EMERGENCY TWO WAY RADIOS

Having an emergency 2-way radio at your home is

essential to being prepared for an emergency or evacuation!

The ability to communicate effectively and accurately within the neighborhood, and to get help from outside of the neighborhood, is vital in an emergency. Personal 2-way radios, also called FRS/GMRS radios or simply "walkie-talkies", can be life-saving tools. Every family should have at least one 2-way radio (two is best), and know how and when to use them.

2-way radios have several advantages over phones. For example, in the event of an emergency, cell phone and/or land-line phone service may be physically disrupted or overloaded and unavailable. 2-way radios however are completely independent of any fixed infrastructure, and they can function when cell phones may not be working.

In addition, cell and land-line phones are point-to-point, so you can only talk with one person at a time. 2-way radios however allow you to talk to, or listen to, many people at once. This feature can be very helpful in an emergency; for example, being able to listen to the Neighborhood Command Center provide disaster response instructions.

Examples of emergency 2-way radios include:

| ICOM IC-4088A FRS | Motorola FRS | Motorola FRS/GMRS | Midland FRS/GMRS |

Purchasing

The Montclair Neighborhood Council recommends that every household purchase a pair of 2-way radios as well as extra batteries. These can be purchased locally at stores such as REI and Big 5 Sporting Goods, and on-line at Amazon.com and similar sites.

It is recommended to purchase and have on-hand several sets of extra batteries for your radio. Many radios can also use rechargeable batteries, but in the event of a disaster you may not have the ability to recharge these.

Operation

It is important to learn how to properly operate your emergency 2-way radio. Instruction on the use of 2-way radios can be provided by the Montclair Neighborhood Council below.

MONTCLAIR ORGANIZED NEIGHBORHOOD (MON)

Radio Communications Recommendations

Last Updated: Dec 20, 2015

Doug Mosher – Montclair Neighborhood Council (emergencyprep@montclairsic.org)

This document from the Montclair Neighborhood Council in Oakland, California, provides 2-way radio communications recommendations. This is intended for emergency communications within and in-between Montclair Organized Neighborhoods (MONs). Additional emergency radio procedures and training are available from Oakland's CORE (Communities of Oakland Respond to Emergencies) organization. Contact detailsare noted at the end of this document.

Note that these are recommendations and guidelines only, and that during an actual emergency one will need to be flexible—for example by changing the assigned channel/frequency usage as appropriate. Therefore it is always a very good idea to know how to setup and configure your particular 2-way radio.

1) Overview of FRS, GMRS and Ham Radio Types

Channel numbers noted in this document refer to the more common consumer dual-service FRS/GMRS radios, unless otherwise noted.

Family Radio Service (FRS) radios:

Family Radios Service (FRS) radios are compact, handheld, wireless 2-way radios that provide good clarity over a relatively short range. FRS radios operate on any of 14 FRS channels designated by the Federal Communications Commission (FCC) for FRS radio usage. In order to comply with FCC standards, FRS radios have a maximum allowable transmit power of ½ watt, and FRS radios and their antennas may not be modified to extend their range.

FRS radio range is typically stated by manufacturers as up to a few miles, but you should note that this is a maximum that can be achieved only under optimal conditions (such as mountain-top to mountain-top or across water). A realistic range for an FRS (low power) radio is ½ mile or so ("line-of-sight"), depending upon conditions. Terrain and obstructions such as hills and canyons will reduce this range.

General Mobile Radio Service (GMRS) radios:

General Mobile Radio Service (GMRS) radios operate on any of 15 GMRS channels designated by the FCC. Handheld GMRS radios typically have transmit power ratings of up to 5 watts, with a maximum allowable power of 50 watts (typically base station models). GMRS radios may legally be outfitted with optional antennas (whip, car or base station antennas for example) to extend their range.

GMRS radios generally achieve greater ranges than FRS radios. GMRS range is typically stated by manufacturers as several miles. Again, this is likely achieved only under ideal conditions. Realistic range for GMRS radios under normal conditions is more likely 1 to 2 miles, depending upon the terrain inbetween the radios, the type of antenna used, weather conditions, etc.

FRS/GMRS dual-service or "hybrid" radios:

Most consumer 2-way handheld radios sold today in sporting good stores like Big 5, REI, and BestBuy, and on amazon.com, etc. (brands such as Motorola, Midland, Uniden, Cobra, etc.) are combination FRS/GMRS radios. These are simply dualservice radios that provide access to both the FRS and GMRS channels, including shared FRS/GMRS channels 1 - 7 (low or high power), FRS-only channels 8 – 14 (low power only),

and GMRS-only channels 15 - 22 (low or high power). These typically cost $40 - 80 for a "bubble pack" set of 2 radios.

GMRS-only radios:

Some radios, such as the Oakland CORE-supplied ICOM IC-F21GM, are GMRSonly. These types of radios are usually meant for more "professional" or demanding use such as business and emergency communications. These radios, like the ICOM, are typically more rugged and have a larger battery capacity than the consumer dualservice FSR/GMRS radios. Plus they allow for removable and replaceable antennas. They are also usually much more expensive than consumer dual-service FRS/GMRS radios--typically costing $125 and up for a single radio.

Ham/Amateur radios:

Ham radio service, also known as amateur radio service, is established by the International Telecommunication Union (ITU). Ham operators are tested and then licensed and assigned a call-sign in the U.S. by the FCC. Ham radios transmit on several different regulated bands and many frequencies, but they do not (typically) transmit on FRS or GMRS channels. Ham service is used by Amateur Radio Emergency Services/Radio Amateur Civil Emergency Services (ARES/RACES) organizations for disaster response. Ham service may also be used to communicate between MONs or with RACES operators in an emergency.

Ham radios range from small handheld transmitters (HTs) costing $100+ to mobile stations for vehicles to table-top base station rigs that can cost $1000+. Ham radios can communicate directly (radio-to-radio or simplex) or can utilize repeaters to broadcast signals over a much longer distance. Hams radios can effectively communicate across continents using special techniques, antennas, etc.

For the purpose of neighborhood communications, typically FRS/GMRS radios are used. However the Montclair Neighborhood Council does encourage you to obtain your Ham license if you can, as it opens up additional capabilities for communications during an emergency.

A note on FRS and GMRS channels (this can be confusing!):

An FRS/GMRS channel number is just an artificial designation for a particular frequency being used for transmission and reception. For example, Channel 1 could designate the radio wave frequency of 462.5625 MHz on a particular radio. It is the frequency of the radio wave (in megahertz, or MHz) that determines if one radio can communicate with another. However it is easier to use channel numbers (i.e. "1") than frequencies (i.e. "462.5625 MHz") when tuning a radio.

Unfortunately, channel numbers are not standardized across the industry for all types of radios. Most consumer dual-service FRS/GMRS radios (Motorola, Midland, Uniden, Cobra, etc.) use the same channel-to-frequency designations. That is, Channel 1 is 462.5625 MHz, Channel 2 is 462.5875 MHz, and so on. This is a "standard" that these manufacturers have adopted, although very early models of these radios (from 15 or more years ago) may not adhere to this "standard."

However, some GMRS-only radios, like the ICOM IC-F21GM, use completely different channel-to-frequency mappings than the consumer dual-service FRS/GMRS radios. Channel 1 on the ICOM IC-F21GM is actually the same frequency as Channel 15 on a consumer FRS/GMRS radio. If the ICOM is on Channel 1, and the FRS/GMRS Motorola is on Channel 15, then both radios can communicate (they are set to the same frequency). This can be confusing and is something to be aware of--2 radios can only communicate if they are using the same frequency, not necessarily the same channel number. A cross-reference of the "standard" consumer dual-service FRS/GMRS radio vs. the ICOM IC-F21GM radio channels and frequencies is noted at the end of this document.

A note on antennas:

An antenna can make a big difference on the range and clarity of transmission of a 2-way radio. It is usually more of a factor than the power output of the radio. Consumer FRS-only and dual-service FRS/GMRS radios

have, by FCC law, fixed antennas that cannot be changed. This is done intentionally to keep the range short in order to reduce interference in crowded areas.

GMRS-only radios, like the ICOM IC-F21GM, typically have removable antennas, as do Ham radios. You can connect a taller and/or more efficient antenna to allow much better range and clarity of transmission. The effect can be dramatic--in testing in the Montclair area between 2 locations blocked by terrain, the stock ICOM IC-F21GM antenna resulted in no reception, but attaching a better ("high-gain") and taller antenna to the same radios resulted in good reception.

A note on GMRS Licensing:

An FCC license is required to transmit on any GMRS channel. FRS/GMRS radios may be used legally without an FCC operator's license only on the FRS-only channels (8 – 14) and the shared FRS/GMRS channels (1 - 7) on the low power setting. Check with http://www.fcc.gov/ or call 1-877-480-3201 for more information.

You should purchase an FCC license for GMRS operation (FCC Form 605 or file online, cost is currently $85 for 5 years). You can be fined by the FCC if you transmit on FRS/GMRS and GMRS channels at more than ½ watt without a license. Family members can share in the use of a GMRS license.

However, in a situation involving the immediate safety of life and/or the immediate protection of property, and where no normal means of communication are available, FCC rules permit you to use any means to send essential information. In other words, during a true emergency disaster you don't have to worry about having an FCC license for GMRS radio operation…

2) Recommended FRS/GMRS Radio Types and Usage

To communicate within Organized Neighborhoods (FRS):

The low-power (½ watt) FRS radios, such as consumer dual-service FRS/GMRS radios (Midland, Motorola, Uniden, Cobra, etc.) and the ICOM IC-4088A FRS-only radio provided by CORE, are recommended to be used for communicating within organized neighborhoods. For example, for Damage Assessment, Search & Recovery, etc. teams to communicate with their Neighborhood Command Post. Using the limited range, low-power FRS radio channels will lessen the chance of one neighborhood interfering with another neighborhood, especially if channels are coordinated appropriately (see below).

Typical FRS and FRS/GMRS radios for use within organized neighborhoods:

| ICOM IC-4088A FRS | Motorola FRS | Motorola FRS/GMRS | Midland FRS/GMRS |

To communicate between Neighborhoods and with Fire Stations (GMRS):

The higher-power (4 or 5 watt) handheld GMRS radios, such as the ICOM IC-F21GM GMRS-only radio provided by CORE, are recommended to be used for communicating between organized neighborhoods and with the local Fire Stations and Ham radio operators. Consumer dual-service FRS/GMRS radios (Midland, Motorola, Uniden, Cobra, etc.) can also be used on the higher-power GMRS channels. Using the higher-power GMRS channels will give the best range and won't interfere with the FRS channels used within each organized neighborhood.

Typical GMRS and FRS/GMRS radios for use between organized neighborhoods and Fire Stations/Ham radio operators:

ICOM IC-F21GM GMRS   Motorola FRS/GMRS   Midland FRS/GMRS   Uniden FRS/GMRS

3) Standardizing FRS/GMRS Radio Channels

Within Organized Neighborhoods (FRS):

Each Montclair Organized Neighborhood should select its own internal-use FRS channel, ideally from 8 – 14 (467.5625 - 467.7125 MHz). You can also select from the shared FRS/GMRS channels 2 - 7 (462.5875 - 462.7125 MHz), but if you do, please try to make sure that everyone knows to set the radio to transmit on low power. Channel 1 (462.5625 MHz) is an unofficial National Call/Distress Channel and thus shouldn't be used as a neighborhood channel.

The Montclair Neighborhood Council will coordinate Montclair Organized Neighborhood FRS channels so that, if possible, no adjacent neighborhoods are using the same channel. All selected and approved neighborhood channels will be noted in the MON Leaders Roster. For example, the following organized neighborhoods have selected these channels/frequencies:

> Holyrood Dr/Manor: FRS Channel 8 (467.5625 MHz)
>
> Skyline / Moon Gate: FRS Channel 9 (467.5875 MHz)
>
> Upper Ascot: FRS Channel 10 (467.6125 MHz)
>
> Larry Ln/ Mastlands: FRS Channel 11 (467.6375 MHz)

Between Neighborhoods/Fire Stations/Ham Radio Operators (GMRS):

GMRS-only channels 15 - 21 (channels 1 - 7 on the ICOM IC-F21GM radio) should be utilized for communicating between neighborhood groups, and from neighborhood groups to Fire Station/Ham radio sites and other "base" command center locations. The higher power of the GMRS channels and the ability to use better antennas on GMRS-only radios will allow a much better chance of radio communications between and outside neighborhoods.

CORE has standardized on GMRS channels to be used throughout Oakland. Each Oakland District has a GMRS channel associated with it. These are assigned by District number matching the ICOM IC-F21GM radio channel number. Montclair is in District 4 and thus will be using ICOM IC-F21GM radio channel 4 (Channel 18 on an FRS/GMRS radio) for communicating between neighborhoods and Fire Stations.

If your neighborhood needs to request assistance from another neighborhood, or needs to pass a message to Oakland OES (Office of Emergency Services) via a Ham radio operator located at a Fire Station, then you should try to establish communications with these other groups on Channel 4 on your ICOM IC-F21GM radio (Channel 18 on your FRS/GMRS radio).

4) Use of "Privacy Codes"

Within Organized Neighborhoods (FRS):

It is recommended that you do not use "Privacy Codes" within organized neighborhoods, unless there is interference with another nearby neighborhood or group that is using the same channel. If a neighborhood decides to select and use a "Privacy Code" with their neighborhood FRS channel, then they should understand the caveats and implications noted below.

Between Neighborhoods/Fire Stations/Ham Radio Operators (GMRS):

"Privacy Codes" (CTCSS/PL tones) should not be used with the GMRS channels selected for communications between Montclair neighborhoods and with Fire Stations and Ham radio operators. Only the "base" GMRS-only radio channels 15 – 22 (channels 1 - 8 on the ICOM IC-F21GM radio) with frequencies between 462.5500 - 462.7125 MHz should be utilized.

Why not use "Privacy Codes"?

"Privacy Codes" (also called Interference Eliminator Codes or CTCSS or PL tone codes) are simply a designated frequency tone added to the transmission frequency. A corresponding radio set to the same "Privacy Code" (or to 0 or "off") will filter out that tone and then "hear" the transmission, but a radio set to a different "Privacy Code" (other than 0 or "off") squelches (ignores) the transmission. Some reasons that the Montclair Neighborhood Council recommends not using "Privacy Codes" are as follows:

- Some older FRS radios do not support "Privacy Codes", and these radios may still be in use within neighborhoods.
- The default setting for FRS, GMRS and FRS/GMRS radios is typically to have the "Privacy Code" turned off (or set to 0). This makes it easier to take a new radio out of the box, set the main channel appropriately, and begin using it. This is especially true with the ICOM IC-F21GM GMRS-only radio provided by CORE. However some radios, for example some Motorola consumer FRS/GMRS radios, may default to a specific "Privacy Code" setting out-of-the-box—check your radio to be sure.
- Setting of "Privacy Codes" on different brands of radios is not a standard procedure. Some are easier to set than others. The GMRS-only ICOM IC-F21GM radio is very difficult to set the "Privacy Code" (CTCSS code), plus there is no way to visually see what it's been set to, and there's no way to perform a master (factory default) reset to reset all changed channel CTCSS codes back to 0.
- The 52 GMRS ICOM IC-F21GM radio CTCSS tone codes do not correspond directly with the 38 consumer FRS/GMRS radio "Privacy Codes". This further confuses the situation. And, some newer FRS/GMRS radios have over 100 "Privacy Codes", many of which aren't compatible with the older FRS/GMRS radio "Privacy Codes". This lack of consistency could cause problems in the field.

If you really want to use "Privacy Codes":

However, if you do decide to use "Privacy Codes" for your neighborhood FRS radio communications, then you should be aware of the following caveats and implications:

- Some residents may have older FRS radios and may not be able to effectively communicate.
- "Privacy Codes" are not really private—anyone listening on the main channel ("Privacy Code" or CTCSS code set off or to 0) can hear all conversations on all "Privacy Codes" on that particular channel/frequency.
- "Privacy Codes" give the illusion that a private "sub-channel" is available, but this is not the case. If 2 or more radios on the same channel/frequency, but on different "Privacy Codes", try to transmit at the exact same time, then they may interfere or "double" (garble each other, or the stronger signal will "win"). This is a false sense of security that could cause communication problems in the field.

5) Summary of FRS/GMRS Radio Types and Channel

RecommendationsWithin Organized Neighborhoods (FRS):

- Use FRS or consumer dual-service FRS/GMRS radios only.
- Select an FRS channel for your organized neighborhood in the range of 2 – 14 inclusive (ideally FRS only 8 - 14), and verify this selection with the Montclair Neighborhood Council.
- Refrain from using "Privacy Codes" with your selected channel unless there is interference with nearby neighborhoods (simplify).
- Test your FRS radios within your organized neighborhood in a variety of conditions (rain, fog, night, day…) and verify you can cover your neighborhood area.
- Practice, practice, practice! Set up weekly neighborhood radio tests, etc.

Between Neighborhoods/Fire Stations/Ham Radio Operators (GMRS):

- Use GMRS radio channels only. Ideally use the ICOM IC-F21GM GMRS-only radios provided by CORE. The consumer dual-service FRS/GMRS radios can also be used on the GMRS channels. Refer to the channel/frequency cross-reference below to make sure you are using the proper channel for your radio.
- Channel 4 on the ICOM IC-F21GM radio (FRS/GMRS Channel 18) should be the channel where initial communications are established in the Montclair area(District 4). Other GMRS channels can be utilized if Channel 4 (18) is in use, or to continue communications between groups.
- "Privacy Codes" (CTCSS codes) should not be used (set to the default off or 0). The ICOM IC-F21GM GMRS-only radio has its CTCSS codes set to 0 ("off") by default, out-of-the-box.

6) Ham/Amateur Radio Communications

Ham/amateur radio service may also be used to communicate between neighborhood organizations, fire stations, etc. Note that you need to be licensed by the FCC for Ham radio service operation. Testing is provided by various organizations such as the Oakland Radio Communication Association (ORCA), and it is not a difficult process to obtain your Ham license and call sign.

CORE has a radio plan for Ham operators that are not involved in a RACES operation to relay or transmit Category 1 Emergency messages to RACES operators (or CORE radio operators assisting RACES operators) at manned Fire Stations. Contact CORE for more information on this subject.

If you are a licensed neighborhood Ham operator and need to communicate in an emergency, you may use the following 2-meter simplex frequencies:

Resource Net: 146.415 MHz / 147.420 MHz

CORE to RACES relay net: 146.505 MHz / 147.510 MHz

Evacuation coordination net: 146.430 MHz / 147.435 MHz

Intra-district communication: 146.445 MHz / 147.450 MHz

7) Recommended FRS/GMRS Two-Way Radio Protocol

Unlike conventional land-line or cellular phones, 2-way radios typically only work in one direction at a time. The technical term for this is "single-duplex". This means only one person can speak at a time, and no one else can speak until that person has released the transmit button on his or her radio.

When transmitting on these FRS, FRS/GMRS and GMRS radios, first listen to hear if the channel is in use. If it is in use then wait until the other conversation is finished. If the channel is open and unused then press the transmit button, wait two seconds, and announce the person you are trying to reach followed by your identifier, which generally consists of your neighborhood name and your function. For example:

> "[Neighborhood] Control, this is [Neighborhood] Damage Assessment Team One, do you copy, over?"

> "[Neighborhood] Damage Assessment Team One, this is [Neighborhood] Control. I copy you loud and clear. What is your need?"

Once you receive a reply to your initial request to establish a conversation, then begin the communication. You may need to include the name of the person you are calling and your own identifier each time if others are using the same channel. You can end each transmission with "over" (which means "over to you") if you like. Or, many FRS/GMRS radios "beep" at the end of each transmission, which lets the other person know you've stopped transmitting. Keep all transmissions brief and to the point. Spell out numbers (i.e. one five two three, not fifteen twenty-three). For example:

> "[Neighborhood] Control, this is [Neighborhood] Damage Assessment Team One, we have an injured person at 1 5 2 3 Oakland Drive, and request a First Aid Team. Do you copy?"

> "[Neighborhood] Damage Assessment Team One, this is [Neighborhood] Control. Affirmative, I copy you. We will send a First Aid Team immediately to 1 5 2 3 Oakland Drive. Please wait for this team to arrive."

When you are finished transmitting all your information, say, "Out." For example:

> "[Neighborhood] Control, this is [Neighborhood] Damage Assessment Team One, I copy you, we will remain at 1 5 2 3 Oakland Drive and wait for the First Aid Team to arrive. Out."

Use clear English in your communications. "Affirmative" and "Negative" are preferred over "Yes" and "No" as they are easier to understand. Do not use shortcuts like "10/4" or "Roger" as they can be easily misunderstood. Be sure to wait to release your transmit button a second or two after speaking so that you don't cut off your transmission. Do not press the transmit button unless you intend to talk.

Note: If conducting a practice exercise in preparation for an actual emergency, you could cause someone listening on your channel who is not familiar with the exercise to be confused or alarmed. Therefore you should include the words "exercise" or "test":

> "[Neighborhood] Control, this is [Neighborhood] Damage Assessment Team One. This is an exercise. We have a major fire at 1 5 2 0 Oakland Drive. This is an exercise/test message, repeat, this is just an exercise." …

8) Consumer FRS/GMRS and ICOM IC-F21GM GMRS

Radio Channel/Frequency Cross Reference This table cross-references the consumer dual-service FRS/GMRS radio (Motorola, Midland, etc.) channels/frequencies with the ICOM IC-F21GM GMRS radio. Use this table to set your ICOM IC-F21GM GMRS channel/frequency to match the specified consumer dual-service

FRS/GMRS radio channel in use. Note that the ICOM IC- 4088A uses the same consumer FRS channels 1 - 14.

Consumer FRS/GMRS Channel	IC-F21GM GMRS Channel	Channel Freq. (MHz)	Consumer FRS/GMRS Channel	IC-F21GM GMRS Channel	Channel Freq. (MHz)
1 (FRS/GMRS)	9	462.5625	13 (FRS only)		467.6875
2 (FRS/GMRS)	10	462.5875	14 (FRS only)		467.7125
3 (FRS/GMRS)	11	462.6125	15 (GMRS only)	1	462.5500
4 (FRS/GMRS)	12	462.6375	16 (GMRS only)	2	462.5750
5 (FRS/GMRS)	13	462.6625	17 (GMRS only)	3	462.6000
6 (FRS/GMRS)	14	462.6875	18 (GMRS only)	4	462.6250
7 (FRS/GMRS)	15	462.7125	19 (GMRS only)	5	462.6500
8 (FRS only)		467.5625	20 (GMRS only)	6	462.6750
9 (FRS only)		467.5875	21 (GMRS only)	7	462.7000
10 (FRS only)		467.6125	22 (GMRS only)	8	462.7250
11 (FRS only)		467.6375			
12 (FRS only)		467.6625	n/a	16	Auto Scan

☐ = designated Montclair Area/District 4 GMRS neighborhood-to-neighborhood/Fire Station channel

Note: These channels/frequencies were verified against the ICOM IC-F21GM specifications and current Motorola (Txxxx, MHxxx, MTxxx, MRxxx, MSxxx), Uniden (GMRxxxx), Midland (GXTxxxx, LXTxxx) and ICOM IC-4088A radio specifications. Older FRS/GMRS radio channels may not correspond to the channel list and frequencies noted in the above table. Check the specifications for your particular radio.

9) Contact Information

CORE - http://www2.oaklandnet.com/Government/o/OFD/s/CORE/index.htm, 510.238.6351

FCC - http://www.fcc.gov/

RACES - http://www.usraces.org/

ORCA - http://www.ww6or.com/