

# Radio Protocol

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*This document outlines a protocol for communicating using short range radios (MURS or FRS band).*

## Protocol:

### How do we talk to each other?

#### General radio protocol:

“You, this is me” is the general protocol for professional radio transmissions.

An example of this type of transmission would be the following:

Outgoing: “Alice, this is Bob”

Incoming: “Bob, this is Alice go ahead”

Outgoing: “Alice, this is Bob \*relay information\*”

Incoming: “Bob, I copy \*repeat back information\*”

Outgoing: “Roger that” OR any affirmation or correcting response to relayed info.

The goal of “you this is me” transmission is to allow clear and concise dialogue that relays valuable information between two parties. Part of professional radio transmission means it is always mandatory to clearly identify yourself by code name, relay accurate info, and verify that info by having the other party audibly repeat it back to you.

## Call Signs

A radio operator is identified by a short, easy to annunciate phrase called a *call sign*. A radio operator can be an individual, group, or entity. A single person with a radio, a group of people in the same location, or a medical pavilion may all have unique call signs. Call signs help decouple names from individuals; for example, if one calls out to a medical pavilion it doesn't particularly matter who answers the radio so long as **someone** answers.

If you need to reach a particular person who is the lead of a group with a call sign use the term “actual”.

For example, if there's a group of people doing range safety with the callsign “RO” and Alice wanted to reach any one of them they would say “RO, this is Alice”. But if they wanted to reach the specific person assigned to be the lead RO they would say “RO Actual, this is Alice”.

In small groups where everyone has a radio and names are unique using verbatim names is sufficient.

## Urgent messages:

To cut through ongoing radio chatter and communicate urgently needed information, prefix your message with "Break break break". This may be a good time to direct your message to "all" instead of an individual.

Outgoing: "Break break break, this is Alice to all, we have someone injured at Bob's position. I repeat, we have someone injured at Bob's position. Please acknowledge."

Incoming: "Alice, this is Carol, I copy, we have someone injured at Bob's position."

## When is a radio call necessary? (not an exhaustive list)

- When you can't see/find the rest of the group
- To warn others of a potentially dangerous situation or person

## Common Terminology:

Avoid the use of acronyms, terms of art, and brevity codes (such as ten-codes) when speaking over the air. Use the plainest, most straightforward language possible to convey information. For example, "where are you?" is much easier to understand than "what's your 20?" for almost everyone, even those familiar with ten-codes.

## Useful Terminology and Usage:

**"Copy"** - This means you understand a sent transmission and require no further explanation

**"Roger"** - A catch-all term for compliance of any transmission

**"Say again your last"** - A common phrase in military radio transmissions for the sender to repeat their last transmission

**"Send it" / "Go ahead"** - Common phrases when answering a radio call for your code name

**"Break break break" / "Breaker Breaker"** - when reporting time-sensitive or emergency-related information

## NATO Phonetic Alphabet:

Used for spelling out critical words, acronyms etc. over the air to make sure they're heard clearly. For example, instead of saying "Alice, we're at Spruce Avenue" you'd say "Alice, we're at Spruce, Sierra Papa Romeo Uniform Charlie Echo, Avenue".

Note: coming up with your own phonetic alphabet is usually *more confusing* than using none at all. Spelling out a word letter-by-letter is a good substitute for not remembering the NATO alphabet in a moment of stress.

Symbol	Code Word	Symbol	Code Word
A	Alfa/Alpha	N	November
B	Bravo	O	Oscar
C	Charlie	P	Papa
D	Delta	Q	Quebec
E	Echo	R	Romeo
F	Foxtrot	S	Sierra
G	Golf	T	Tango
H	Hotel	U	Uniform
I	India	V	Victor
J	Juliett	W	Whiskey
K	Kilo	X	X-ray
L	Lima	Y	Yankee
M	Mike	Z	Zulu

## Common Radio Bands

Modern consumer and amateur grade radios are more powerful than ever, and even out of the box a simple \$25 radio is beefy enough to get you in some hot water with the FCC without trying too hard. Consumer and amateur radio use is regulated by the FCC, and Part 95 of the Title 47 of the Code of Federal Regulation guides most enforcement. Nothing detailed here is legal advice, and should not be considered a guide for compliance, regulatory enforcement, or legal operation of radios.

Below is some basic information that is critical to understand when deciding which frequencies your group will operate on. For the purpose of this guide, it is assumed that you are using a radio similar to the Baofeng UV-5R, TERA TR-505, Retevis H-77, or the like.

### Family Radio Service (FRS)

Originally created for consumer use, and popular as the “walkie-talkie” frequencies. This is what you use when you buy Walmart handheld comms, and it’s extremely commonly used. Anyone with a radio, almost without exception, can freely use FRS channels. Mostly due to its extreme ease of use and common availability, FRS is especially insecure, and channels may be used by multiple groups at once. FRS radios are limited to 0.5 Watts, cannot be modified to amplify signal, and cannot have external/detachable antennas. Typically used as “channels” instead of frequencies.”

Pros: Extremely widespread adoption; easy to use

Cons: Low power; common public use; restrictive to low-power radios.

Frequencies: 462 MHz. Channels 1-7

### General Mobile Radio Service (GMRS) aka UHF

GMRS uses the same frequencies as FRS, but with designated channels within those frequencies that are not available to FRS radios. However, [GMRS radios require licenses to use](#). The license does not require an exam, and is valid for ten years with a \$70 application. GMRS radios have access to up to 30 channels, inclusive of FRS channels. Radios on this band may transmit with no limit on transmitter power, and generally penetrate buildings and bounce off surfaces better than MURS. Like FRS, typically used as

“channels” instead of frequencies. *Important regulatory note: The 467 MHz band is restricted to communications with repeater stations only.*

Pros: Inclusive of FRS channels; wide variety of radio configurations permitted; superior urban capabilities; no power limitations

Cons: Requires licensing for legal usage

Frequencies: 462 through 467 MHz.

### **Multi User Radio Service (MURS) aka VHF**

MURS is relatively new for amateur and consumer use. Five frequencies are provided by the FCC for free and open public use without any license requirements. The only limitations on the use of these frequencies is a 2W transmitter limit, and a maximum 60ft antenna tower. For handheld and general use, these limitations are immaterial. MURS allows for detachable antennas, including whip and vehicle mounted antennas. Compared to GMRS, these frequencies are better at bending over hills, but are worse at penetrating buildings or bouncing off hard surfaces.

Pros: Superior wilderness/rural capabilities; license-free usage

Cons: Limited to five frequencies; barred from using repeater stations; limited to 2W

Frequencies: 151 MHz (Narrow band only), 154 MHz (Wide or narrow band).

## **2 Meters**

The 2 meter band (144 to 148 MHz) is a common amateur radio band for local (< 100 miles) communication via handsets, vehicle, and stationary radios. It is one of the bands available to amateur radio operators with a Technician license, the most basic license available. It can be used to transmit voice and data. The 2 meter band is subdivided into chunks allocated to different types of radio use; for example, voice, repeater use, data etc. Here's a [good run down](#) on the frequency band allocation in western Washington. Within the voice use of the 2 meter band things are not sub-divided into discrete channels, however most radios can only discriminate between ~5 KHz bands which effectively limits the number of “channels” that can be used. Local standards may explicitly designate a band separation (usually 12.5 or 15 KHz).

Pros: Allows repeater use (including satellites); range can be hundreds or thousands of miles with chains of repeaters. Maximum power is *1500 watts* (Peak Envelope Power).

Cons: Requires an amateur radio license. Requires use of a radio callsign that is linked to your real name and address (although the address may be PO box). Tends to be somewhat congested in densely populated areas. Requires adherence to amateur radio protocol (which is not the same as what is outlined in this document). Messages *must* be unencrypted.

## **Frequencies Recommended for Group Use**

<b>Frequency</b>	<b>Band</b>	<b>License Required</b>
151.820 MHz	MURS 1	No
151.880 MHz	MURS 2	No
151.940 MHz	MURS 3	No
154.570 MHz	MURS 4	No

154.600 MHz	MURS 5	No
462.600 MHz	FRS/GMRS 17	No (FRS), Yes (GMRS)
462.625 MHz	FRS/GMRS 18	No (FRS), Yes (GMRS)

MURS, GMRS, and FRS all offer additional nuance in the form of privacy codes. These codes can be either PL (private line) codes or CTCSS (Continuous Tone Coded Squelch System). Without getting too technical, these systems allow for semi-private use of channels without hearing chatter directed to other users. **THIS IS NOT ENCRYPTION. THIS DOES NOT PROTECT COMMUNICATIONS.** The convenience provided by these private line codes is just that, convenience. Anyone operating with the same PL code or CTCSS configuration can listen in.

## APPENDIX: Channels and Frequencies

### [FRS and GMRS:](#)

CHANNEL	FREQUENCY	FRS POWER	GMRS POWER	BEST FOR
01	462.5625	2 W	5 W	Maximum Transmission Distance
02	462.5875	2 W	5 W	
03	462.6125	2 W	5 W	
04	462.6375	2 W	5 W	
05	462.6625	2 W	5 W	
06	462.6875	2 W	5 W	
07	462.7125	2 W	5 W	
08	467.5625	0.5 W	0.5 W	Short Distances, Many Radios
09	467.5875	0.5 W	0.5 W	
10	467.6125	0.5 W	0.5 W	
11	467.6375	0.5 W	0.5 W	
12	467.6625	0.5 W	0.5 W	
13	467.6875	0.5 W	0.5 W	
14	467.7125	0.5 W	0.5 W	
15	462.5500	2 W	50 W	Maximum Transmission Distance
16	462.5750	2 W	50 W	
17	462.6000	2 W	50 W	
18	462.6250	2 W	50 W	
19	462.6500	2 W	50 W	
20	462.6750	2 W	50 W	
21	462.7000	2 W	50 W	
22	462.7250	2 W	50 W	