

# Introduction to Communication by Radio

An event which takes down the internet would also likely take down cellphone service, making distant communications among citizens difficult. People who have copper wire telephone service (land-line) may have communication for awhile, but only until the phone company's backup power is exhausted. For this reason, some thought to having personal radio communication should be considered before an event occurs.

## Voice Communication

For voice communication, there are generally five options available:

- FRS or Family Radio Service
- MURS or Multi-Use Radio Service
- GMRS or General Mobile Radio Service
- CBRS or CB or Citizen's Band
- HAM or Amateur Radio

### Family Radio Service

Family Radio Service<sup>(1)</sup> offers 22 channels of communication between 462 MHz and 467 MHz. There is no license required to operate an FRS radio. Hand held FRS radios are fairly inexpensive and can be found many places. These low power (2 watt maximum) radios are suitable for short distance communication within a one to two mile range depending on area conditions. The higher frequencies allow the signal to pass through obstacles, but are less efficient at long distance communications. These radios use CTCSS and/or DCS codes to prevent the reception of signals intended for others.<sup>(2)</sup>

### Multi-Use Radio Service

Multi-Use Radio Service<sup>(1)</sup> is a "license by rule"<sup>(3)</sup> service offering 5 channels between 151 MHz and 154 MHz. Maximum power is 2 watts. They are suitable for short distance communication within a one to two mile range depending on area conditions. The lower frequencies work better for distance, but are less effective if there are obstacles in the area. These radios use CTCSS and/or DCS codes to prevent the reception of signals intended for others.<sup>(2)</sup>

### General Mobile Radio Service

General Mobile Radio Service<sup>(1)</sup> offers 30 channels between 462 MHz and 467 MHz. **An FCC license is required to operate a GMRS system.** Licenses are issued for a 10 year term. There is not test to get a license and you will generally have your license within 24 hours of submitting your application. Higher power is allowed depending on the GMRS channel. Some channels have a maximum of 5 watts, while others have a maximum of 50 watts. The 50 watt channels are for use by repeaters. These radios can reach distances of 30 miles or more. These radios use CTCSS and/or DCS codes to prevent the reception of signals intended for others.<sup>(2)</sup>

### Citizen's Band

Citizen's Band has been around for quite awhile offering 40 channels of communication between 26.965 MHz and 27.405 MHz. **A license is required by regulation, but is granted automatically** in that the Federal Communications Commission calls "license by rule."<sup>(3)</sup> CB radios have a maximum power of 4 watts and their lower frequency may help with distance as well, but they are not as good at getting through obstacles. Depending on the terrain and antenna you might get a range of up to 10 miles.

## Amateur Radio

Amateur radio operators have a number of frequencies to choose from based on their class of license. Not only is a license required, but to get that license there is a test to determine the individuals technical skill and knowledge of the FCC rules and regulations. Some classes of license allow operation on certain frequencies of up to 1500 watts. Around the world communication is typical on some frequencies at certain times of the day. Links are provided for additional information on how to start your pursuit of an amateur radio license.

1. FRS, MURS, & GMRS radios are relatively inexpensive but sometimes difficult to get radios from different manufacturers to talk to each other. An excellent article found here can be helpful: <https://www.k0tfu.org/reference/frs-gmrs-privacy-codes-demystified.html>
2. CTCSS and DCS are signals included with the transmission and used by the receivers to turn the audio on and off depending on which code is sent. This does not prevent reception by unintended receivers because this feature can be disabled at the receiver, allowing it to receive all signals on a particular channel. It does allow a user to reject all signals that do not transmit a specific code.
3. License by rule means that a license is required to operate the equipment, but owning the equipment automatically grants you the license to use it. This just saves a lot of paperwork for everybody.

## Wireless Data Communication

If you use wifi you are already using wireless data communication. The wifi routers that give us wireless access to the internet all use spread spectrum technology to move data through the air. These routers have a very short range and would not be very efficient for communication between devices over any distance. Besides, the wifi routers are designed to work in a networking environment in conjunction with the internet. While it might be possible to modify a wifi router to do point to point communication between two devices, there are already devices on the market designed to do just that—but they are expensive. At frequencies of 2.4GHz, 5GHz and 6GHz these devices require line of sight between the transmitter and receiver to achieve distance.

Short point to point text message transmission may be possible up to 3 miles in the 433MHz band which is designated for use by remote controls. A pair of 1 watt devices cost around \$100.00. Transmitters in the 433MHz band can not be operated continuously. They must be operated in short bursts.

The usefulness of serial wireless data communication after an incident is yet to be determined. Using such transmitters assumes the availability of operational computer terminals that have serial ports. This would be something akin to 1980 computer communication using 300 baud modems over the telephone network.

# Links for More Information

## Family Radio Service

<https://www.fcc.gov/wireless/bureau-divisions/mobility-division/family-radio-service-frs>  
<https://www.survivalsullivan.com/family-radio-service-101/>  
<https://www.k0tfu.org/reference/frs-gmrs-privacy-codes-demystified.html>

## Multi-Use Radio Service

<https://www.fcc.gov/wireless/bureau-divisions/mobility-division/multi-use-radio-service-murs>  
<https://www.itstactical.com/digicom/comms/the-best-kept-secret-in-radio-communication/>  
<https://www.k0tfu.org/reference/frs-gmrs-privacy-codes-demystified.html>

## General Mobile Radio Service

<https://www.fcc.gov/wireless/bureau-divisions/mobility-division/general-mobile-radio-service-gmrs>  
<https://quality2wayradios.com/store/GMRS-FCC-License>  
<https://www.baofengradio.com/blogs/news/about-gmrs-10-things-you-better-know>  
<https://www.k0tfu.org/reference/frs-gmrs-privacy-codes-demystified.html>

## Citizen's Band

<https://www.fcc.gov/wireless/bureau-divisions/mobility-division/citizens-band-radio-service-cbrs>  
<https://carcbradios.com/citizens-band-radios-learn-use-right-way/>  
[https://en.wikipedia.org/wiki/Citizens\\_band\\_radio](https://en.wikipedia.org/wiki/Citizens_band_radio)  
<https://www.walcotradio.com/citizens-band-radio.php>

## Amateur Radio

<https://www.arrl.org/getting-licensed>  
<https://www.fcc.gov/wireless/bureau-divisions/mobility-division/amateur-radio-service>  
<https://www.ratedradardetector.org/radio/ham/how-to-get-license/>  
<https://hamradioprep.com/how-to-get-your-ham-radio-license-made-easy/>  
<https://w5nor.org/ham/>

## Spread Spectrum

<https://wlanprofessionals.com/updated-unlicensed-spectrum-charts/>  
<https://www.ni.com/en-us/innovations/white-papers/06/understanding-spread-spectrum-for-communications.html>  
<https://pdfserv.maximintegrated.com/en/an/AN1890.pdf>

