GMRS
8	467.5625	FRS Only
9	467.5875	FRS Only
10	467.6125	FRS Only
11	467.6375	FRS Only
12	467.6625	FRS Only
13	467.6875	FRS Only
14	467.7125	FRS Only

General Mobile Radio Service (GMRS)

The General Mobile Radio Service, more commonly known simply as GMRS, is a licensed personal communications service using FM modulation on 23 specified frequencies in the UHF band at 462 MHz and 467 MHz. (The 467 MHz frequencies are available only as repeater input frequencies.)

The FCC regulations for GMRS are contained in Part 95 which also covers CB, FRS, and MURS.

Originally GMRS licenses were available to individuals and non-individuals such as businesses and organizations. Many *REACT* Teams held GMRS licenses. In 1987 the FCC changed the regulations so that GMRS licenses are only available to individuals (real live persons; not groups, businesses, corporations, etc.) Non-individuals who held a valid GMRS license prior to July 31, 1987 were "grandfathered" and allowed to continue to renew their GMRS license provided they did not make any modifications to that license. This provision was not well understood at first (even at the FCC) and many non-individual GMRS licensees subsequently lost the right to renew their licenses under this limitation. *REACT* Teams and other "non-individual" licensees must be careful to operate within the limitations of their grandfathered GMRS license.

In 1998 and 1999 the FCC again made changes in the regulations for GMRS. These changes "simplified" the rules and opened all the available GMRS frequencies to all individual licensees. Some of the changes resulted in sections of the rules that appeared to conflict with other sections and with the FCC's new licensing procedures. These conflicts will undoubtedly be resolved, but until the confusion is resolved all GMRS licensees will have to be especially careful.

One very significant aspect of the latest rule changes was opening all the available frequencies to all individual licensees. Originally each licensee could operate only on the one or two frequencies or frequency-pairs specified on the license. Later the FCC added seven low power simplex frequencies spaced in between the eight original 462 MHz channels, and authorized GMRS stations to use the 462.675/467.675 MHz frequency pair for emergency and traveler assistance communications *when operating outside their normal area specified on their license.* The most recent change opens all the authorized frequencies to all individual licensees, *but these changes do not apply to grandfathered non-individual licensees.* Thus we have a situation where there are effectively two different sets of rules for GMRS licensees.

- A GMRS license issued to an individual covers the "immediate family members" as defined in section 95.179(a). Grandfathered non-individual licenses cover the owners and employees of a business or the members and employees of an association as listed in section 95.179(b).
- GMRS stations operating under an individual license may use any of the frequencies specified in section 95.29 (subject to the limitations in the rules). GMRS stations operating under a grandfathered non-individual license may use only the frequencies specified on their license.

Station identification requirements for GMRS are similar but not identical to those for the Amateur Radio Service as mentioned elsewhere in this program.

Section 95.119, Station Identification, says:

(a) Except as provided in paragraph (e), every GMRS station must transmit a station identification:

(1) Following the transmission of communications or a series of communications; and

(2) Every 15 minutes during a long transmission.

(b) The station identification is the call sign assigned to the GMRS station or system.

(c) A unit number may be included after the call sign in the identification.

(d) The station identification must be transmitted in:

(1) Voice in the English language; or

(2) International Morse code telegraphy.

(e) A station need not identify its transmissions if it automatically retransmits communications from another station which are properly identified.

In general, this sets a station ID requirement that is basically the same as for amateur radio except that the interval for identifications within a long transmission or series of communications is 15 minutes for GMRS compared to 10 minutes for amateur radio. The procedures recommended elsewhere in this program for call sign identification by amateur radio operators would also meet all requirements for GMRS operators.

GMRS Frequencies - There are a total of 23 authorized frequencies in the General Mobile Radio Service listed in section 95.29:

The eight frequencies available for simplex operation and as repeater outputs are listed in section 95.29(a): For a base station, fixed station, mobile station, or repeater station (a GMRS station that simultaneously retransmits the transmission of another GMRS station on a different channel or channels), the licensee of the GMRS system must select the transmitting channels or channel pairs for the stations in the GMRS system from the following 462 MHz channels: 462.550, 462.575, 462.600, 462.625, 462.650, 462.675, 462.700, and 462.725.

The eight frequencies available only for repeater control and input are listed in section 95.29(b): For a mobile station, control station, or fixed station operated in the duplex mode, the following 467 MHz channels may be used only to transmit communications through a repeater station and for remotely controlling a repeater station. The licensee of the GMRS system must select the transmitting channels or channel pairs for the stations operated in the duplex mode, from the following 467 MHz channels: 467.550, 467.575, 467.600, 467.625, 467.650, 467.675, 467.700, and 467.725.

The seven interstitial channels are available only for low-power (5 watt) simplex operation by "mobile" stations licensed to an individual. (Note: The definition of "mobile" includes handheld radios or other stations capable of operating while moving. It does not include a station operating from a fixed location such as any radio connected to a base antenna even if the same radio would be mobile if mounted in a vehicle.)

- The interstitial channels are listed in section 95.29(f): Except for a GMRS system licensed to a non-individual, a mobile station or a small base station operating in the simplex mode may transmit on the following 462MHz interstitial channels: 462.5625, 462.5875, 462.6125, 462.6375, 462.6625, 462.6875, and 462.7125.
- These channels may be used only under the following conditions:
  (1)Only voice type emissions may be transmitted;
  (2)The station does not transmit one-way pages; and
  (3)The station transmits with no more than 5 watts ERP.
- The interstitial GMRS frequencies are the same as FRS channels 1 through 7.

GMRS Frequencies	
Frequency	Usage Notes
462.5500	GMRS simplex and repeater output
462.5625	FRS & GMRS simplex
462.5750	GMRS simplex and repeater output
462.5875	FRS & GMRS simplex
462.6000	GMRS simplex and repeater output
462.6125	FRS & GMRS simplex
462.6250	GMRS simplex and repeater output
462.6375	FRS & GMRS simplex
462.6500	GMRS simplex and repeater output
462.6625	FRS & GMRS simplex
462.6750	GMRS simplex and repeater output *
462.6875	FRS & GMRS simplex
462.7000	GMRS simplex and repeater output
462.7125	FRS & GMRS simplex
462.7250	GMRS simplex and repeater output
467.5500	GMRS repeater input only
467.5750	GMRS repeater input only
467.6000	GMRS repeater input only
467.6250	GMRS repeater input only
467.6500	GMRS repeater input only
467.6750	GMRS repeater input only *
467.7000	GMRS repeater input only
467.7250	GMRS repeater input only

* The "675" frequency pair is generally recognized for emergency and travelers assistance *in addition to* regular communications.

Multi-Use Radio Service (MURS)

MURS is a new radio service created by the FCC decision to eliminate license requirements for operation on five specific VHF "color dot" frequencies. These frequencies were previously licensed to itinerant business users and regulated under Part 90 of the FCC Regulations. In delicensing operation on these frequencies, the FCC designated them as a new personal radio service and placed the new regulations for this service in Part 95 along with GMRS, FRS, and CB. The final version of the rules for MURS was published in the Federal Register and the new service has been available for unlicensed use since November 13, 2000. The information about MURS published here is based on the final version of the rules published by the FCC. Although these rules are "final" there are several petitions for reconsideration and for rules changes that may result in further changes. This information will be updated if the rules are changed in ways that impact the information here.

The Multi-Use Radio Service (MURS) is a private, two-way, short-distance voice, data, or image communications service for personal or business activities of the general public. The rules for this service are contained in the new subpart J of Part 95.

Each MURS transmitter must be certified in accordance with Section 90.203.

The MURS channel frequencies are 151.820 MHz, 151.880 MHz, 151.940 MHz, 154.570 MHz, and 154.600 MHz.

According to the rules, "No MURS unit, under any condition of modulation, shall exceed 2 W effective radiated power (ERP)." Comments have been filed with the FCC recommending that this limitation be changed to specifying the transmitter output power rather than the effective radiated power. Transmitter output power is a function of the radio itself, whereas the effective radiated power changes with whatever feedline and antenna are connected to the radio.

MURS is available for both individual and business use by any person or entity *except* a foreign government or representative of a foreign government.

MURS operation is authorized anywhere CB station operation is permitted under 95.405; and aboard any vessel of the United States, with the permission of the captain, while the vessel is travelling either domestically or in international waters.

MURS operation is not authorized aboard aircraft in flight.

Anyone intending to operate a MURS unit on the islands of Puerto Rico, Desecheo, Mona, Vieques, and Culebra in a manner that could pose an interference threat to the Arecibo Observatory shall notify the Interference Office, Arecibo Observatory. The procedures for this notification are in section 95.1303 of the regulations. The operator will be required to make reasonable efforts in order to resolve or mitigate any potential interference problem with the Arecibo Observatory.

MURS should be a very flexible service. The rules authorize voice, data, and image transmission, including remote control and telemetry, using AM and FM modulation; but it is likely that only FM voice radios will be available initially.

The channels authorized for MURS systems are available on a shared basis only and will not be assigned for the exclusive use of any entity. Those using MURS must cooperate in the selection and use of channels in order to reduce interference and make the most effective use of authorized facilities. Channels must be selected in an effort to avoid interference to other MURS transmissions. This may be a difficult and contentious task:

- Existing business licensees on these channels are not likely to welcome the sudden surge of unlicensed (but perfectly legal) personal users. Likewise, the new personal users are not likely to appreciate having the channels occupied by continuous transmissions of some existing business operations. Some of the channels allocated to MURS are currently in use by fast food drive-thru windows.
- While many existing business licensees use these channels for purposes that might be considered trivial, others are using these same channels for functions that can impact public safety. Occasional unintentional interference to the local hamburger drive-thru may not be much problem, but interference to a construction company worker directing a crane swinging a steel I-beam into position a few hundred feet in the air could be quite serious.
- CTCSS may well make these problems worse rather than better. The use of tone squelch keeps users of one tone from hearing users of a different tone on the same channel, but does nothing to eliminate the interference when both users attempt to transmit at the same time. This could be a severe problem if radio manufacturers and stores make the same kind of false claims about CTCSS on MURS as are common in their advertising for FRS radios now.

The first MURS radios on the market are existing commercial radios already certified under Part 90 for these same frequencies. These existing radios generally have only one or two channels available or to have a mix of MURS and *non*-MURS channels available through internal dip switches or other programming.

- Some distributors and dealers may try to sell off existing radios that were certified under Part 90, but do not actually meet the specifications for MURS.
- These early MURS radios lack the flexibility likely to be found in later radios actually designed for MURS operation. Later radios are likely to have the five MURS frequencies directly available at a channel knob. This will be important to enable individual users to select a channel that avoids existing business users who in many cases will not be able to change frequencies.
- Some existing radios for these frequencies lack tone squelch. CTCSS or DCS will certainly be needed for any practical use of MURS in most areas.

Teams and individuals considering using MURS may want to program the MURS frequencies into a scanner to check existing activity on these channels throughout their local area. The “look-before-you-leap” approach is always a good idea before planning to use any new radio frequency.