



# FCC and its Public Radio Services



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# In the beginning . . .

- There was just Citizen Band (CB) radio
- In the late 50's and 60's, CB was populated by non-ham hams.
- Lots of fun – to my mind, as a young boy, it was more about the contact than the technical side
- But then an evil wind started to blow in . . .



# Things started to fall apart . . .

- As a Child of the 60's, CB became a “protest” community of truckers, kids, and adults with an agenda.
- A *Smokey and the Bandit / Convoy* mentality took over, right good buddy?
- It became an ‘Us verses the “the Man” ‘ . . .



# Things started to fall apart . . .

- The world descended into a kind of “Mad Max Beyond Thunderdome”



# Things started to fall apart . . .

- We needed a hero
- Well that didn't happen . . .
- Finally the FCC seemed to just gave up and moved on
  - Had to actually change the law
  - No license – and so long as you don't push power up too high, they dropped all enforcement





But the FCC didn't give up.

They came up with a new bureaucracy-speak term:  
“Personal radio service”

**Personal radio services** provide short-range, low power radio for personal communications, radio signaling, and business communications not provided for in other wireless services.

- The range of applications is wide, spanning from varied one- and two way voice communications systems to non-voice data transmission devices used for monitoring patients or operating equipment by radio control.
- Licensing and eligibility rules vary.
  - Some personal radio services require a license grant from the FCC (License “By Exam”, or License “By Fee”),
  - While others require only that you use equipment that is properly authorized under the FCC's rules (License “By Rule”).

# Personal Radio Services (all are Part **95**)

1. **218-219 MHz Service** - One or two way communications for transmission of information to subscribers within a specific service area.
2. **Citizens Band (CB) Radio Service** - 1-5 mile range two-way voice communication for use in personal and business activities.
3. **Family Radio Service (FRS)** - 1 mile range Citizen Band service for family use in their neighborhood or during group outings
4. **General Mobile Radio Service (GMRS)** - 5-25 mile range Citizen Band service for family use in their neighborhood or during group outings
5. **Low Power Radio Service (LPRS)** - private, one-way communications providing auditory assistance for persons with disability, language translation, and in educational settings, health care, law, and AMTS coast stations.
6. **Medical Implant Communications Service (MICS)** - for transmitting data in support of diagnostic or therapeutic functions associated with implanted medical devices.
7. **Multi-Use Radio Service (MURS)** - private, two-way, short-distance voice or datacommunications service for personal or business activities of the general public.
8. **Personal Locator Beacons (PLB)** - used by hikers, and people in remote locations to alert search and rescue personnel of a distress situation.
9. **Radio Control Radio Service (R/C)** - one-way non-voice radio service for on/off operation of devices at places distant from the operator.
10. **Wireless Medical Telemetry Service (WMTS)** - for remote monitoring of patients' health through radio technology and transporting the data via a radio link to a remote location, such as a nurses' station.

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Let's look at 4 of them . . .

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# GMRS: what CB was supposed to be . . .

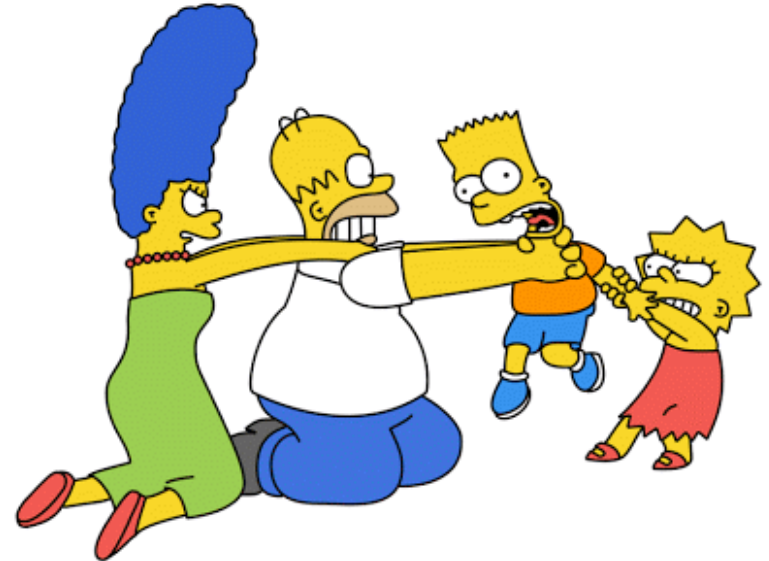
- FCC: “The GMRS is a land mobile radio service available to persons for short-distance two-way communications to facilitate the activities of licensees and their immediate family members. Each licensee manages a system consisting of one or more stations.”

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- The FCC definition of immediate family includes a spouse, children, stepchildren, parents, stepparents, siblings, grandparents, aunts, uncles, nephews, nieces, and in-laws (see 47 CFR 95.179)



# GMRS: what CB was supposed to be . . .

- FCC no longer accepts GMRS license applications from non-individuals.
- Licensed “By Fee”: Application fee \$65 + Regulatory fee (was \$25; now **\$0**)
  - To make it truly “By Rule” requires an act of Congress (proposed by FCC in 2010, but no action taken so far)
- 22 UHF “channels” (some shared with other services). Power limit of 5w on HTs.
- The use of some channels is restricted to certain types of stations, e.g. repeaters (up to 50 w) permitted, although not particular popular.
  - See: <http://nwigmrs.com/repeaters.html> for an example








# FRS: the poor man's brother



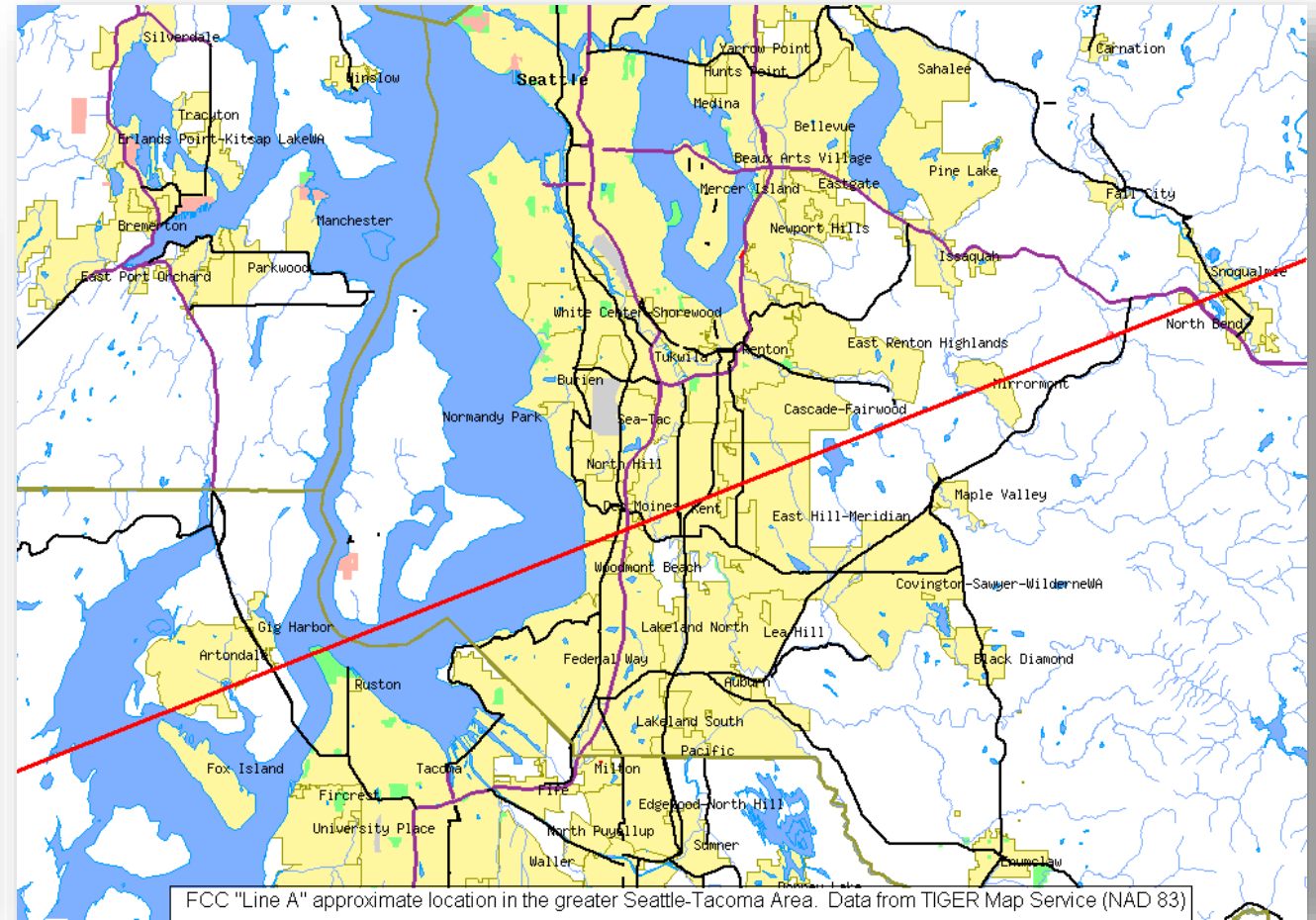
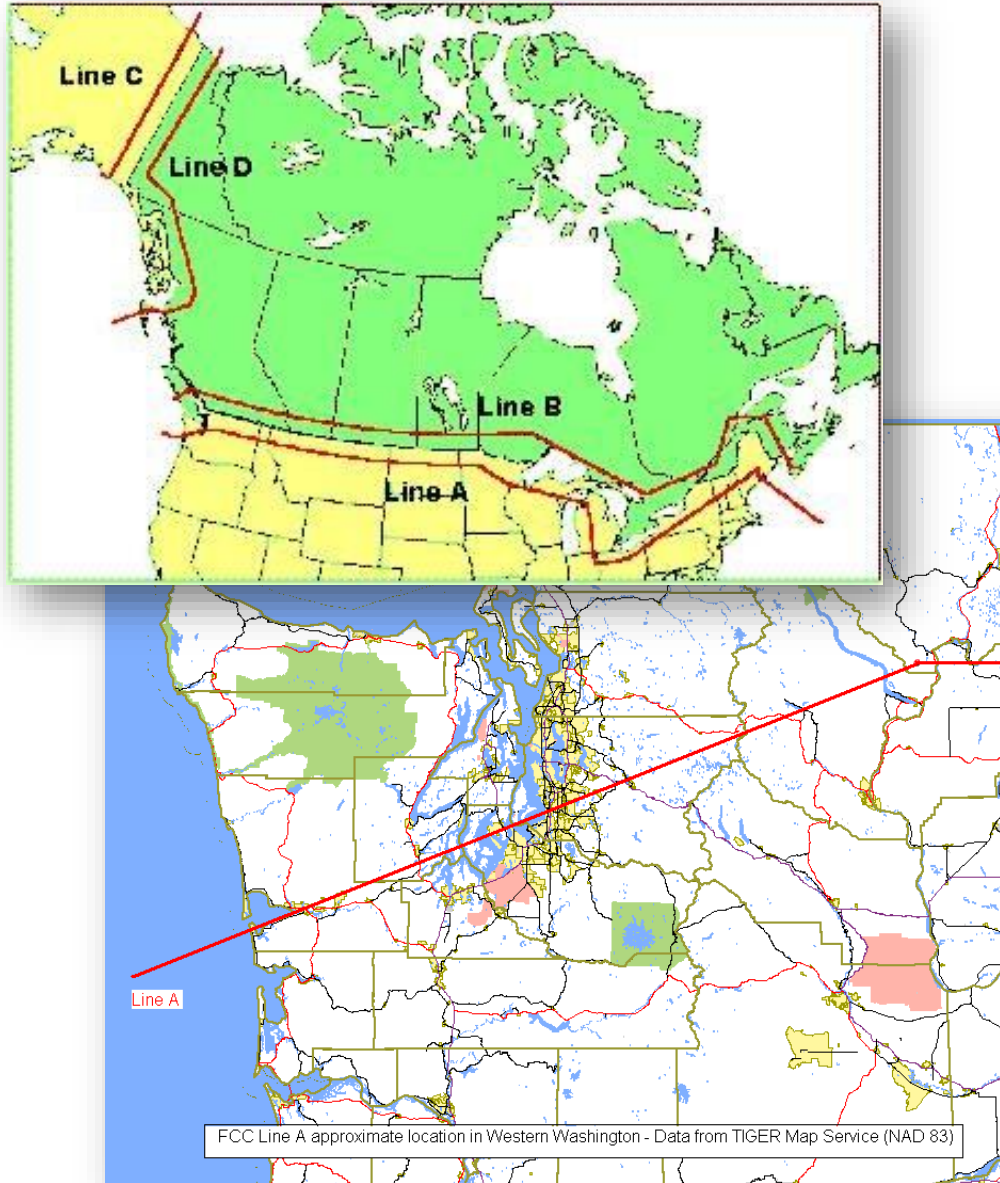
- The Family Radio Service (FRS) is a private, two-way, very short-distance voice and data communications service for facilitating family and group activities. The most common use for FRS channels is short-distance, two-way voice communication: using small hand-held radios that are similar to walkie-talkies.
- 14 UHF “channels” (narrow-band 12.5kHz). Seven of the channels (Channels 1-7) are shared with the GMRS, so you may hear communications from GMRS station on these channels. The other seven channels are “FRS-only” channels.
- Units have a **.5w** power limit with a **non-detachable** antenna
- “An FRS unit may transmit only emission type F3E [which is a type of voice emission]. A non-voice emission is limited to selective calling or tone-operated squelch tones to establish or continue voice communications.” 47 C.F.R. § 95.631(d).
- In 2003, expanded to include GPS location data also. See: [https://apps.fcc.gov/edocs\\_public/attachmatch/FCC-03-26A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/FCC-03-26A1.pdf)
- Very popular with families and young kids.

# GMRS and FRS Shared Channels

- FRS only: 7 channels
- GMRS only: 8 channels
- GMRS & FRS shared: 7 channels
- On FRS-only channels, GMRS/FRS radios must use reduced power
- Notice that GMRS has “Line A” restrictions near Canadian border (as ham radio does)

Channel No. 	Frequency 	FRS 	FRS Max Output 	GMRS 	GMRS Max Output 	Usage/Notes 
01	462.5625	FRS 1	500 mW	GMRS 9	5 W	Unofficial national calling channel
02	462.5875	FRS 2	500 mW	GMRS 10	5 W	
03	462.6125	FRS 3	500 mW	GMRS 11	5 W	
04	462.6375	FRS 4	500 mW	GMRS 12	5 W	
05	462.6625	FRS 5	500 mW	GMRS 13	5 W	
06	462.6875	FRS 6	500 mW	GMRS 14	5 W	
07	462.7125	FRS 7	500 mW	GMRS 15	5 W	
08	467.5625	FRS 8	500 mW			
09	467.5875	FRS 9	500 mW			
10	467.6125	FRS 10	500 mW			
11	467.6375	FRS 11	500 mW			
12	467.6625	FRS 12	500 mW			
13	467.6875	FRS 13	500 mW			
14	467.7125	FRS 14	500 mW			
15	462.5500			GMRS 1	50 W	
16	462.5750			GMRS 2	50 W	
17	462.6000			GMRS 3	50 W	
18	462.6250			GMRS 4	50 W	
19	462.6500			GMRS 5	50 W	Use restricted near Canadian border
20	462.6750			GMRS 6	50 W	Unofficial emergency/traveler assistance channel (PL 141.3)
21	462.7000			GMRS 7	50 W	Use restricted near Canadian border
22	462.7250			GMRS 8	50 W	
	467.5500			GMRS 1 in	50 W	Repeater input
	467.5750			GMRS 2 in	50 W	Repeater input
	467.6000			GMRS 3 in	50 W	Repeater input
	467.6250			GMRS 4 in	50 W	Repeater input
	467.6500			GMRS 5 in	50 W	Repeater input. Use restricted near Canadian border
	467.6750			GMRS 6 in	50 W	Repeater input, Unofficial emergency/traveler assistance channel (PL 141.3)
	467.7000			GMRS 7 in	50 W	Repeater input. Use restricted near Canadian border
	467.7250			GMRS 8 in	50 W	Repeater input

# “Line A” applies to us! (both hams and GMRS)



# MURS: the 'different' kid on the block

- Ok for individuals, groups or businesses
- VHF “channels” very similar to Land Mobile
  - In fact, many share same radio families with MURS
- History – First Congressional law that made it license “By Rule”
- Where it is today
  - A station identification announcement is not required to be transmitted.
  - The usual range of communications between MURS stations is less than a few miles; connecting a MURS radio to an external antenna can extend the range to ten miles or more.





# MURS frequencies

Frequency	Type	Alpha Tag	Description	Mode	Tag
151.82000	M	MURS 151.82	Common Use	FMN	Other
151.88000	M	MURS 151.88	Common Use	FMN	Other
151.94000	M	MURS 151.94	Common Use	FMN	Other
154.57000	M	MURS 154.57	Common Use	FM	Other
154.60000	M	MURS 154.60	Common Use	FM	Other

The **Multi-Use Radio Service**, or MURS, is a low power, short range, **unlicensed** personal radio service in the 150 [MHz](#) band. MURS is intended for short-range local voice or data communications. Antenna height is limited to 20 feet above structure or 60 feet above ground, whichever is the greater. Very narrow [bandwidth](#) transmissions (maximum 11.25 [kHz](#) channel bandwidth, with +/- 2.5 kHz deviation) are permissible on all five MURS channels. The older +/- 5 kHz deviation signals (with a maximum 20 kHz channel [bandwidth](#)) are also permitted (but not required) on the two upper channels (in the 154 MHz band).

MURS' authorized five channels were previously in the industrial/business (Land Mobile) radio service and were known as the "color dot" frequencies in Part 90 of the FCC rules.

# GMRS/FRS/MURS are mobile-to-mobile



- They are primarily for voice communication.
- All have prohibitions against:
  - Transmissions across services (except in the case of shared GMRS + FRS channels)
  - Interconnecting to the public switched telephone network (PSN).
  - Store-and-forward scenarios, e.g. text/SMS
- Only GMRS allows for repeater operation; no mention of repeater linking.
- FRS-only radios are rapidly disappearing being replaced with GMRS+FRS radios that do both . . .

All services have similar emergency communications provisions as §97.403



**§95.143 Managing a GMRS system in an emergency.**

(a) The stations in a GMRS system must cease transmitting when the station operator of any station on the same channel is communicating an *emergency message* (concerning the immediate protection of property or the safety of someone's life).

(b) If necessary to communicate an emergency message from a station in a GMRS system, the licensee may permit:

- (1) Anyone to be the station operator (see §95.179); and
- (2) The station operator to communicate the emergency message to any radio station.

**§95.183 Prohibited communications.**

(a) (13) Messages (except emergency messages) to any station in the Amateur Radio Service, to any unauthorized station, or to any foreign station;

In case you have forgotten 😊



**§97.403 Safety of life and protection of property.**

No provision of these rules prevents the use by an amateur station of any means of radio communication at its disposal to provide essential communication needs in connection with the immediate safety of human life and immediate protection of property when normal communication systems are not available.



# Service “D”: The chaos that is CB



- Where it is today: (from Part 95D)
  - You may not raise the power output of a CB transmitter.
  - You may not attach a "linear," "linear amplifier" or any other type of power amplifier to your CB transmitter.
  - There are no height restrictions for antennas mounted on vehicles or for hand-held devices.
  - For structures, the highest point of your antenna must not be more than 20 feet above the highest point of the building or tree on which it is mounted, or 60 feet above the ground. There are lower height limits if your antenna structure is located within two miles of an airport.
  - You may use an on-the-air pseudonym ("handle") of your choosing.
  - You are not required to transmit a station identification announcement. You are, however, encouraged to identify your CB communications by transmitting a previously assigned CB station call sign; a self-assigned call sign consisting of the letter “K” followed by your initials and residence zip code; your name; or an organizational description including name and any applicable operator unit number.
  - You must at all times and on all channels, give priority to emergency communications.
- Foul-mouth truckers (and others with similar language challenges) still reign
- However, it is still very, very popular – good for reaching out to the public in an emergency



# Comparing Personal Radio Services

	Band	Mode	FCC-issued License	Power	# of Channels	FCC Regs	Repeater permitted	Type Certified
“Ham”	All	All	Yes (by exam)	1.5k W PEP	n/a	97	Yes	PA only
GMRS	UHF	FM <sup>4</sup> (25kHz)	Yes (by fee)	5 W ERP HT/base (20 ft antenna); 50 W ERP for a repeater	22	95A	Yes	Yes
FRS <sup>2</sup>	UHF	NFM <sup>4</sup> (12.5kHz)	No <sup>1</sup>	½ W ERP	14	95B	No	Yes
MURS	VHF	FM/ NFM <sup>3 4</sup>	No <sup>1</sup>	2 W ERP	5	95J	No	Yes
“CB”, aka 11 meters	HF	AM + SSB <sup>4</sup>	No <sup>1</sup>	4 W AM or 12 W PEP SSB	40	95D	No	Who cares?

<sup>1</sup> Licensed “By Rule”: This means an individual license is not required to operate a radio provide you comply with the rules. You may operate an radio regardless of your age, and for personal or for business use if you are not a representative of a foreign government.

<sup>2</sup> In addition to its lower power limits, a FRS radio may not have a detachable antenna. This was purposely specified in the Part 95B regulations to ensure that its range is limited.

<sup>3</sup> Bandwidth varies based on channel or frequency chosen; either 11.25kHz or 20kHz

<sup>4</sup> Various restrictions on emission types, see slides for additional info

# Type certification – Part **95**



- Equipment must be ‘type certified’ for Part 95, e.g. GMRS states:

“§95.129 Station equipment

Every station in a GMRS system must use transmitters the FCC has certificated for use in the GMRS. Transmitters that have been certified for use in the GMRS may be found on the FCC Web site at

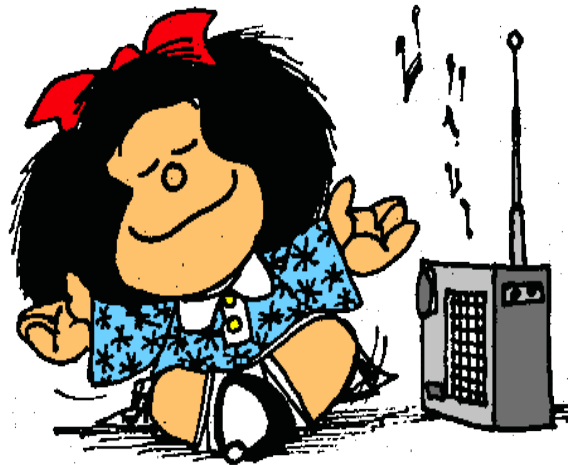
<https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm>

All station equipment in a GMRS system must comply with the technical rules in part 95.”

- Let the arguing begin . . .



Enough 'words' – Let's look at some radios!





# Sample GMRS Radios

- Midland GMRS/FRS 2-pack (\$85)  
<http://www.amazon.com/dp/B00R3HL8YA>

- Powerwerx TR-505 (\$100)  
<http://www.hamradio.com/detail.cfm?pid=XT-000026>



- Garmin Rino 650 US GPS (\$400)  
<http://www.amazon.com/Garmin-Rino-650-US-GPS/dp/B004XJEQTA/>  
(Standalone GPS + GMRS/FRS + NOAA + 3-axis electronic compass and barometric altimeter)

# Sample Radios (FRS and FRS/GMRS)

- Motorola 23-Mile Range 22-Channel FRS/GMRS Two-Way Radio 2-pack (w/ NOAA alert) (\$41)  
<http://www.amazon.com/Motorola-MH230R-23-Mile-22-Channel-Two-Way/dp/B001UE6MIO/>



- Alinco DJ-FX45 UHF Handheld Transceiver (FRS only – PC programmable) \$40  
<http://www.mtcradio.com/alinco-dj-fx45-uhf-handheld-transceiver/>

- Motorola MT352TPR FRS Weatherproof Two-Way - 35 Mile Radio Triple Pack – Silver \$155  
<http://www.amazon.com/Motorola-MT352TPR-FRS-Weatherproof-Two-Way/dp/B007UKVO3U/>



# Sample radios (MURS)

- Dakota Alert MURS Wireless 2-Way Handheld Radio, M538-HT  
<http://www.amazon.com/Dakota-Alert-Wireless-Handheld-M538-HT/dp/B013XQMPSM/> (\$85)  
<http://www.amazon.com/Dakota-Alert-MURS-Transmitter/dp/B001BI4QUK/> (\$120)

- Motorola RMM2050 \$189  
<http://www.amazon.com/Motorola-RMM2050-On-Site-Two-Way-Business/dp/B00EAHGL5W/>



# Sample radios (CB)

- Midland 75-822 40 Channel CB-Way Radio (\$79)  
<http://www.amazon.com/Midland-75-822-Channel-CB-Way-Radio/dp/B00000K2YR/>
- Midland 1001Z 40-Channel CB Radio – base station (\$30)  
<http://www.amazon.com/Midland-1001Z-40-Channel-CB-Radio/dp/B00024DIDK/>



# “Borderline” radios (Type 90 certified, or not)

- BaoFeng UV-5R Dual Band Two Way Radio (\$25)

<http://www.amazon.com/BaoFeng-UV-5R-Dual-Radio-Black/dp/B007H4VT7A/>

- ICOM F4001 / F3001 (16 channel business band radio) (\$135)

<http://www.gmroutlet.com/icom-f4001-f3001.html>



- Wouxun KG-UV3X Pro Dual Band VHF/UHF 125 Channel Handheld Commercial Radio (\$140)

<http://www.powerwerx.com/two-way-radios/handheld-wouxun-radios/kg-uv3x-dual-band-commercial.html>

# If you decide to go with a 'borderline' radio, consider the UV-82C

- Commercial version of UV-82 (only BaoFeng actually Part 90 certified)
  - Better ergonomics (easier to hold; stronger case; display moved to near keypad)
  - Better quality 1w speaker
  - Many battery options: 1800Mah standard battery; optional 3600Mah extended battery; 12V battery eliminator; AAA battery pack
- Adds VFO lock-out (default + set via programming); transmit timeout; dual PTT on both body + remote mic + ear bud
- Amazon \$55  
<http://www.amazon.com/gp/product/B00IJHLNE/>



**BAOFENG**  
FM PORTABLE TRANSCEIVER  
MODEL: **UV-82**  
FREQ: 136-174MHz/400-520MHz

⚠ Device must be restricted to occupational use to satisfy FCC therefore exposure compliance. See owner's manual for specific operating requirements.

**FCC-ID: ZP5BF-82**

This device complies with part 90 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation.

# References

- Youtube videos: [https://www.youtube.com/watch?v=Bw\\_WkbsuAZI](https://www.youtube.com/watch?v=Bw_WkbsuAZI) by mjlorton (KD8LON)
- FCC web site on GMRS, FRS, MURS and CB
- Wikipedia (look up each of the personal radio services)
- <http://wiki.radioreference.com/> (for frequency charts)





Background material

# Type certification mismatch



Part 95 explicitly say that, while transceivers can be cross-certificated for use in other radio services, if a transceiver is capable of transmitting on Part 97 frequencies, it cannot be certificated for Part 95 use.

## § 95.655 Frequency capability.

- (a) No transmitter will be certificated for use in the CB service if it is equipped with a frequency capability not listed in § 95.625, and no transmitter will be certificated for use in the GMRS if it is equipped with a frequency capability not listed in § 95.621, unless such transmitter is also certificated for use in another radio service for which the frequency is authorized and for which certification is also required.

**(Transmitters with frequency capability for the Amateur Radio Services and Military Affiliate Radio System will not be certificated.)**

. . .

- (d) (d) No transmitter will be certificated for use in MURS if it is equipped with a frequency capability not listed in §95.632

# Emission Designators for Part 95

- GMRS
  - Modulation (A, F, G, H, J, R) : Double-sideband; FM (frequency); PM (phase); SSB (full carrier); SSB (suppressed carrier); SSB (reduced carrier)
  - Main carrier (1, 3) : single channel with quantized or digital and no modulated sub-carrier (no TDM); single channel w/ analog
  - Type of information (D, E): data transmission, telemetry, telecommand; telephony (voice)
- FRS (limited to)
  - F3E: FM; single channel w/ analog; telephony (voice), or
  - F2D: (emission used for GPS location data)
- CB
  - Same as GMRS, but no FM (frequency) or PM (phase)
- MURS
  - A1D, A2B, A2D, A3E, F2B, F1D, F2D, F3E, G3E
  - Just double-sideband; FM --- note: No CW 😊