National Interoperability Field Operations Guide

U.S. Department of Homeland Security
Emergency Communications Division
Version 1.6.1A

Homeland Security

January 2019

First printing- January 2019

INTRODUCTION

The National Interoperability Field Operations Guide (NIFOG) is a technical reference for emergency communications planning and for radio technicians responsible for radios that will be used in disaster response. The NIFOG includes rules and regulations for use of nationwide and other interoperability channels, tables of frequencies and standard channel names, and other reference material, formatted as a pocket-sized guide for radio technicians to carry with them.

If you are not familiar with interoperability and mutual aid communications, start with the "How to Use the National Interoperability Field Operations Guide" section.

We encourage you to program as many of these interoperability channels in your radios as possible, as permitted by the applicable regulations. Even if geographic restrictions on some channels preclude their use in your home area, you may have the opportunity to help in a distant location where the restrictions do not apply. Maximize your flexibility.

To download or request copies of the NIFOG, please visit

https://www.dhs.gov/publication/fog-documents

Your comments are welcome at NIFOG@HQ.DHS.GOV

Thank you.

Ronald T. Hewitt, Assistant Director for Emergency Communications
Ross Merlin, NIFOG Author, National Coordinating Center for Communications

U.S. Department of Homeland Security

TABLE OF CONTENTS

COMMON COMMUNICATIONS REFERENCES 58

USING THE NATIONAL INTEROPERABILITY FIELD OPERATIONS GUIDE

What is the "National Interoperability Field Operations Guide"?

The "National Interoperability Field Operations Guide" (NIFOG) is a pocket-sized listing of land mobile radio (LMR) frequencies that are often used in disasters or other incidents where radio interoperability is required, and other information useful to emergency communicators.

Terms used in this document:

- FCC – Federal Communications Commission
- FCC Rules – contained in Title 47, Code of Federal Regulations (47CFR)
- Federal – used herein to differentiate between radio stations of the United States Government and those of any state, tribal, local, or regional governmental authority. "Federal Frequencies" refer to frequencies (channels) available for assignment to U.S. Government Agencies. Although the FCC is a Federal Government agency, the frequencies it administers are not "Federal frequencies"- they are administered for state/tribal/local governments, commercial entities, and individuals.
- NCC – (1) the Public Safety National Coordination Committee, a Federal Advisory Committee formed by the FCC to advise it on interoperability; (2) National Coordinating Center for Telecommunications.

- NPSTC – the National Public Safety Telecommunications Council is a federation of organizations whose mission is to improve public safety communications and interoperability through collaborative leadership. After the charter for the NCC expired, NPSTC continued NCC's efforts to establish a common channel nomenclature. NPSTC channel IDs used in the NIFOG are based on the "Standard Channel Nomenclature for the Public Safety Interoperability Channels", APCO ANS 1.104.1-2010, approved June 9, 2010 by the American National Standards Institute (ANSI) - see http://www.npstc.org/documents/APCO-NPSTC-ANS1-104-1web.pdf
- NTIA – National Telecommunications and Information Administration
- NTIA Manual – The NTIA "Manual of Regulations and Procedures for Federal Radio Frequency Management" http://www.ntia.doc.gov/osmhome/redbook/redbook.html
- Radio frequencies are in Megahertz (MHz) unless otherwise noted.
- CTCSS tone frequencies are in Hertz (Hz) or two-character Motorola codes.
- Emissions on frequencies above 138 MHz are narrowband analog FM, unless otherwise noted.

How is the NIFOG used?

The NIFOG may be used by radio technicians when programming channels in radios. We recommend having these channels programmed in radios at all times, as permitted by the applicable regulations, rather than waiting until a disaster is imminent or occurring to do the programming.

The NIFOG also is a useful tool for emergency communications planners, providing them with information on the interoperability channels most likely to be in the radios of responders from another discipline or jurisdiction.

Don't I need a license for these channels before programming them into radios?

If you are licensed under Part 90 of the FCC rules, you may program frequencies (other than maritime or aviation) that you are not licensed to use IF "the communications involved relate directly to the imminent safety-of-life or property" or "with U.S. Government stations ... in connection with mutual activities" (see FCC rules 90.427 and 90.417, and Public Notice DA 01-1621). See "Conditions for Use of Federal Interoperability Channels", pages 19-22. There are no restrictions on programming frequencies into U.S. Government radios.

However, note that 90.403(g) requires that "[f]or transmissions concerning the imminent safety-of-life or property, the transmissions shall be suspended as soon as the emergency is terminated." Also, the *safety of life* provision of 90.417(a) makes it clear that the exception applies only when the communications involved "relate directly" to the "imminent" safety of life or property. Because one overriding policy concern of the FCC is the prevention of harmful interference, any exceptions to the general prohibition on using non-licensed frequencies are limited to responding to an imminent threat to safety-of-life or property. See also 90.407 dealing with communications during an emergency which disrupts normal communications facilities and §90.411 dealing with civil defense communications.

Programming of maritime channels must be performed only by a person holding a first or second class radiotelegraph operator's certificate, a radiotelegraph operator license, or a general radiotelephone operator's license - 47 CFR 80.203(b)(3). See also 80.203(b)(4) and §80.169(a).

A general radiotelephone operator must directly supervise and be responsible for all transmitter adjustments or tests during installation, servicing or maintenance of an aeronautical radio station - see §87.73.

How can I use these frequencies if I don't have a license for them?

There are seven ways you can legally use these radio frequencies:

1. You or your employer may already have a Federal Communications Commission (FCC) license or a National Telecommunications and Information Administration (NTIA) authorization for some of the interoperability and mutual aid frequencies.
2. **For FCC licensees**, the non-Federal National Interoperability Channels VCALL10-VTAC14 and VTAC33-38, UCALL40-UTAC43D, the 800 MHz interoperability channels, and 8CALL90-8TAC94D are covered by a "blanket authorization" from the FCC -"Public safety licensees ... can operate mobile units on these interoperability channels without an individual license." See FCC 00-348, paragraph 90 (released October 10, 2000) for VHF and UHF; see FCC rules 90.421(a)(3) and 90.525(a) for 700 MHz; see FCC 87-112, paragraph 34 (released December 18, 1987), for 800 MHz. When North of Line A or East of Line C the blanket authorization in paragraph 90 of FCC 00-348 applies only to mobile (including hand-held) stations operating with an effective radiated power (ERP) of 3 watts or less. At higher power levels, frequency coordination is required. Line A and C are defined in 47CFR90.7. You can check a location for Line A and Line C restrictions at http://wireless.fcc.gov/uls/index.htm?job=line_a_c
3. You may operate on frequencies authorized to another licensee when that licensee designates you as a unit of their system, in accordance with FCC rule 90.421; or as an authorized user of a shared radio system pursuant to a written agreement as described in FCC rule 90.179.
4. In extraordinary circumstances, the FCC may issue a "Special Temporary Authority" (STA) for such use in a particular geographic area.

5. In extraordinary circumstances, the NTIA may issue a "Temporary Assignment" for such use in a particular area.
6. **If you are an FCC Part 90 licensee, you may operate a mobile station on the Federal Interoperability Channels only when authorized by the FCC (by license or STA) and only for interoperability with Federal radio stations authorized by the NTIA to use those channels. You may not use these channels for interoperability with other state, tribal, regional, or local radio stations – these are not a substitute for your regular mutual aid channels. See FCC Public Notice DA 01-1621, released July 13, 2001.**
7. When necessary for the IMMEDIATE protection of life or property, **FCC Part 90 licensees** may use prudent measures beyond the specifics of their license. See FCC rule 90.407, "Emergency communications". **U.S. Government stations** are authorized by NTIA rule 7.3.6 to operate on any Part 90 frequency with the permission of the FCC licensee when such use is necessary for communications directly related to the emergency at hand.

FCC Rules for Interoperability

90.407 Emergency communications.

The licensee of any station authorized under this part may, during a period of emergency in which the normal communication facilities are disrupted as a result of hurricane, flood, earthquake or similar disaster, utilize such station for emergency communications in a manner other than that specified in the station authorization or in the rules and regulations governing the operation of such stations. The Commission may at any time order the discontinuance of such special use of the authorized facilities. [49 FR 36376, Sept. 17, 1984]

90.411 Civil defense communications.

The licensee of any station authorized under this part may, on a voluntary basis, transmit communications necessary for the implementation of civil defense activities assigned such station by local civil defense authorities during an actual or simulated emergency, including drills and tests. The Commission may at any time order the discontinuance of such special use of the authorized facilities. [49 FR36376, Sept. 17, 1984]

(FCC Rules for Interoperability – continued)

90.417 Interstation communication.

(a) Any station licensed under this part may communicate with any other station without restriction as to type, service, or licensee when the communications involved relate directly to the imminent safety-of-life or property.

(b) Any station licensed under this part may communicate with any other station licensed under this part, with U.S. Government stations, and with foreign stations, in connection with mutual activities, provided that where the communication involves foreign stations prior approval of the Commission must be obtained, and such communication must be permitted by the government that authorizes the foreign station. ...

90.421 Operation of mobile station units not under the control of the licensee.

Mobile stations, as defined in § 90.7, include vehicular-mounted and handheld units. Such units may be operated by persons other than the licensee ...

90.423 Operation on board aircraft.

Allowed on most Public Safety frequencies up to 1 mile altitude, up to 10 watts, secondary to land-based systems; for air-to-mobile, air-to-base, air-to-air, and air-to-ship communications.

90.427 Precautions against unauthorized operation.

(a) ...

(b) Except for frequencies used in accordance with § 90.417, no person shall program into a transmitter frequencies for which the licensee using the transmitter is not authorized.

NTIA Rules for Interoperability

7.3.4 Emergency Communications for which an Immediate Danger Exists to Human Life or Property

1. In situations where immediate danger exists to human life or property, an agency may operate temporarily on any regularly assigned frequency in a manner other than that specified in the terms of an existing assignment. Emergency operations under such situations should continue only as long as necessary to ensure that the danger to human life or property no longer exists. Emergency operations under these circumstances shall be reevaluated on a regular basis until such time as normal/routine operations can be reestablished.
2. Interoperable communications for disaster/emergency response involving Federal, state, local, and tribal entities shall be in conformance with Section 4.3.16 of this Manual. Additional information regarding interoperable communications can also be found in the National Interoperability Field Operations Guide (NIFOG) ... promulgated by the Department of Homeland Security.

7.3.6 Emergency Use of Non-Federal Frequencies

In emergency situations, a Federal radio station may utilize any frequency authorized to a non-Federal radio station, under Part 90 of the FCC Rules and Regulations, when such use is necessary for communications with non-Federal stations and is directly related to the emergency at hand. Such use is subject to the following conditions:

a. The non-Federal licensee has given verbal or written concurrence.
b. Operations are conducted in accordance with the FCC Rules and Regulations.

(NTIA Rules for Interoperability – continued)

c. Use is restricted to the service area and station authorization of the licensee.

d. All operations are under the direct control of the licensee and shall be immediately terminated when directed by the licensee.

e. Operations do not exceed 60 days.

f. A written report of each such use shall be provided, through the agency's FAS [Frequency Assignment Subcommittee, of NTIA's IRAC (Interdepartment Radio Advisory Committee)] representative, to the FCC as soon as practicable.

7.5.2 Frequencies Authorized by the FCC for Ship Stations

Frequencies authorized by the Federal Communications Commission for ship stations may be used by Federal mobile stations to communicate with non-Federal stations in the maritime mobile service.

7.5.3 Frequencies for the Safety of Life and Property

... (5) The frequency 40.5 MHz is designated as the military joint common frequency. Use of this channel is limited to communications necessary to establish contact when other channel information is not available and for emergency communications. This frequency also may be used for search and rescue communications.

(NTIA Rules for Interoperability – continued)

(6) The provisions of this Manual do not prevent mobile stations, or mobile earth stations, in distress from using any frequency at its disposal to attract attention, make known its position, and obtain help. (See ITU Radio Regulation Ap. 13 Part A1, § 6,1.)

7.5.4 Frequencies for Coordinating Search and Rescue Operations

... (2) The frequency 123.1 MHz, using class A3E emission, may be used by stations of the aeronautical mobile service and by other mobile and land stations engaged in coordinated search and rescue operations.

(3) The frequency 156.3 MHz [VHF Marine channel 6] may be used for communications between ship stations and aircraft stations, using G3E emission, engaged in coordinated search and rescue (SAR) operations. When control of the scene of a SAR incident is under a Coast Guard coast station, 156.3 MHz may be used by ship stations to communicate with that coast station.

Does the NIFOG authorize me to use certain frequencies?

NO. The NIFOG does not grant authority to operate on any radio frequencies. Such authority can come only from the FCC or the NTIA.

Is the NIFOG the national emergency communications plan?

The NIFOG is the national guide for possible use in a situation where no other radio interoperability arrangement was promulgated by local authorities, or where emergency responders are unaware of such an arrangement. The NIFOG does NOT supersede any Federal, state, tribal, local, or regional emergency communications plan. If you are dispatched to a disaster or incident scene and

have no other information on how to make contact with other emergency responders, the NIFOG provides useful suggestions for which frequencies to use to attempt initial contact.

Are the interoperability channels discussed in the NIFOG available nationwide?

No. Not all frequencies are available nationwide for use as described in the NIFOG. In particular, the "Non-Federal VHF Inland Interoperability Channels" may be used only in certain inland parts of the country, away from coastal areas and major waterways (see the map titled *Counties Where VTAC17/ VTAC17D May Be Used* on page 27 for further details). Other channels in this plan may not be usable due to the potential for adjacent channel interference in some areas, or due to authorized on-channel uses that are different than the common uses described in the NIFOG. Use of the VCALL/ VTAC and UCALL/UTAC channels by mobiles (and hand-helds) North of Line A / East of Line C is limited to 3 watts ERP; higher power requires frequency coordination with Canada.

For a detailed list of which counties are in which VHF Public Coast (VPC) area, see:

http://www.fcc.gov/oet/info/maps/areas/data/2000/FCCCNTY2K.txt and

http://www.fcc.gov/oet/info/maps/areas/data/2000/README_FCCCNTY2K.txt

FCC online area cross-reference search: http://www.fcc.gov/fcc-bin/cesearch.pl

Who do I contact to use interoperability channels?

These channels can be used where licensed or authorized by FCC or NTIA, including authorization by a STA.

Plans for how these channels will be used may be in the Statewide Communications Interoperability Plan (SCIP) or the Tactical Interoperable Communications Plan (TICP) for the area of operations. Information on using 700 and 800 MHz interoperability channels may be found in the plans of your 700 MHz Regional Planning Committee or 800 MHz Regional Planning Committee. Contact your Statewide Interoperability Coordinator (SWIC) for these plans, and for additional guidance on use of these channels.

The COML (Communications Unit Leader) acts as or delegates the role of frequency manager; assigning specific uses to available radio channels and coordinating with dispatchers, the FCC, and NTIA for authorization to use additional channels as needed.

If access to the COML has not been pre-arranged or is not working as planned, try the calling channels specified in the NIFOG at or near the command post, incident scene, or staging area.

Directory of 700 MHz Regional Planning Committees:

http://publicsafety.fcc.gov/pshs/public-safety-spectrum/700-MHz/rpc-map.htm

Directory of 800 MHz Regional Planning Committees:

http://publicsafety.fcc.gov/pshs/public-safety-spectrum/800-MHz/regional-planning.htm

How do I request a Special Temporary Authorization (STA)?

FCC licensees request a Special Temporary Authorization (STA) from the FCC:

During Normal FCC Business Hours (Monday through Friday, 8:00am - 4:30pm EST/EDT)
Tracy Simmons - STA Licensing (Part 90--Land Mobile and Public Safety), Public Safety & Homeland Security Bureau - phone: 717-338-2657 email: Tracy.Simmons@fcc.gov
or file electronically: FCC Form 601 - ULS http://wireless.fcc.gov/uls/ then click on Online Filing "LOG IN"

Outside of Normal FCC Business Hours (4:30pm - 8am EST/EDT, weekends, and holidays)
FCC Operations Center (FCCOC)
phone: 202-418-1122 email: FCCOPS@fcc.gov

First Responders and Public Safety Entities with general STA inquiries

Zenji Nakazawa, Deputy Division Chief, Public Safety & Homeland Security Bureau
phone: 202-418-7949 email: Zenji.Nakazawa@fcc.gov

or

FCC Operations Center (FCCOC) phone: 202-418-1122 email: FCCOPS@fcc.gov

U.S. Government radio stations request temporary assignment or STAs via their agency representative to the Frequency Assignment Subcommittee (FAS) of the Interdepartment Radio Advisory Committee (IRAC). See NTIA Manual section 8.3.32.

The telephone number for the NTIA Frequency Assignment Branch is 202-482-1132.

[See the previous page for requesting STAs when a Joint Field Office is operational for an incident.]

Does the NIFOG specify exactly how to program channels?

No. There is no one-size-fits-all solution due to differing radio designs. The NIFOG uses the ANSI "Standard Channel Nomenclature for the Public Safety Interoperability Channels" for channel names - see "NPSTC" on page 2.

For some channels, the standard nomenclature specifies a "direct" ("talk-around") channel for repeaters which takes an additional memory slot. Some radios have a switch for talk-around on a repeater channel, and using this feature saves memory slots. Similarly, some radios may have a switch or button to enable or disable receive CTCSS; if not, another channel may be programmed so both modes are available.

Consider programming additional VHF Marine channels as possible interoperability channels (for use when properly authorized), based on local or regional use. In particular, channels used by drawbridge tenders may be appropriate; see http://wireless.fcc.gov/marine/vhfchanl.pdf for authorized channel uses and http://www.navcen.uscg.gov/?pageName=mtVhf for frequencies.

Recommended modes for using Federal Interoperability Channels: use analog for all Incident Response channels (CTCSS 167.9 Hz) and Law Enforcement channels LE A, LE 1, LE B, LE 10, and LE 16 (CTCSS 167.9 Hz); use P25 digital for the remaining LE channels, NAC \$68F (1679_{10}). CTCSS should always be transmitted on the analog channels, but carrier squelch (CSQ, no CTCSS) should be used on receive. Consider allowing the user to enable or disable CTCSS on receive by a switch or button; otherwise use CSQ on receive.

How do emergency responders use the calling channels?

As you approach an incident scene or staging area, you might establish contact on a dispatch or working channel. If you can't make contact, or if no channel was designated for this purpose, attempt to make contact on one of the designated interoperability calling channels. If it is a repeater channel and you get no response, try the "direct" or "talk-around" mode if your radio has that capability. In some cases, the talk-around channel exists as a distinct channel on the radio. For example, the VHF Incident Response Federal Interoperability Channel is known as "NC 1". The talk-around for this repeater channel is known as "IR 5".

The non-Federal national interoperability calling channels are VCALL10, UCALL40, 7CALL50, 7CALL70, and 8CALL90; the Federal IR and LE calling channels are "NC 1" (direct: "IR5"), "NC 2" (direct: "IR15"), "LE A", and "LE B". You may be able to learn what you need without transmitting, by just listening to radio traffic on one of these channels.

If a "travel channel" is needed (e.g. for communications between vehicles in a convoy), 7CALL70D is recommended if that will not interfere with its use as a calling channel.

May the Nationwide Interoperability Channels be used for tests and exercises?

FCC rule 90.417 authorizes communications "in connection with mutual activities", which includes tests and exercises. FCC rule 90.411 authorizes communications for civil defense (emergency management) activities during an actual or simulated emergency, including drills and tests.

How do Search and Rescue personnel on land, on watercraft, and on aircraft coordinate by radio?

Certain VHF Marine channels are designated in this plan for Search and Rescue (SAR) interoperability. Searchers on land, in boats, and in aircraft need to be able to communicate with each other to coordinate rescues. There is no VHF channel authorized and readily available to all three communities. Some aircraft involved in SAR have VHF Marine radios, as do most boaters; but the VHF radios that many ground SAR groups use are not approved for use on maritime frequencies, and they may be incapable of being programmed to operate in the wideband FM mode used on maritime frequencies. VHF marine radios may not be used on land unless they are licensed as marine utility stations, public or private coast stations, or maritime support stations. VHF Marine channels may not be used for terrestrial search and rescue operations – they are in this plan due to the likelihood of boats being involved in SAR in coastal areas.

Frequency 155.16 MHz is licensed to many SAR organizations. It is the *de facto* SAR interoperability channel, and has been given the standardized channel name of VSAR16. We encourage public safety entities to obtain licenses for this frequency to facilitate interoperability.

State or local government vehicles used to tow vessels involved in search and rescue operations are authorized to operate on maritime mobile frequencies as associated ship units. Such operations may use Distress, Safety and Calling, Intership Safety, Liaison, U.S. Coast Guard, or Maritime Control VHF intership frequencies; and may have a transmitter power of 25 watts. [FCC rule 80.115] Federal vehicles have similar authorization. [NTIA Manual 8.2.29(c)(6)]

Should Fire/EMS radios have the Law Enforcement interoperability channels programmed, and vice versa?

Yes. Radios for public safety personnel should have as many of these interoperability channels programmed as possible, as permitted by the applicable regulations. Interoperability may require crossing jurisdictional and functional lines. On the Federal interoperability channels, "Incident Response" (IR) means everybody – Fire, Rescue, EMS, Public Works, Law Enforcement, etc. The "Law Enforcement" (LE) channels will be used "primarily" for Law Enforcement activities, but could be designated for other incident support if that would not hamper Law Enforcement activities, and if assigned by the agency in control of the incident.

How can I get answers to questions about the "National Interoperability Field Operations Guide", or how can I offer suggestions to improve it?

Please send your questions or comments to the U.S. Department of Homeland Security, Emergency Communications Division, at NIFOG@HQ.DHS.GOV and include your name, agency or organization affiliation, and your email address.

How do I get copies of the NIFOG?

The latest version of the NIFOG can be downloaded or ordered from https://www.dhs.gov/publication/fog-documents

Regulations and Guidelines for National Interoperability

1. The FCC and NTIA rules allow for some flexibility in frequency use by personnel directly involved in a situation where there is imminent danger to human life or property. This does NOT mean "In an emergency, anything goes."
2. For communications not covered by #1, your use of a radio frequency must be authorized by:
   a. Your (or your agency's) FCC license or NTIA authorization
   b. "License by rule"– a provision in FCC rules that authorizes use of a radio frequency under specified conditions without a specific license or authorization issued to the user
   c. A "Special Temporary Authorization" provided by FCC or NTIA
3. Digital P25 operations on non-Federal interoperability channels should transmit the default Network Access Code (NAC) $293 ($659_{10}$), and receive with NAC $F7E ($3966_{10}$) (accept any incoming NAC). Specify talkgroup $FFFF ($65535_{10}$), which includes everyone.
4. Default modes for using Federal Interoperability Channels: use analog for all Incident Response channels and Law Enforcement channels LE A, LE 1, LE B, LE 10, and LE 16; use P25 Digital for the remaining LE channels, NAC $68F ($1679_{10}$).

Conditions for Use of Federal Interoperability Channels

1. The "VHF Incident Response (IR) Federal Interoperability Channel Plan", the "UHF Incident Response (IR) Federal Interoperability Channel Plan", the "VHF Law Enforcement (LE) Federal Interoperability Channel Plan", and the "UHF Law Enforcement (LE) Federal Interoperability Channel Plan" show frequencies available for use by all Federal agencies to satisfy law enforcement and public safety incident response interoperability requirements. These frequencies will be referred to hereinafter as "Federal Interoperability Channels".
2. The Federal Interoperability Channels are available for use among Federal agencies and between Federal agencies and non-Federal entities with which Federal agencies have a requirement to operate.
3. The channels are available to non-Federal entities to enable joint Federal/non-Federal operations for law enforcement and incident response, subject to the condition that harmful interference will not be caused to Federal stations. These channels are restricted to interoperability communications and are not authorized for routine or administrative uses.
4. Extended operations and congestion may lead to frequency conflicts. Coordination with NTIA is required to resolve these conflicts.
5. Only narrowband emissions are to be used on the Federal Interoperability Channels.

6. Equipment used (transmitters and receivers) must meet the standards established in Section 5.3.5.2 of the NTIA Manual:
    a. TIA/EIA 603-B for narrowband analog;
    b. TIA TSB 102.CAAB-A for narrowband digital
7. A complete listing of conditions for use by Federal users can be found in Section 4.3.16 of the NTIA Manual.
8. Use of these frequencies within 75 miles of the Canadian border and 5 miles of the Mexican border require special coordination and in some cases will not be available for use.

Law Enforcement Plans

1. Frequencies 167.0875 MHz and 414.0375 MHz are designated as National Calling Channels for initial contact and will be identified in the radio as indicated in the Law Enforcement Federal Interoperability Channel Plans.
2. Initial contact communications will be established using narrowband analog FM emission (11K25F3E).
3. The interoperability channels will be identified in mobile and portable radios as indicated in the Law Enforcement Federal Interoperability Channel Plans with Continuous Tone-Controlled Squelch Systems (CTCSS) frequency 167.9 Hz and/or Network Access Code (NAC) $68F ($1679_{10}$).

Incident Response Plans

1. Frequencies 169.5375 MHz (paired with 164.7125 MHz) and 410.2375 MHz (paired with 419.2375 MHz) are designated as the calling channels for initial contact and will be identified in the radio as indicated in the Incident Response Federal Interoperability Channel Plans.
2. Initial contact will be established using narrowband analog FM emission (11K25F3E).
3. To ensure access by stations from outside the normal area of operation, Continuous Tone-Controlled Squelch Systems (CTCSS) will not be used on the calling channels.
4. The interoperability channels will be identified in mobile and portable radios as indicated in the "VHF Incident Response (IR) Federal Interoperability Channel Plan" and the "UHF Incident Response (IR) Federal Interoperability Channel Plan".

Recommendations for Programming the Federal Interoperability Channels

1. If there is enough room in your radio, program all channels as analog and again as digital channels. If not, program as follows:
   a. Incident Response channels – all analog.
   b. Law Enforcement channels – program all as P25 digital with NAC $68F ($1679_{10}$) except LE A, LE 1, LE B, LE10, and LE 16 which are to be programmed analog with Tx CTCSS 167.9 Hz (6Z) and no Rx CTCSS (carrier squelch, CSQ).
2. If your radio has a user-selectable option to enable/disable CTCSS on receive, you may choose to configure this option so that the user can enable the same CTCSS tone used on transmit for receive. The default configuration should be CSQ receive.

Note on using the Federal Interoperability Channels: These channels may not be used for state/state, state/local, or local/local interoperability. A Federal entity must be involved when these are used.

FCC Rules and Regulations

Title 47, Code of Federal Regulations, Parts 0-199

http://wireless.fcc.gov/rules.html

Part 80	Maritime Services
	For information on VHF Marine channels, see
	http://www.navcen.uscg.gov/?pageName=mtVhf
Part 87	Aviation Services
Part 90	Private Land Mobile Radio Services
Part 95	Personal Radio Services (includes GMRS, FRS, CB, & MURS)
Part 97	Amateur Radio Service

NTIA Rules and Regulations

Title 47, Code of Federal Regulations, Part 300

http://www.ntia.doc.gov/osmhome/redbook/redbook.html

INTEROPERABILITY CHANNELS

Non Federal VHF National Interoperability Channels				
VHF Low Band				
Description	**Channel Name**	**Mobile Receive Frequency**	**Mobile Transmit Frequency**	**Receive and Transmit CTCSS Tone**
Law Enforcement	LLAW1	39.4600	45.8600	156.7 (5A)
Law Enforcement	LLAW1D	39.4600	39.4600	156.7 (5A)
Fire (Proposed)	LFIRE2	39.4800	45.8800	156.7 (5A)
Fire (Proposed)	LFIRE2D	39.4800	39.4800	156.7 (5A)
Law Enforcement	LLAW3	45.8600	39.4600	156.7 (5A)
Law Enforcement	LLAW3D	45.8600	45.8600	156.7 (5A)
Fire (Proposed)	LFIRE4	45.8800	39.4800	156.7 (5A)
Fire	LFIRE4D	45.8800	45.8800	156.7 (5A)
Frequency 39.4800 MHz is pending FCC assignment for exclusive fire intersystem use.				
These channels are WIDEBAND FM, 20 kHz authorized bandwidth.				

Non Federal VHF National Interoperability Channels					
VHF High Band					
Description	Channel Name	Mobile Receive Freq.	Mobile Receive CTCSS Tone	Mobile Transmit Freq.	Mobile Transmit CTCSS Tone
Calling	VCALL10	155.7525	156.7 (5A)	155.7525	156.7 (5A)
Tactical	VTAC11 *	151.1375	156.7 (5A)	151.1375	156.7 (5A)
Tactical	VTAC12 *	154.4525	156.7 (5A)	154.4525	156.7 (5A)
Tactical	VTAC13	158.7375	156.7 (5A)	158.7375	156.7 (5A)
Tactical	VTAC14	159.4725	156.7 (5A)	159.4725	156.7 (5A)
Tac Rpt	VTAC33 * •	159.4725	156.7 (5A)	151.1375	136.5 (4Z)
Tac Rpt	VTAC34 * •	158.7375	156.7 (5A)	154.4525	136.5 (4Z)
Tac Rpt	VTAC35 •	159.4725	156.7 (5A)	158.7375	136.5 (4Z)
Tac Rpt	VTAC36 * •	151.1375	156.7 (5A)	159.4725	136.5 (4Z)
Tac Rpt	VTAC37 * •	154.4525	156.7 (5A)	158.7375	136.5 (4Z)
Tac Rpt	VTAC38 •	158.7375	156.7 (5A)	159.4725	136.5 (4Z)

*VTAC11-12, VTAC33-34, and VTAC36-37 may not be used in Puerto Rico or the USVI.

• **VTAC33-38 recommended for deployable tactical repeater use only** (FCC Station Class FB2T).

• VTAC36-38 are preferred; VTAC33-35 should be used only when necessary due to interference.

All channels on this page are NARROWBAND only. Limited to 3 watts ERP North of Line A or East of Line C.

Non Federal VHF National Interoperability Channels			
VHF Inland			
Description	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Tactical – narrowband FM	VTAC17	161.8500	157.2500
Tactical – narrowband FM	VTAC17D	161.8500	161.8500

CTCSS 156.7 Hz(5A) transmit and receive.

For VTAC17/VTAC17D only: Base stations: 50 watts max, antenna HAAT 400 feet max. Mobile stations: 20 watts max, antenna HAAT 15 feet max. These channels are for tactical use and may not be operated on board aircraft in flight. These channels use narrowband FM and are available only in certain inland areas at least 100 miles from a major waterway. These channels use the same frequencies as VHF Marine channel 25, which uses wideband FM. Use only where authorized. See map on next page. In these authorized areas, interoperability communications have priority over grandfathered public coast and public safety licensees. See FCC rule 90.20(g)(3).

All channels on this page are NARROWBAND only.

Limited to 3 watts ERP North of Line A or East of Line C.

“Blanket authorization” does not apply - use of these channels must be licensed, or authorized by STA.

Counties Where VTAC17/VTAC17D May Be Used

Numbers Indicate VHF Public Coast Station Areas – see 47CFR80.371(c)(ii)

CA: Alpine, Inyo, Lassen, Mono, Plumas, Sierra

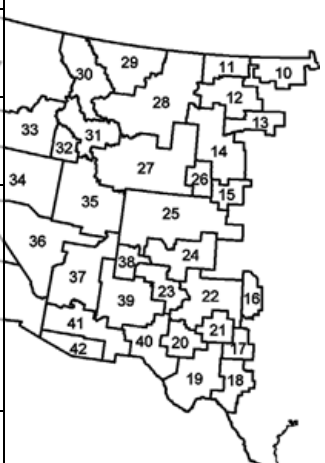
KS: Cheyenne, Gove, Logan, Sheridan, Sherman, Thomas, Wallace

MN: Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau

NE: Arthur, Banner, Blaine, Box Butte, Chase, Cherry, Cheyenne, Dawes, Deuel, Dundy, Garden, Grant, Hooker, Keith, Kimball, Lincoln, Logan, McPherson, Morrill, Perkins, Scotts Bluff, Sheridan, Sioux, Thomas

OK: Beckham, Custer, Dewey, Ellis, Greer, Harmon, Harper, Jackson, Kiowa, Roger Mills, Washita, Woodward

All of CO, MT, NM, NV, UT, & WY



All counties in AZ ID & ND except:
AZ: La Paz, Yuma
ID: Benewah, Bonner, Boundary, Clearwater , Idaho, Kootenai, Latah, Lewis Nez Perce, & Shoshone
ND: Barnes, Cass, Dickey, Foster, Griggs, LaMoure, Pierce, Ransom, Richland, Sargent, Sheridan, Stutsman, Wells

OR: Harney, Malheur

SD: All counties except Aurora, Beadle, Bon Homme, Brookings, Brule, Buffalo, Charles Mix, Clark, Clay, Codington, Davison, Deuel, Douglas, Grant, Gregory, Hamlin, Hand, Hanson, Hughes, Hutchinson, Hyde, Jerauld, Kingsbury, Lake, Lincoln, Lyman, McCook, Miner, Minnehaha, Moody, Roberts, Sanborn, Stanley, Sully, Tripp, Turner, Union, Yankton

TX Counties – see page 28

Texas Counties Where VTAC17/VTAC17D May Be Used

(see page 27)

Andrews	Dawson	Hudspeth	Moore	Swisher
Armstrong	Deaf Smith	Hutchinson	Motley	Taylor
Bailey	Dickens	Irion	Nolan	Terrell
Borden	Donley	Jeff Davis	Ochiltree	Terry
Brewster	Ector	Jones	Oldham	Tom Green
Briscoe	Edwards	Kent	Parmer	Upton
Callahan	El Paso	Kimble	Pecos	Val Verde
Carson	Fisher	King	Potter	Ward
Castro	Floyd	Kinney	Presidio	Wheeler
Childress	Gaines	Knox	Randall	Winkler
Cochran	Garza	Lamb	Reagan	Yoakum
Coke	Glasscock	Lipscomb	Reeves	
Collingsworth	Gray	Loving	Roberts	
Concho	Hale	Lubbock	Runnels	
Cottle	Hall	Lynn	Schleicher	
Crane	Hansford	McCulloch	Scurry	
Crockett	Hartley	Martin	Sherman	
Crosby	Haskell	Menard	Sterling	
Culberson	Hockley	Midland	Stonewell	
Dallam	Howard	Mitchell	Sutton	

VHF Public Safety Mutual Aid and Common Channels

WARNING: These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required. Availability subject to other licensed users in the same area.

Frequency (MHz)	Usage	Channel Name	Note
155.1600 base/mobile	Search and Rescue Common (CTCSS 127.3 transmit & receive)	VSAR16 a.k.a. SAR NFM & SAR160	Not restricted to SAR by FCC; availability varies.
154.2800 base/mobile	Fire Mutual Aid	VFIRE21	Not available in Puerto Rico and the U.S. Virgin Islands.
154.2650 base/mobile		VFIRE22	
154.2950 base/mobile		VFIRE23	
154.2725 base/mobile		VFIRE24	
154.2875 base/mobile		VFIRE25	
154.3025 base/mobile		VFIRE26	
155.3400 base/mobile	EMS Mutual Aid	VMED28	May be designated for EMS Mutual Aid.
155.3475 base/mobile		VMED29	
155.4750 base/mobile	Law Enforcement Mutual Aid	VLAW31	
155.4825 base/mobile		VLAW32	

LICENSING REQUIRED - These are NOT nationwide interoperability channels - CTCSS tones vary by jurisdiction. Rules for use of these channels are contained in 47 CFR 90.20 and NTIA Manual Section 4.3.11 & 7.3.6. See also "Non-Federal VHF National Interoperability Channels" and "Non-Federal VHF Inland Interoperability Channels" on pages 24-28 of this document. EXCEPT for VSAR16, the recommended CTCSS tones are 156.7 receive and transmit for all channels on this page for interoperability; local use may specify other tones.

NOAA Weather Radio "All Hazards" Broadcasts

NWR broadcasts National Weather Service (NWS) warnings, watches, forecasts and other non-weather related hazard information 24 hours a day. Channels WX1-WX7 are used in the US & Canada; channels WX8-WX9 are used for Canada Marine Weather broadcasts in some areas. These channels should be programmed as wideband FM (16K0F3E) RECEIVE ONLY. Some radio manufacturers number the US weather channels in the order they came into use, others number them in frequency order. For programming in land-mobile radios, frequency order is recommended.

Weather Radio Broadcasts Receive Only (WX1-WX7 US & Canada; WX8-WX9 Canada Marine Weather)						
WX1	**WX2**	**WX3**	**WX4**	**WX5**	**WX6**	**WX7**
162.550	162.400	162.475	162.425	162.450	162.500	162.525

WX8 (Marine 21B)	**WX9** (Marine 83B)
161.650	161.775

NOAA Weather Radio outages or transmitter problems:
Listing http://www.nws.noaa.gov/nwr/outages/outages.php
Report form http://www.nws.noaa.gov/nwr/outages/report.php
or call 1-888-886-1227 or email nwroutage@noaa.gov

Federal / Non Federal SAR Command Interoperability Plan				
	Channel Name*	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**CTCSS**
Connect with Gateway	IR 12**	410.8375	419.8375	167.9 Tx, CSQ Rx
	VTAC14	159.4725	159.4725	156.7 Rx and Tx
	UTAC43	453.8625	458.8625	156.7 Rx and Tx
	8TAC94 (ITAC4 before rebanding)	853.0125 (868.0125 before rebanding)	808.0125 (823.0125 before rebanding)	156.7 Rx and Tx
	VHF Marine Ch. 17***	156.8500 (this use requires FCC STA)	156.8500 (this use requires FCC STA)	none
	* If a repeater is not available, substitute the corresponding talk-around channel: IR 18 for IR 12, UTAC43D for UTAC43, 8TAC94D for 8TAC94. ****See Conditions for Use of Federal Interoperability Channels on pages 19-21.** ***VHF marine ch. 17 is wideband FM, emission 16K00F3E.			

Federal / Non Federal VHF SAR Operations Interoperability Plan	
Suggested SAR Function	**Frequency (MHz)**
Ground Operations	155.1600 narrowband FM
Maritime Operations *	157.050 or 157.150 (VHF Marine ch.1021 or 1023) as specified by USCG Sector Commander
Air Operations – civilian	123.100 MHz AM (may not be used for tests or exercises)
Air Operations – USCG/Military	345.0 MHz AM for initial contact only, then move to 282.8 MHz AM or other working channel
Air rescue assets to air rescue assets (deconfliction)	As charted on standard air chart or MULTICOM 122.850 (south or west sector) & 122.900 MHz (north or east sector), or as specified by FAA. 122.850 may not be used for tests or exercises
Ground to Air SAR working channel	157.175 1083 (1021, 1023, 1081 alternates as specified by local USCG Sector Commander) **
Ground to Maritime SAR working channel	157.050 1021 (1023, 1081, 1083 alternates as specified by local USCG Sector Commander) **
Maritime/Air/Ground SAR working channel *	157.175 1083 (1021, 1023, 1081 alternates as specified by local USCG Sector Commander) **
EMS / Medical Support	155.3400 narrowband FM
Hailing* & DISTRESS only - Maritime/Air/Ground	156.800 VHF Marine channel 16 *

*** Use VHF Marine ch.16 to make contact (30 seconds max.), then move to appropriate working channel as directed by local USCG Sector Commander. Non-maritime use of any VHF Marine channel requires FCC Special Temporary Authority or appropriate license. VHF marine channels use wideband FM, emission 16K0F3E**

** VHF Marine channels: 16=156.800 1021=157.050 1022=157.100 1023=157.150 1081=157.075 1082=157.125 1083=157.1750 **Direction from USCG, FCC, or FAA overrides information in this table. This table does not convey authority to operate.**

VHF Incident Response (IR) Federal Interoperability Channels				
Suggested Assignment (subject to availability & local plans)	**Channel Name**	**Note**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Incident Calling	NC 1	Calling	169.5375	164.7125
Incident Command	IR 1		170.0125	165.2500
Medical Evacuation Control	IR 2		170.4125	165.9625
Logistics Control	IR 3		170.6875	166.5750
Interagency Convoy	IR 4		173.0375	167.3250
Incident Calling (Direct)	IR 5	Direct for NC 1 Calling	169.5375	169.5375 (S)
Incident Command (Direct)	IR 6	Direct for IR 1	170.0125	170.0125 (S)
Medical Evacuation Control (Direct)	IR 7	Direct for IR 2	170.4125	170.4125 (S)
Logistics Control (Direct)	IR 8	Direct for IR 3	170.6875	170.6875 (S)
Interagency Convoy (Direct)	IR 9	Direct for IR 4	173.0375	173.0375 (S)

See "Conditions for Use of Federal Interoperability Channels" on pages 19-21.

Default operation should be carrier squelch receive, CTCSS 167.9 transmit. If the user can enable/disable CTCSS without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.

All channels on this page are NARROWBAND only.

VHF Law Enforcement (LE) Federal Interoperability Channels					
Description	**Channel Name**	**Note**	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**CTCSS or NAC**
Calling	LE A	Analog	167.0875	167.0875 (S)	167.9 Tx, CSQ Rx
Tactical	LE 1	Analog	167.0875	162.0875	167.9 Tx, CSQ Rx
Tactical	LE 2		167.2500	162.2625	\$68F (1679_{10})
Tactical	LE 3		167.7500	162.8375	\$68F (1679_{10})
Tactical	LE 4		168.1125	163.2875	\$68F (1679_{10})
Tactical	LE 5		168.4625	163.4250	\$68F (1679_{10})
Tactical	LE 6	Direct for LE 2	167.2500	167.2500 (S)	\$68F (1679_{10})
Tactical	LE 7	Direct for LE 3	167.7500	167.7500 (S)	\$68F (1679_{10})
Tactical	LE 8	Direct for LE 4	168.1125	168.1125 (S)	\$68F (1679_{10})
Tactical	LE 9	Direct for LE 5	168.4625	168.4625 (S)	\$68F (1679_{10})

See "Conditions for Use of Federal Interoperability Channels" on pages 19-21.

CTCSS on receive only if user selectable; else CSQ.

All channels on this page are NARROWBAND only.

UHF Incident Response (IR) Federal Interoperability Channels				
Suggested Assignment (subject to availability & local plans)	**Channel Name**	**Note**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Incident Calling	NC 2	Calling	410.2375	419.2375
Ad hoc assignment	IR 10		410.4375	419.4375
Ad hoc assignment	IR 11		410.6375	419.6375
SAR Incident Command	IR 12		410.8375	419.8375
Ad hoc assignment	IR 13		413.1875	413.1875 (S)
Interagency Convoy	IR 14		413.2125	413.2125 (S)
Incident Calling (Direct)	IR 15	Direct for NC 2 Calling	410.2375	410.2375 (S)
Ad hoc assignment (Direct)	IR 16	Direct for IR 10	410.4375	410.4375 (S)
Ad hoc assignment (Direct)	IR 17	Direct for IR 11	410.6375	410.6375 (S)
SAR Incident Command (Direct)	IR 18	Direct for IR 12	410.8375	410.8375 (S)

See "Conditions for Use of Federal Interoperability Channels" on pages 19-21.

Default operation should be carrier squelch receive, CTCSS 167.9 transmit. If the user can enable/disable CTCSS without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.

UHF Law Enforcement (LE) Federal Interoperability Channels					
Description	**Channel Name**	**Note**	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**CTCSS or NAC**
Calling	LE B	Analog	414.0375	414.0375 (S)	167.9 Tx, CSQ Rx
Tactical	LE 10	Analog	409.9875	418.9875	167.9 Tx, CSQ Rx
Tactical	LE 11		410.1875	419.1875	$68F (1679$_{10}$)
Tactical	LE 12		410.6125	419.6125	$68F (1679$_{10}$)
Tactical	LE 13		414.0625	414.0625 (S)	$68F (1679$_{10}$)
Tactical	LE 14		414.3125	414.3125 (S)	$68F (1679$_{10}$)
Tactical	LE 15		414.3375	414.3375 (S)	$68F (1679$_{10}$)
Tactical	LE 16	Direct for LE 10 Analog	409.9875	409.9875 (S)	167.9 Tx, CSQ Rx
Tactical	LE 17	Direct for LE 11	410.1875	410.1875 (S)	$68F (1679$_{10}$)
Tactical	LE 18	Direct for LE 12	410.6125	410.6125 (S)	$68F (1679$_{10}$)

See "Conditions for Use of Federal Interoperability Channels" on pages 19-21.
CTCSS on receive only if user selectable; else CSQ.
All channels on this page are NARROWBAND only.

Non Federal UHF National Interoperability Repeater Channels			
Description	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Calling	UCALL40	453.2125	458.2125
Calling	UCALL40D	453.2125	453.2125
Tactical	UTAC41	453.4625	458.4625
Tactical	UTAC41D	453.4625	453.4625
Tactical	UTAC42	453.7125	458.7125
Tactical	UTAC42D	453.7125	453.7125
Tactical	UTAC43	453.8625	458.8625
Tactical	UTAC43D	453.8625	453.8625

CTCSS 156.7 Hz (5A) transmit and receive.
All channels on this page are NARROWBAND only. Limited to 3 watts ERP North of Line A or East of Line C.

UHF MED (Medical, EMS) Channels			
These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required.			
Channel Name	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**Bandwidth**
MED–9 *	462.950	467.950	12.5, 6.25
MED–91 *	462.95625	467.95625	6.25
MED–92 *	462.9625	467.9625	12.5, 6.25
MED–93 *	462.96875	467.96875	6.25
MED–10 *	462.975	467.975	12.5, 6.25
MED–101 *	462.98125	467.98125	6.25
MED–102 *	462.9875	467.9875	12.5, 6.25
MED–103 *	462.99375	467.99375	6.25
* Used primarily for dispatch; may be used for mutual aid. 47CFR90.20(d)(65). Direct mode: receive & transmit on “Mobile RX” freq.; add “D” to channel name. Repeater mode: mobile transmits on “Mobile TX” freq., receives on “Base & Mobile TX” freq. CTCSS as required by local plan.			

(continued)

UHF MED (Medical, EMS) Channels			
These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required.			
Channel Name	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**Bandwidth**
MED–1	463.000	468.000	12.5, 6.25
MED–11	463.00625	468.00625	6.25
MED–12	463.0125	468.0125	12.5, 6.25
MED–13	463.01875	468.01875	6.25
MED–2	463.025	468.025	12.5, 6.25
MED–21	463.03125	468.03125	6.25
MED–22	463.0375	468.0375	12.5, 6.25
MED–23	463.04375	468.04375	6.25
Direct mode: receive & transmit on “Mobile RX” freq.; add “D” to channel name. Repeater mode: mobile transmits on “Mobile TX” freq., receives on “Base & Mobile TX” freq. CTCSS as required by local plan.			

(continued)

UHF MED (Medical, EMS) Channels			
These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required.			
Channel Name	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**Bandwidth**
MED–3	463.050	468.050	12.5, 6.25
MED–31	463.05625	468.05625	6.25
MED–32	463.0625	468.0625	12.5, 6.25
MED–33	463.06875	468.06875	6.25
MED–4	463.075	468.075	12.5, 6.25
MED–41	463.08125	468.08125	6.25
MED–42	463.0875	468.0875	12.5, 6.25
MED–43	463.09375	468.09375	6.25
Direct mode: receive & transmit on “Mobile RX” freq.; add “D” to channel name. Repeater mode: mobile transmits on “Mobile TX” freq., receives on “Base & Mobile TX” freq. CTCSS as required by local plan.			

(continued)

UHF MED (Medical, EMS) Channels			
These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required.			
Channel Name	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**Bandwidth**
MED–5	463.100	468.100	12.5, 6.25
MED–51	463.10625	468.10625	6.25
MED–52	463.1125	468.1125	12.5, 6.25
MED–53	463.11875	468.11875	6.25
MED–6	463.125	468.125	12.5, 6.25
MED–61	463.13125	468.13125	6.25
MED–62	463.1375	468.1375	12.5, 6.25
MED–63	463.14375	468.14375	6.25
Direct mode: receive & transmit on “Mobile RX” freq.; add “D” to channel name. Repeater mode: mobile transmits on “Mobile TX” freq., receives on “Base & Mobile TX” freq. CTCSS as required by local plan.			

(continued)

UHF MED (Medical, EMS) Channels			
These frequencies are NOT covered by the blanket authorization for nationwide interoperability channels. A valid FCC license for these frequencies is required.			
Channel Name	**Mobile RX (MHz)**	**Mobile TX (MHz)**	**Bandwidth**
MED–7	463.150	468.150	12.5, 6.25
MED–71	463.15625	468.15625	6.25
MED–72	463.1625	468.1625	12.5, 6.25
MED–73	463.16875	468.16875	6.25
MED–8	463.175	468.175	12.5, 6.25
MED–81	463.18125	468.18125	6.25
MED–82	463.1875	468.1875	12.5, 6.25
MED–83	463.19375	468.19375	6.25
Direct mode: receive & transmit on “Mobile RX” freq.; add “D” to channel name. Repeater mode: mobile transmits on “Mobile TX” freq., receives on “Base & Mobile TX” freq. CTCSS as required by local plan.			

700 MHz Nationwide Interoperability Channels			
Mode: Only P25 FDMA Phase 1 Common Air Interface permitted per FCC R&O 14-172 ¶ 87 (10/24/2014).			
TX NAC: \$293 (659_{10}). RX NAC \$F7E (3966_{10}). Talk Group ID: \$00001 (1_{10}) Manufacturer's ID: \$00 (0_{10}) Message ID: \$00000000000000000000 (0_{10})		Encryption: • No encryption on calling channels • Algorithm ID: \$80 (128_{10}) • Key ID: \$0000 (0_{10})	
"\$" indicates hexadecimal value, "10" subscript indicates decimal value.			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Calling Channel *	7CALL50	769.24375	799.24375
Calling Channel *	7CALL50D	769.24375	769.24375
General Public Safety	7TAC51	769.14375	799.14375
General Public Safety	7TAC51D	769.14375	769.14375
General Public Safety	7TAC52	769.64375	799.64375
General Public Safety	7TAC52D	769.64375	769.64375
General Public Safety	7TAC53	770.14375	800.14375
General Public Safety	7TAC53D	770.14375	770.14375
* Recommended as PRIMARY calling channel for 700 MHz Band.			

700 MHz Nationwide Interoperability Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
General Public Safety	7TAC54	770.64375	800.64375
General Public Safety	7TAC54D	770.64375	770.64375
General Public Safety	7TAC55	769.74375	799.74375
General Public Safety	7TAC55D	769.74375	769.74375
General Public Safety	7TAC56	770.24375	800.24375
General Public Safety	7TAC56D	770.24375	770.24375
Other Public Service	7GTAC57	770.99375	800.99375
Other Public Service	7GTAC57D	770.99375	770.99375
Mobile Repeater	7MOB59	770.89375	800.89375
Mobile Repeater	7MOB59D	770.89375	770.89375
Law Enforcement	7LAW61	770.39375	800.39375
Law Enforcement	7LAW61D	770.39375	770.39375
Law Enforcement	7LAW62	770.49375	800.49375
Law Enforcement	7LAW62D	770.49375	770.49375

700 MHz Nationwide Interoperability Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Fire	7FIRE63	769.89375	799.89375
Fire	7FIRE63D	769.89375	769.89375
Fire	7FIRE64	769.99375	799.99375
Fire	7FIRE64D	769.99375	769.99375
EMS	7MED65	769.39375	799.39375
EMS	7MED65D	769.39375	769.39375
EMS	7MED66	769.49375	799.49375
EMS	7MED66D	769.49375	769.49375
Mobile Data *	7DATA69	770.74375	800.74375
Mobile Data *	7DATA69D	770.74375	770.74375
Calling Channel **	7CALL70	773.25625	803.25625
Calling Channel **	7CALL70D	773.25625	773.25625

* Voice communications are permitted on 7DATA69 / 7DATA69D on a secondary basis - 90.531(b)(1)(i).
** Recommended as SECONDARY calling channel or INCIDENT calling channel for 700 MHz band.

700 MHz Nationwide Interoperability Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
General Public Safety	7TAC71	773.10625	803.10625
General Public Safety	7TAC71D	773.10625	773.10625
General Public Safety	7TAC72	773.60625	803.60625
General Public Safety	7TAC72D	773.60625	773.60625
General Public Safety	7TAC73	774.10625	804.10625
General Public Safety	7TAC73D	774.10625	774.10625
General Public Safety	7TAC74	774.60625	804.60625
General Public Safety	7TAC74D	774.60625	774.60625
General Public Safety	7TAC75	773.75625	803.75625
General Public Safety	7TAC75D	773.75625	773.75625
General Public Safety	7TAC76	774.25625	804.25625
General Public Safety	7TAC76D	774.25625	774.25625

700 MHz Nationwide Interoperability Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Other Public Service	7GTAC77	774.85625	804.85625
Other Public Service	7GTAC77D	774.85625	774.85625
Mobile Repeater	7MOB79	774.50625	804.50625
Mobile Repeater	7MOB79D	774.50625	774.50625
Law Enforcement	7LAW81	774.00625	804.00625
Law Enforcement	7LAW81D	774.00625	774.00625
Law Enforcement	7LAW82	774.35625	804.35625
Law Enforcement	7LAW82D	774.35625	774.35625

700 MHz Nationwide Interoperability Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Fire	7FIRE83	773.50625	803.50625
Fire	7FIRE83D	773.50625	773.50625
Fire	7FIRE84	773.85625	803.85625
Fire	7FIRE84D	773.85625	773.85625
EMS	7MED86	773.00625	803.00625
EMS	7MED86D	773.00625	773.00625
EMS	7MED87	773.35625	803.35625
EMS	7MED87D	773.35625	773.35625
Mobile Data *	7DATA89	774.75625	804.75625
Mobile Data *	7DATA89D	774.75625	774.75625
* Voice communications are permitted on 7DATA89 / 7DATA89D on a secondary basis - 90.531(b)(1)(i).			

700 MHz Nationwide Air-Ground Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Air - Ground	7AG58	769.13125	799.13125
Air - Ground	7AG58D	769.13125	769.13125
Air - Ground	7AG60	769.63125	799.63125
Air - Ground	7AG60D	769.63125	769.63125
Air - Ground	7AG67	770.13125	800.13125
Air - Ground	7AG67D	770.13125	770.13125
Air - Ground	7AG68	770.63125	800.63125
Air - Ground	7AG68D	770.63125	770.63125

(Continued)

TX NAC: \$293 (659_{10}). RX NAC \$F7E (3966_{10}). These channels are reserved for air-ground communications to be used by low-altitude aircraft and ground based stations: See FCC rule 90.531(7). (i) Airborne use of these channels is limited to aircraft flying at or below **457 meters (1500 feet) above ground level.** (ii) **Aircraft are limited to 2 watts effective radiated power (ERP)** when transmitting while airborne on these channels. (iii) Aircraft may transmit on either the mobile or base transmit side of the channel pair. (iv) States are responsible for the administration of these channels. *These are NOT nationwide interoperability channels.*

700 MHz Nationwide Air-Ground Channels			
Primary Use	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Air - Ground	7AG78	773.11875	803.11875
Air - Ground	7AG78D	773.11875	773.11875
Air - Ground	7AG80	773.61875	803.61875
Air - Ground	7AG80D	773.61875	773.61875
Air - Ground	7AG85	774.11875	804.11875
Air - Ground	7AG85D	774.11875	774.11875
Air - Ground	7AG88	774.61875	804.61875
Air - Ground (LZ)*	7AG88D	774.61875	774.61875

* 7AG88D is recommended for **Landing Zone** use.

TX NAC: \$293 (659_{10}). RX NAC \$F7E (3966_{10}). These channels are reserved for air-ground communications to be used by low-altitude aircraft and ground based stations: See FCC rule 90.531(7). (i) Airborne use of these channels is limited to aircraft flying at or below **457 meters (1500 feet) above ground level.** (ii) **Aircraft are limited to 2 watts effective radiated power (ERP)** when transmitting while airborne on these channels. (iii) Aircraft may transmit on either the mobile or base transmit side of the channel pair. (iv) States are responsible for the administration of these channels. *These are NOT nationwide interoperability channels.*

Non-Federal 800 MHz National Mutual Aid Repeater Channels			
Description	**Ch. Name**	**Mobile RX (MHz)***	**Mobile TX (MHz)***
Calling	8CALL90	851.0125 (866.0125)	806.0125 (821.0125)
Calling – Direct	8CALL90D	851.0125 (866.0125)	851.0125 (866.0125)
Tactical	8TAC91	851.5125 (866.5125)	806.5125 (821.5125)
Tactical – Direct	8TAC91D	851.5125 (866.5125)	851.5125 (866.5125)
Tactical	8TAC92	852.0125 (867.0125)	807.0125 (822.0125)
Tactical – Direct	8TAC92D	852.0125 (867.0125)	852.0125 (867.0125)
Tactical	8TAC93	852.5125 (867.5125)	807.5125 (822.5125)
Tactical – Direct	8TAC93D	852.5125 (867.5125)	852.5125 (867.5125)
Tactical	8TAC94	853.0125 (868.0125)	808.0125 (823.0125)
Tactical – Direct	8TAC94D	853.0125 (868.0125)	853.0125 (868.0125)

CTCSS 156.7(5A) receive and transmit.

*The frequency in parenthesis, which is 15 MHz higher, is the frequency used before rebanding - channel names were ICALL, ITAC1 - ITAC4. Wideband FM 20K0F3E before and after rebanding.

25 Cities Project Federal Interoperability Channels

The 25 Cities Federal Interoperability Channels mostly use FBI infrastructure in and around major urban areas to provide wide area VHF coverage. The channels are for use by all Federal, state, local, and tribal agencies. The primary designated use of the channels is for interoperable communications among agencies during both pre-planned and emergency events. The channels may be available for internal agency communications. All pre-planned use must be coordinated with the local FBI Telecommunications Manager. Federal, state, local, and tribal agencies are authorized to and encouraged to program the 25 Cities frequencies into their land mobile radio subscriber devices. Most Federal agencies include the 25 Cities frequencies in their codeplugs.

Most 25 Cities VHF channels are accessible by non-VHF users via permanent or ad hoc patching capabilities provided to many agencies as part of the 25 Cities Project. Please note that in certain of the 25 Cities, the channels use the VHF Law Enforcement (LE) Federal Interoperability Channel pairs: Baltimore (BA LE 3); Boston (BS LE 4); Charlotte (CE LE 4); Milwaukee (MW FIOLE2, MW FIOLE3, and MW FIOLE5); Newark (NK FIO LE 2); San Juan/Puerto Rico (SJ LE 2, SJ LE 3, SJ LE 4, and SJ LE 5), and Washington, D.C. (DC LE 2). For a current list of the 25 Cities frequencies and the contact information for the local FBI Telecommunications Managers, please contact:

Rob Zanger, DOJ / FBI
202-305-5071 ROBERT.M.ZANGER@USDOJ.GOV

Information as of December 4, 2018

City	Channel Name
ATLANTA	ATL FIO (VHF P25 Voted System)
BALTIMORE	BA LE 3 (VHF P25 Voted System)
BOSTON	BPD FIO (VHF Analog Voted System)
BOSTON	BS LE 4, BK FIO (VHF P25 Voted System)
CHARLOTTE	CE LE 4 (VHF P25 Stand-alone 125 watt repeater)
CHICAGO	CGCOM-N, CGCOM-C, CGCOM-S (VHF P25 Multicast Voted System)
CHICAGO	CGTAC-N, CGTAC-C, CGTAC-S (VHF P25 Multicast Voted System)
DALLAS	DFW-E (VHF P25 Voted System)
DALLAS	DFW-W (VHF P25 Voted System)
DENVER	DEN IO-N, DEN IO-E, DEN IO-C, DEN IO-S, DEN IO-W (VHF P25 Multicast Voted System)
EL PASO	ELP FIO-W, ELP FIO-E (VHF P25 Multicast Voted System)

(continued)

25 Cities Project Federal Interoperability Channels – continued

City	Channel Name
HONOLULU	HNL FIO (VHF P25 Stand-alone 125 watt repeater)
HONOLULU	HNL FIO2 (VHF P25 Stand-alone 125 watt repeater)
HONOLULU	HNL LE 4 (VHF P25 Transportable 125 watt repeater)
HONOLULU	HNL FIRE (VHF Analog Voted System)
HOUSTON	HOU CMD (VHF P25 Voted System)
HOUSTON	HOU PAT (VHF P25 Voted System)
LOS ANGELES	LA FIO1 (VHF P25 Voted System)
LOS ANGELES	LA FIO2 (VHF P25 Voted System)
LOS ANGELES	LA FIO3 (VHF P25 Voted System)
MIAMI	MIA FIO (VHF P25 Voted System)
MILWAUKEE	MW FIOLE2 (VHF P25 Stand-alone 125 watt repeater)
MILWAUKEE	MW FIOLE3 (VHF P25 Stand-alone 125 watt repeater)
MILWAUKEE	MW FIOLE5 (VHF P25 Stand-alone 125 watt repeater)

(continued)

25 Cities Project Federal Interoperability Channels – continued

City	Channel Name
MINNEAPOLIS	FED-MP, FED-SP (VHF P25 Multicast Voted System)
NEWARK NJ	NK FIO LE 2 (VHF P25 Voted System)
NEW HAVEN	CFedcom-N, CFedcom-S, CFedcom-E, CFedcom-W (VHF P25 Multicast Voted System)
NEW ORLEANS	NOLA FIO (VHF P25 Voted System)
NEW YORK	NYC FIO (NYC), NYC FIO-N (Orange-Putnam), NYC FIO-E (Suffolk County), NYC FIO-S (Central NJ) (VHF P25 Multicast Voted system)
NEW YORK	NYC FIO2 (VHF P25 Voted System)
NORFOLK / HAMPTON ROADS	HRN FIOP DRI, HRN FIOP TOA (VHF P25 Voted System)
ORLANDO	ORL FIO (VHF P25 Voted System)
PHILADELPHIA	PH FIO (VHF P25 Voted System)
RICHMOND VA	RH LE4, PB LE5 (VHF P25 Multicast Voted System)

(continued)

25 Cities Project Federal Interoperability Channels – continued

City	Channel Name
SAN DIEGO	SD-VHF (VHF Analog Voted System with Transmitter Selected by RCS Dispatchers)
SAN FRANCISCO	SF MA V-A (VHF Analog or Digital Stand-alone 125 watt repeater)
SAN FRANCISCO	SF MA U-A (UHF Analog or Digital Stand-alone 125 watt repeater)
SAN FRANCISCO	CLEMARS 7 (LLAW1) (Low Band Wideband Analog Stand-alone repeater)
SAN FRANCISCO	SF MAT-A (UHF-T Band Wideband Analog Stand-alone 125 watt repeater)
SAN FRANCISCO	8TAC94 (800 MHz Wideband Analog Stand-alone 125 watt repeater)
SAN FRANCISCO	SF FED-V (VHF P25 Stand-alone 125 watt repeater)
SAN FRANCISCO	SF FED-U (UHF P25 Stand-alone 125 watt repeater)
SAN FRANCISCO	All of the above repeaters can be networked together.
SAN FRANCISCO	SF FED-ED, SF FED-ES, SF FED-ET, SF FED-EW (VHF P25 Multicast Voted System)

(continued)

25 Cities Project Federal Interoperability Channels – continued

City	Channel Name
SAN JUAN	SJ LE 2 ME (VHF P25 Multicast System)
SAN JUAN	SJ LE 3 YQ (VHF P25 Multicast System)
SAN JUAN	SJ LE 4 CS (VHF P25 Multicast System)
SAN JUAN	SJ LE 5 CP (VHF P25 Multicast System)
SAN JUAN	SJ LE 2 STT (VHF P25 Multicast System)
ST LOUIS	STL CALL (VHF P25 Voted System)
ST LOUIS	STL TAC (VHF P25 Voted System)
ST LOUIS	8CALL90 (800 MHz Wideband Simulcast Repeater System)
TAMPA	TAM FIO (VHF P25 Voted System)
WASHINGTON DC	DC IO-1 (VHF P25 Voted System)
WASHINGTON DC	DC LE 2 (VHF P25 Voted System)
NATIONWIDE	J-SMART (Talkgroup # 15) (Ligado [former LightSquared] MSAT Radio PTT)

COMMON COMMUNICATIONS REFERENCES

Operations Center Telephone Numbers

DHS	Main Number	202-282-8000
	NOC Senior Watch Officer	202-282-8101
	NCC Watch	703-235-5080
	SHARES HF Radio	703-235-5329
	SHARES Email nccshares@dhs.gov	
FCC	Federal Communications Commission	
	FCC Operations Center (FCCOC)	202-418-1122, - 2813 FAX
	FCC Email FCCOPS@fcc.gov / FCCOPcenter@fcc.gov	
	General Info (1-888-CALL-FCC)	1-888-225-5322, 1-866-418-0232 FAX
FEMA	Federal Emergency Management Agency	
	National Watch Center	202-646-2828
	National Response Coordination Center (NRCC)	202-212-2424
	NRCC Email FEMA-NRCC@fema.dhs.gov	
FPS	Federal Protective Service, National Emergency Number	1-877-4FPS-411 (437-7411)
ARC	American National Red Cross	
	24-hr Disaster Operations Center	800-526-3571, 202-303-5555
ARRL	American Radio Relay League Email emergency@arrl.org	
	Main Number	860-594-0200, - 0259 FAX
	Emergency Preparedness Manager	860-594-0222
	Radio Station W1AW	860-594-0268

Emergency Support Functions (ESF)

ESF #1: Transportation	ESF #9: Urban Search & Rescue
ESF #2: Communications	ESF #10: Oil & Hazardous Materials Response
ESF #3: Public Works and Engineering	ESF #11: Agriculture and Natural Resources
ESF #4: Firefighting	ESF #12: Energy
ESF #5: Emergency Management	ESF #13: Public Safety and Security
ESF #6: Mass Care, Housing, and Human Services	ESF #14: National Disaster Recovery Framework
ESF #7: Resource Support	ESF #15: External Affairs
ESF #8: Public Health and Medical Services	**Telephone number for all ESFs during activations 202-212-2424**

FEMA Regions - States and Territories

Region I: CT, MA, ME, NH, RI, VT – 1-617-956-7506 or 1-877-336-2734

Region II: NJ, NY, Puerto Rico and the US Virgin Islands

NJ and NY: 1-212-680-3600

PR and USVI: 1-787-296-3500

Region III: DC, DE, MD, PA, VA, WV – 1-215-931-5500

Region IV: AL, FL, GA, KY, MS, NC, SC, TN – 1-770-220-5200

Region V: IL, IN, MI, MN, OH, WI – 1-312-408-5500

Region VI: AR, LA, NM, OK, TX – 1-940-898-5399

Region VII: IA, KS, MO, NE – 1-816-283-7061

Region VIII: CO, MT, ND, SD, UT, WY – 1-303-235-4800

Region IX: AZ, CA, Guam (GU), HI, NV, CNMI, RMI, FSM, American Samoa (AS) – 1-510-627-7100

Region X: AK, ID, OR, WA – 1-425-487-4600

FEMA Headquarters, Washington DC: 1-202-646-2500

FEMA Disaster Assistance: 1-800-621-FEMA (3362)

U.S. Coast Guard Rescue Coordination Centers		
24 hour Regional Contacts for Emergencies Last Modified 10/02/2018		
RCC	**Location**	**Phone Number**
Atlantic Area SAR Coordinator	*Portsmouth, VA*	*(757) 398-6700*
RCC Boston	Boston, MA	(617) 223-8555
RCC Norfolk	Portsmouth, VA	(757) 398-6231
RCC Miami	Miami, FL	(305) 415-6800
RSC San Juan	San Juan, PR	(787) 289-2042
RCC New Orleans	New Orleans, LA	(504) 589-6225
RCC Cleveland	Cleveland, OH	(216) 902-6117
Pacific SAR Coordinator	*Alameda, CA*	*(510) 437-3701*
RCC Alameda	Alameda, CA	(510) 437-3701
RCC Seattle	Seattle, WA	(206) 220-7001
RCC Honolulu	Honolulu, HI	(808) 535-3333
Sector Guam	Santa Rita, GU	(671) 355-4824
RCC Juneau	Juneau, Alaska	(907) 463-2000

CTCSS Tones and Codes

Freq. (Hz)	Motorola Code	NIFC & CA Fire *	Freq. (Hz)	Motorola Code	NIFC & CA Fire *
67.0	XZ	17	136.5	4Z	4
69.3**	WZ		141.3	4A	13
71.9	XA	18	146.2	4B	5
74.4	WA	19	151.4	5Z	14
77.0	XB	20	156.7	5A	6
79.7	WB	21	162.2	5B	15
82.5	YZ	22	167.9	6Z	7
85.4	YA	23	173.8	6A	29
88.5	YB	24	179.9	6B	30
91.5	ZZ	25	186.2	7Z	31
94.8	ZA	26	192.8	7A	16
97.4	ZB	27	203.5	M1	32
100.0	1Z	9	206.5	8Z	
103.5	1A	8	210.7	M2	
107.2	1B	10	218.1	M3	
110.9	2Z	1	225.7	M4	
114.8	2A	11	229.1	9Z	
118.8	2B	28	233.6	M5	
123.0	3Z	2	241.8	M6	
127.3	3A	12	250.3	M7	
131.8	3B	3	254.1	0Z	

* California FIRESCOPE tone list, used by NIFC and CA fire agencies
Ref. http://WWW.FIRESCOPE.ORG/macs-docs/MACS-441-1.pdf

** 69.4 in some radios

DCS Codes							
Normal	Inverted	Nor.	Inv.	Nor.	Inv.	Nor.	Inv.
023	047	155	731	325*	526	516	432
025	244	156	265	331	465	523*	246
026	464	162	503	332*	455	526*	325
031	627	165	251	343	532	532	343
036*	172	172	036	346	612	546	132
043	445	174	074	351	243	565	703
047	023	205	263	364	131	606	631
051	032	212*	356	365	125	612	346
053*	452	223	134	371	734	624	632
054	413	225*	122	411	226	627	031
065	271	226	411	412	143	631	606
071	306	243	351	413	054	632	624
072	245	244	025	423	315	654	743
073	506	245	072	431	723	662	466
074	174	246*	523	432	516	664	311
114	712	251	165	445	043	703	565
115	152	252*	462	446*	255	712	114
116	754	255*	446	452*	053	723	431
122*	225	261	732	454*	266	731	155
125	365	263	205	455*	332	732	261
131	364	265	156	462*	252	734	371
132	546	266*	454	464	026	743	654
134	223	271	065	465	331	754	116
143	412	274*	145	466	662		
145*	274	306	071	503	162		
152	115	311	664	506	073		
032	051	315	423				

* This Code is not standard amongst sampling of 12 different radios checked.

P25 Digital Codes

NAC – Network Access Codes

$293	**659_{10}**	default NAC
$F7E	**3966_{10}**	receiver will un-squelch with any incoming NAC
$F7F	**3967_{10}**	a repeater with this NAC will allow incoming signals to be repeated with the NAC intact

TGID – Talkgroup ID

$0001	**1_{10}**	default
$0000	**0_{10}**	no-one, talkgroup with no users – used for individual call
$FFFF	**65535_{10}**	a repeater with this NAC will allow incoming signals to be repeated with the NAC intact

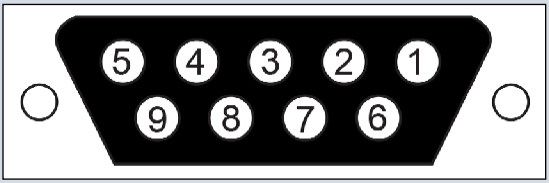
Unit ID

$000000	**0_{10}**	default
$000001-$98767F	**1_{10} – 9991807_{10}**	no-one, talkgroup with no users – used for individual call
$989680-$FFFFFE	**10000000_{10} -16777214_{10}**	a repeater with this NAC will allow incoming signals to be repeated with the NAC intact
$FFFFFF	**16777215_{10}**	designates everyone – used when implementing a group call with a TGID3

Note: Project 25 System Administrators should be aware of possible Unit ID conflicts when conducting operations with neighboring jurisdictions. System administrators should coordinate Unit IDs with agencies likely to operate on their system(s) to address any radio Unit ID conflicts.
"$" indicates hexadecimal values, "10" subscript indicates decimal value.

RS-232 Connectors (DB25 and DE9)

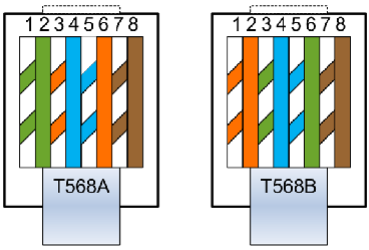
"Front" refers to the ends with the pins; "rear" refers to the end with the cable. The following is a view of the pins, looking at the front of the female connector (rear of male):



same for DB25, except top pins 13 - 1, bottom 25 - 14 (left to right)

DE9	DB25	Signal
1	8	Carrier Detect
2	3	Receive Data
3	2	Transmit Data*
4	20	Data Terminal Ready*
5	1,7	Ground **
6	6	Data Set Ready
7	4	Request to Send*
8	5	Clear to Send
9	22	Ring Indicator
* An output from the computer to the outside world.		
** On the DB25, 1 is the protective ground, 7 is the signal ground.		

RJ-45 Wiring					
		T568A (less common)		**T568B (more common)**	
Pin	**Pair**	*Color*	*Name*	**Color**	**Name**
1	**2**	*white/green*	*RecvData +*	**white/orange**	**TxData +**
2	**2**	*green*	*RecvData -*	**orange**	**TxData -**
3	**3**	*white/orange*	*TxData +*	**white/green**	**RecvData +**
4	**1**	*blue*		**blue**	
5	**1**	*white/blue*		**white/blue**	
6	**3**	*orange*	*TxData -*	**green**	**RecvData -**
7	**4**	*white/brown*		**white/brown**	
8	**4**	*brown*		**brown**	
Note that the odd pin numbers are always the white-with-stripe color.					



A straight cable has both ends the same –
both T568A (older standard) or
both T568B (newer standard).
A crossover cable has one end wired as
T568A, the other as T568B.

IP Addresses - Private Networks

These IP address ranges may be used in private networks. They may not be routed to the public internet.

IPv4 Address Range	Number of Addresses	Subnet Mask
10.0.0.0 - 10.255.255.255	16,777,216	255.0.0.0
172.16.0.0 - 172.31.255.255	1,048,576	255.240.0.0
192.168.0.0 - 192.168.255.255	65,536	255.255.0.0

IPv6 address block fc00::/7 is reserved for Unique Local Addresses

Wi-Fi 2.4 GHz Non-Overlapping Channels			
Protocol	**Bandwidth**	**Channel**	**Center Freq**
802.11b	**22 MHz**	**1**	**2412 MHz**
802.11b	**22 MHz**	**6**	**2437 MHz**
802.11b	**22 MHz**	**11**	**2462 MHz**
802.11g/n	**20 MHz**	**1**	**2412 MHz**
802.11g/n	**20 MHz**	**6**	**2437 MHz**
802.11g/n	**20 MHz**	**11**	**2462 MHz**
802.11n	**40 MHz**	**3**	**2422 MHz**

Use 5 GHz Wi-Fi instead of 2.4 GHz whenever possible to avoid interference from non- Wi-Fi devices such as cordless phones that operate in the 2.4 GHz band.

Public Domain Name System (DNS) Servers

DNS servers resolve IP addresses from hostnames to numeric IP addresses. Firewall ports 53/UDP and 53/TCP must be open. Others are available; no endorsement implied.

Provider	Primary DNS Server	Secondary DNS Server
Level3	209.244.0.3	209.244.0.4
Google (IPv4)	8.8.8.8	8.8.4.4
Google (IPv6)	2001:4860:4860::8888	2001:4860:4860::8844
OpenDNS Home	208.67.222.222	208.67.220.220

Public Network Time Protocol (NTP) Servers

Others are available; no endorsement implied.

Domain Name	IP Address
0.pool.ntp.org	(randomly assigned)
1.pool.ntp.org	(randomly assigned)
2.pool.ntp.org	(randomly assigned)
3.pool.ntp.org	(randomly assigned)
tick.usno.navy.mil	192.5.41.40
tock.usno.navy.mil	192.5.41.41
bigben.cac.washington.edu	140.142.16.34
ntp-nasa.arc.nasa.gov	198.123.30.132

CISCO Tactical Operations

Cisco Tactical Operations provides temporary, mission-critical voice, data and video service to first responder, state, local, and Federal agencies, critical infrastructure and humanitarian aid organizations. Services may be provided for pre-planned and disaster incidents, subject to availability. This is a best-effort, pro-bono service.

For additional information see http://www.cisco.com/go/tacops or email tacops-info@cisco.com

Emergency Contact Information

Email: emergencyresponse@cisco.com
24x7 Hotline: 1-919-392-4646

Be prepared to provide:

- Requesting individual's name, agency, title, phone, email
- Exact location(s) of incident
- Business need (e.g. telephone, internet, radio interoperability, video surveillance)
- Approximate number of users
- Expected duration
- Current ground situation re: logistics, security, personnel support etc.

Telephone Block Wiring

Pair Tip/Ring	Base /Stripe	Color	66/110 Block	50 Pin RJ-21
1T	W/BL		1	26
1R	BL/W		2	1
2T	W/O		3	27
2R	O/W		4	2
3T	W/G		5	28
3R	G/W		6	3
4T	W/BR		7	29
4R	BR/W		8	4
5T	W/S		9	30
5R	S/W		10	5
6T	R/BL		11	31
6R	BL/R		12	6
7T	R/O		13	32
7R	O/R		14	7
8T	R/G		15	33
8R	G/R		16	8
9T	R/BR		17	34
9R	BR/R		18	9
10T	R/S		19	35
10R	S/R		20	10
11T	BK/BL		21	36
11R	BL/BK		22	11
12T	BK/O		23	37
12R	O/BK		24	12

Base colors: W-white, R-red, BK-black, Y-yellow, V-violet
Stripe colors: BL-blue, O-orange, G-green, BR-brown, S-slate

Telephone Block Wiring – continued

Pair Tip/Ring	Base /Stripe	Color	66/110 Block	50 Pin RJ-21
13T	BK/G		25	38
13R	G/BK		26	13
14T	BK/BR		27	39
14R	BR/BK		28	14
15T	BK/S		29	40
15R	S/BK		30	15
16T	Y/BL		31	41
16R	BL/Y		32	16
17T	Y/O		33	42
17R	O/Y		34	17
18T	Y/G		35	43
18R	G/Y		36	18
19T	Y/BR		37	44
19R	BR/Y		38	19
20T	Y/S		39	45
20R	S/Y		40	20
21T	V/BL		41	46
21R	BL/V		42	21
22T	V/O		43	47
22R	O/V		44	22
23T	V/G		45	48
23R	G/V		46	23
24T	V/BR		47	49
24R	BR/V		48	24
25T	V/S		49	50
25R	S/V		50	25

Base colors: W-white, R-red, BK-black, Y-yellow, V-violet
Stripe colors: BL-blue, O-orange, G-green, BR-brown, S-slate

Telephone Connectors

Pin numbers are from left to right, holding the plug with the contacts up and looking at the side that does not have the spring clip.
"T" and "R" indicate "Tip" and "Ring".

Pin	RJ25	RJ14	RJ11
1	T3		
2	T2	T2	
3	R1	R1	R1
4	T1	T1	T1
5	R2	R2	
6	R3		

Circuit	Twisted-Pair Colors	25-Pair Colors	Solid Colors
T1	White/Blue	White/Blue	Green
R1	Blue	Blue/White	Red
T2	White/Orange	White/Orange	Black
R2	Orange	Orange/White	Yellow
T3	White/Green	White/Green	White
R3	Green	Green/White	Blue
T4	White/Brown	White/Brown	Orange
R4	Brown	Brown/White	Brown

Telephone Keypad Letters		
1: (QZ)	2: ABC	3: DEF
4: GHI	5: JKL	6: MNO
7: P(Q)RS	8: TUV	9: WXY(Z)
*	0	#

N11 Numbers	
N11 Code	**Description**
2-1-1	Community information and referral services
3-1-1	Non-emergency police and other government services
4-1-1	Directory assistance
5-1-1	Traffic and transportation information
6-1-1	Repair service
7-1-1	Telecommunications relay services
8-1-1	Utility excavation notification - “Call Before You Dig”
9-1-1	Emergency services

https://www.nationalnanpa.com/number_resource_info/n11_codes.html

DSN Area Codes

Defense Switched Network - Global Operator – 1-719-567-1110
(DSN 312-560-1110)
https://www.disa.mil/Network-Services/Voice/SBU-Voice/Using-DSN/DSN-Tutorial/Area-Codes

312 – CONUS
313 – Caribbean
314 – Europe
315 – Pacific
317 – Alaska
318 – Southwest Asia
319 – Canada

DSN Directory - Global

https://www.disa.mil/network-services/voice/sbu-voice/directory

Cellular Telephone Emergency Response

Some cellular telephone companies have transportable cell sites (Cellular On Wheels – COWs, Cellular on Light Trucks – COLTs, etc.) that can be deployed during disasters, emergencies, and special events. Local jurisdictions are encouraged to coordinate with their established service provider representatives for local events; however, the U.S. Department of Homeland Security – National Coordinating Center for Telecommunications will assist jurisdictions with referrals to corporate level contacts for wireless/wireline service provider representatives if needed.

The NCC Watch can be reached 24x7 at 1-703-235-5080 or email NCC@hq.dhs.gov

Satellite Phone Dialing Instructions

Iridium PIN (default) is 1111

(enter when powering-on the Iridium Subscriber Unit)

From a US Landline

Two-Stage Dialing: 1-480-768-2500, at prompt 12-digit Iridium number

To an Iridium phone directly as an International Call
011 + 8816xxxxxxx (Iridium Phone Number)

To an Iridium phone via toll call to Chandler AZ ("two-stage dialing"):
1-480-768-2500, follow prompts to enter Iridium phone number

To an M4 phone directly as an International Call
011 + 870 + 76xxxxxxx (Mobile Number)

From an M4 or BGAN: [Note - Cannot call Toll-Free numbers]

To a US Phone number:
00 + 1 + (10-digit US phone number) + #

To an Iridium phone directly
00 + 8816xxxxxxx (Iridium Phone Number) + #

To an M4 phone directly
00 + 870 + 76xxxxxxx (Mobile Number) + #

From an Iridium provisioned commercially

To a US Phone number
00 + 1 + xxx.xxx.xxxx (US phone number)

To an Iridium phone directly
00 + 8816xxxxxxx (Iridium Phone Number)

To an M4 phone directly
00 + 870 + 76xxxxxxx (Mobile Number)

Test call - no airtime charge: 00 + 1 + 480.752.5105

From an Iridium provisioned by DOD

ISU (Iridium Subscriber Unit) to DSN

00 + 696 + (DSN Area Code) + (DSN 7-digit number)

ISU to U.S. Domestic

00 + 697 + (U.S. Area Code) + (7-digit US number)

ISU to International Long Distance (ILD)

00 + 698 + (Country Code) + ("National Destination Code" or "City Code") + (Subscriber Number)

ISU to INMARSAT

00 + 698 + 870 + (INMARSAT subscriber number)

ISU to Local Hawaii

00 + 699 + (7-digit local commercial number)
1-800 toll-free 00 + 699 + 1+ 800 + (7-digits)

ISU to ISU, handset-to-handset

00 + (12-digit ISU subscriber number, e.g., 8816 763-xxxxx)

INMARSAT Country Code

All INMARSAT satellite telephones now use country code 870.

The Ocean Region Codes were discontinued January 1, 2009:

871 Atlantic Ocean Region – East [AOR-East]
872 Pacific Ocean Region [POR]
873 Indian Ocean Region [IOR]
874 Atlantic Ocean Region – West [AOR-West]

Inmarsat Customer Care Helpline - international direct dialing from USA to London, United Kingdom: 011 44 20 7728 1030

INMARSAT-M Service Codes	
00	Automatic Calls
11	International Operator
12	International Information
13	National Operator
14	National Information
17	Telephone Call Booking
20	Access to a Maritime PAD
23	Abbreviated Dialing
24	Post FAX
31	Maritime Enquiries
32	Medical Advice
33	Technical Assistance
34	Person-to-Person Call
35	Collect Call
36	Credit Card Call
37	Time and Duration
38	Medical Assistance
39	Maritime Assistance
41	Meteorological Reports
42	Navigational Hazards and Warnings
43	Ship Position Reports
57	Retrieval of Mailbox Messages
6x	Administration, Specialized Use
70	Databases
91	Automatic Line Test
911	Emergency Calls
92	Commissioning Tests

Priority Telecommunications Programs

For assistance and information on all DHS Emergency Communications Division Priority Telecommunications programs, contact the DHS Priority Telecommunications Service Center at 1-866-627-2255, 703-676-2255, or gwids@saic.com

GETS – Govt. Emergency Telecommunications Service

http://www.dhs.gov/gets

(see next page for GETS access info)

WPS – Wireless Priority Service

http://www.dhs.gov/wps

(see next page for WPS access info)

GETS and WPS provide priority on voice networks - not data.

TSP – Telecommunications Service Priority

http://www.dhs.gov/tsp

For TSP restoration service, contact the telephone service provider with the TSP authorization codes for the affected circuits and request TSP service. TSP restoration service is available only for circuits that have been enrolled in the TSP program before the outage occurred.

For TSP priority provisioning, contact the TSP Program Office at 1-703-235-5613 or 1-703-235-5359 – outside of normal business hours, contact the NCC Watch at 1-703-235-5080.

Government Emergency Telecommunications Service Card

Text Messaging	
Selected US & Canadian Cellular Text Messaging Carriers	
"number" is the 10-digit mobile telephone number, unless 11-digit-number is specified	
Alltel	SMS: number@sms.alltelwireless.com MMS: number@mms.alltelwireless.com
AT&T	SMS: number@txt.att.net MMS: number@mms.att.net
Bell Canada	SMS & MMS: number@txt.bell.ca
Boost Mobile	SMS: number@sms.myboostmobile.com MMS: number@myboostmobile.com
C Spire Wireless	SMS & MMS: number@cspire.com
Cricket Wireless	SMS: number@sms.mycricket.com SMS: number@sms.cricketwireless.net MMS: number@mms.mycricket.com MMS: number@mms.cricketwireless.net
Metro PCS	SMS & MMS: number@mymetropcs.com or number@metropcs.sms.us
Qwest	SMS & MMS: number@qwestmp.com
SouthernLinc Wireless	SMS: number@page.southernlinc.com MMS: number@mms.southernlinc.com
Sprint	SMS & MMS: number@messaging.sprintpcs.com or number@pm.sprint.com
T-Mobile	SMS & MMS: 10-digit-number@tmomail.net
Continued	

Text Messaging (continued)	
Telus Mobility	SMS & MMS: number@msg.telus.com MMS: number@mms.telusmobility.com
TracFone	SMS & MMS: number@mmst5.tracfone.com
U.S. Cellular	SMS: number@email.uscc.net MMS: number@mms.uscc.net
Verizon	SMS: number@vtext.com MMS: number@vzwpix.com
Virgin Mobile	SMS: number@vmobl.com MMS: number@vmpix.com
Alaska	
Alaska Communications	SMS: number@txt.acsalaska.net MMS: 11-digit-number@mms.ak.net
General Communications Inc. (GCI)	SMS: number@mobile.gci.net MMS: number@mms.gci.net
Puerto Rico	
Centennial Wireless	SMS: number@cwemail.com
Claro	SMS: number@vtexto.com
TracFone	SMS: number@mmst5.tracfone.com
U.S. Virgin Islands	
Centennial Wireless	SMS: number@cwemail.com
TracFone	MMS: number@mmst5.tracfone.com
Worldwide	
Iridium	SMS: number@msg.iridium.com

Line-of-Sight Formulas

Visual Line-of-Sight

Approximate distance in miles = 1.33 x $\sqrt{}$ (height in feet)

Radio Line-of-Sight

$D = \sqrt{}(2Hr) + \sqrt{}(2Ht)$

Where:

D = approximate distance (range) to radio horizon in miles

Hr = height of receive antenna in feet

Ht = height of transmit antenna in feet

These are rough estimates, which do not take into account power or frequency.

Range (miles)	Tx Ant. Height (ft)	Rx Ant. Height (ft)
8	10	5.5
10	20	5.5
11	30	5.5
12	40	5.5
13	50	5.5
16	75	5.5
17	100	5.5

Range (miles)	Tx Ant. Height (ft)	Rx Ant. Height (ft)
21	150	5.5
23	200	5.5
28	300	5.5
32	400	5.5
35	500	5.5
42	750	5.5
48	1000	5.5

Notice to Airmen (NOTAM) Filing Instructions

File a Notice to Airmen (NOTAM) with the FAA to alert aircraft pilots of any hazards (such as a temporary tower or tethered antenna platform).

Filing Instructions:

1. Before calling FAA have Tower Registration number or ASR number, which is the 7-digit number assigned to the tower by the FCC; and the nearest airport to tower.
2. Call **1-877-4-US-NTMS (1-877-487-6867)** - you will be prompted to enter state abbreviation (use letters on telephone keypad - page 73) or to verbally indicate a state.
3. Log the file number you will be given by the Flight Service Center attendant.
4. NOTAMs are valid for 15 days and will expire unless a new NOTAM is filed.

When filing a NOTAM for the erection of obstacles near airfields **including temporary heliports** it may be helpful to have the latitude, longitude, height above ground level, and type of obstruction lighting used (steady red, flashing etc.)

NOTAMs are issued (and reported) for a number of reasons, such as:

- hazards such as air-shows, parachute jumps, kite flying, lasers, rocket launches etc.
- inoperable radio navigational aids
- inoperable lights on tall obstructions
- temporary erection of obstacles near airfields (e.g., cranes, portable towers)

FAA NOTAMs, ARTCC Notices, TFRs and Special Notices

https://pilotweb.nas.faa.gov/PilotWeb/

Defense Internet NOTAM Service

https://www.notams.faa.gov/dinsQueryWeb/

Other FAA telephone numbers:
Flight Service Stations: 1-800-WX-BRIEF (1-800-992-7433)
FAA Main Number: 1-866-TELL-FAA (1-866-835-5322)

COMMONLY USED FREQUENCIES

Aviation Frequencies

121.5 Emergency & Distress

122.9 SAR Secondary and Training

123.1SAR

122.925 – for use only for communications with or between aircraft when coordinating natural resources programs of Federal or state natural resources agencies, including forestry management and fire suppression, fish and game management and protection and environmental monitoring and protection.

Typical Uses	Fixed Wing	Rotary Wing
Air-to-Air	122.750 F	
	122.850 M	122.850 M
	122.925 M	122.925 M
	122.975 U	122.975 U
		123.025 A
	123.075 U	123.075 U
Air-to-Ground	122.850 M	122.850 M
	122.925 M	122.925 M
	122.975 U	122.975 U
		123.025 A
	123.075 U	123.075 U

A – Helicopter air-to-air, air traffic control operations.

F – Fixed-wing air-to-air. M – Multicom. U – Unicom.

Ask FAA/FCC for emergency use of 123.3 or 123.5 (flight training).

All frequencies on this page use AM (emission designator 6K00A3E).

VHF Marine Channel Listing

This chart summarizes a portion of the FCC rules – 47 CFR 80.371(c) and 80.373(f)

Type of Message	Appropriate Channels *
DISTRESS SAFETY AND CALLING - Use this channel to get the attention of another station (calling) or in emergencies (distress and safety).	16
INTERSHIP SAFETY - Use this channel for ship-to-ship safety messages and for search and rescue messages to ships and aircraft of the Coast Guard.	6
COAST GUARD LIAISON - Use this channel to talk to the Coast Guard (but first make contact on Channel 16).	1022
COAST GUARD - These channels are Coast Guard working channels, not available to commercial or non-commercial vessels for normal use.	1021, 1023, 1081, 1083
U.S. Government - Environmental protection operations.	1081
U.S. Government - This channel is a working channel for U.S. Government vessels and U.S. Government coast stations only.	1082
NONCOMMERCIAL - Working channels for voluntary boats. Messages must be about the needs of the ship. Typical uses include fishing reports, rendezvous, scheduling repairs and berthing information. Use Channels 67 and 72 only for ship-to- ship messages.	9[6], 67[9], 68, 69, 71[8], 72, 1078, 1079[4], 1080[4]

Type of Message	Appropriate Channels *
COMMERCIAL - Working channels for working ships only. Messages must be about business or the needs of the ship. Use channels 8, 67, 72 and 88 only for ship-to-ship messages.	1001[5], 1007, 8, 9, 10, 11, 1018, 1019, 1063[5], 67[7], 1079, 1080, 88[1]
PUBLIC CORRESPONDENCE (MARINE OPERATOR) - Use these channels to call the marine operator at a public coast station. By contacting a public coast station, you can make and receive calls from telephones on shore. Except for distress calls, public coast stations usually charge for this service.	24, 25, 26, 27, 28, 84, 85, 86
PORT OPERATIONS - These channels are used in directing the movement of ships in or near ports, locks or waterways. Messages must be about the operational handling movement and safety of ships. In certain major ports, Channels 11, 12 and 14 are not available for general port operations messages. Use channel 20 only for ship-to-coast messages. Channel 77 is limited to intership communications to and from pilots.	1001[5], 1005[3], 12, 14, 20, 1063[5], 1065, 1066, 73, 74, 75[10],76[10], 77
NAVIGATIONAL - (Also known as the bridge-to-bridge channel.) This channel is available to all ships. Messages must be about ship navigation, for example, passing or meeting other ships. You must keep your messages short. Your power output must not be more than one watt. This is also the main working channel at most locks and drawbridges.	13, 67

Type of Message	Appropriate Channels *
MARITIME CONTROL - This channel may be used to talk to ships and coast stations operated by state or local governments. Messages must pertain to regulation and control, boating activities, or assistance to ships.	17
DIGITAL SELECTIVE CALLING - Use this channel for distress and safety calling and for general purpose calling using only digital selective calling techniques.	70
WEATHER - On these channels you may receive weather broadcasts of the National Oceanic and Atmospheric Administration. These channels are only for receiving. You cannot transmit on them.	WX1 through WX7

Footnotes

1. Not available in the Great Lakes, St. Lawrence Seaway, or the Puget Sound and the Strait of Juan de Fuca and its approaches.
2. Only for use In the Great Lakes, St Lawrence Seaway, and Puget Sound and the Strait of Juan de Fuca and its approaches.
3. Available only in the Houston and New Orleans areas.
4. Available only in the Great Lakes.
5. Available only in the New Orleans area.
6. Available for intership, ship, and coast general purpose calling by noncommercial ships.
7. Available only In the Puget Sound and the Strait of Juan de Fuca.

Type of Message	Appropriate Channels *
8. Available for port operations communications only within the U.S. Coast Guard designated VTS radio protection area of Seattle (Puget Sound). Normal output must not exceed 1 watt.	
9. Available for navigational communications only in the Mississippi River/Southwest Pass/Gulf outlet area.	
10. Available for navigation-related port operations or ship movement only. Output power limited to 1 watt.	
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.	
December 21, 2010 Adapted from http://wireless.fcc.gov/services/index.htm?job=service_bandplan&id=ship_stations	

Shipboard repeaters: 457.525 457.550 457.575 457.600 MHz

Inputs are +10.225 MHz (foreign vessels may use +10.0 MHz offset – not permitted in U.S. waters).

Maritime freqs. assignable to aircraft:

(HF) 2.738 2.830 3.023 4.125 5.680 MHz
(VHF) channels 6 8 9 16 1018 1022 67 68 72 & 88
See 47CFR80.379 for restrictions.

Maritime Distress Frequencies - Radiotelephone

(HF, USB - 2K80J3E) 2182, 4125, 6215, 8291, 12290, 16420 kHz

(VHF, FM wideband - 16K00F3E) 156.800 MHz (Channel 16)

VHF Marine Channels & Frequencies

Source: http://www.navcen.uscg.gov/?pageName=mtVhf

Channel Number *	Ship Transmit MHz	Ship Receive MHz	Use
1001	156.050	156.050	Port Operations and Commercial, VTS. Available only in New Orleans/Lower Mississippi area
1005	156.250	156.250	Port Operations or VTS in the Houston, New Orleans and Seattle areas
6	156.300	156.300	Intership Safety
1007	156.350	156.350	Commercial
8	156.400	156.400	Commercial (Intership only)
9	156.450	156.450	Boater Calling. Commercial and Non-Commercial
10	156.500	156.500	Commercial
11	156.550	156.550	Commercial. VTS in selected areas
12	156.600	156.600	Port Operations. VTS in selected areas
13	156.650	156.650	Intership Navigation Safety (Bridge-to-bridge). Ships >20m length maintain a listening watch on this channel in US waters.
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.			

Channel Number *	Ship Transmit MHz	Ship Receive MHz	Use
14	156.700	156.700	Port Operations. VTS in selected areas.
15	--	156.750	Environmental (Receive only). Used by Class C EPIRBs.
16	156.800	156.800	International Distress, Safety and Calling. Ships required to carry radio, USCG, and most coast stations maintain a listening watch on this channel.
17	156.850	156.850	State & Local Government Maritime Control
1018	156.900	156.900	Commercial
1019	156.950	156.950	Commercial
20	157.000	161.600	Port Operations (duplex)
1020	157.000	157.000	Port Operations
1021	157.050	157.050	U.S. Coast Guard only
1022	157.100	157.100	Coast Guard Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16.
1023	157.150	157.150	U.S. Coast Guard only
24	157.200	161.800	Public Correspondence (Marine Operator)
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.			

Channel Number *	Ship Transmit MHz	Ship Receive MHz	Use
25	157.250	161.850	Public Correspondence (Marine Operator)
26	157.300	161.900	Public Correspondence (Marine Operator)
27	157.350	161.950	Public Correspondence (Marine Operator)
28	157.400	162.000	Public Correspondence (Marine Operator)
1063	156.175	156.175	Port Operations and Commercial, VTS. Available only in New Orleans/Lower Mississippi area.
1065	156.275	156.275	Port Operations
1066	156.325	156.325	Port Operations
67	156.375	156.375	Commercial. Used for bridge-to-bridge communications in lower Mississippi River. Intership only.
68	156.425	156.425	Non-Commercial
69	156.475	156.475	Non-Commercial
70	156.525	156.525	Digital Selective Calling (voice communications not allowed)
71	156.575	156.575	Non-Commercial
72	156.625	156.625	Non-Commercial (intership only)
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.			

Channel Number *	Ship Transmit MHz	Ship Receive MHz	Use
73	156.675	156.675	Port Operations
74	156.725	156.725	Port Operations
77	156.875	156.875	Port Operations (intership only)
1078	156.925	156.925	Non-Commercial
1079	156.975	156.975	Commercial. Non-Commercial in Great Lakes only
1080	157.025	157.025	Commercial. Non-Commercial in Great Lakes only
1081	157.075	157.075	U.S. Government only - Environmental protection operations.
1082	157.125	157.125	U.S. Government only
1083	157.175	157.175	U.S. Coast Guard only
84	157.225	161.825	Public Correspondence (Marine Operator)
85	157.275	161.875	Public Correspondence (Marine Operator)
86	157.325	161.925	Public Correspondence (Marine Operator)
87	157.375	157.375	Public Correspondence (Marine Operator)
88	157.425	157.425	Commercial, intership only.
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.			

Channel Number *	Ship Transmit MHz	Ship Receive MHz	Use
AIS 1	161.975	161.975	Automatic Identification System (AIS)
AIS 2	162.025	162.025	Automatic Identification System (AIS)
*"10" channel prefix indicates simplex use of the ship station transmit frequency of an international duplex channel. Used in U.S. waters only.			

Shipboard repeaters:

457.525 457.550 457.575 457.600 MHz, wideband FM.

Inputs are +10.225 MHz

Foreign vessels may use +10.0 MHz offset outside U.S. waters.

On-board Communications:

Narrowband FM: 457.5375, 457.5625, 467.5375, 467.5625 MHz

Maritime freqs. assignable to aircraft:

(HF) 2.738 2.830 3.023 4.125 5.680 MHz

(VHF) channels 6 8 9 16 1018 1022 67 68 72 & 88

See 47CFR80.379 for restrictions.

Maritime Distress Frequencies - Radiotelephone:

(HF, USB - 2K80J3E) 2182, 4125, 6215, 8291, 12290, 16420 kHz

(VHF, FM wideband - 16K00F3E) 156.800 MHz (Channel 16)

Multi-Use Radio Service (MURS)

151.820 MHz (11.25 kHz)

151.880 MHz (11.25 kHz)

151.940 MHz (11.25 kHz)

154.570 MHz (20.00 kHz) (shared with business band)

154.600 MHz (20.00 kHz) (shared with business band)

Maximum power output 2 watts.

Narrowband on 151 MHz frequencies.

Narrowband or wideband on the 154 MHz frequencies.

External gain antennas may be used (must be no more than 60 feet above ground or 20 feet above the structure on which it is mounted).

Voice or data, except:

no store-and-forward packet operation
no continuous carrier operation
no interconnection with the public switched network
no use aboard aircraft in flight

Authorized emission types:

A1D, A2B, A2D, A3E, F2B, F1D, F2D, F3E, G3E.

Personal or business use.

Equipment must be certificated per FCC rules Part 95, Subpart J.

No license required.

GMRS Frequencies

Authorized bandwidth: 25 kHz, 50 W power. Repeater outputs (inputs are +5 MHz): 462.550 462.575 462.600 462.625 462.650 462.675* 462.700 462.725

* nationwide traveler's assistance; if CTCSS is required, try 141.3 Hz.

Simplex prohibited on repeater inputs.

Interstitial frequencies, 12.5 kHz. 467 MHz power: 0.5 W. 462 MHz power: 2 W for FRS, 5 W for GMRS channels (simplex, not more than 5 watts):

462.5625 .5875 .6125 .6375 .6625 .6875 .7125 (shared with FRS)

North of Line A / East of Line C: 462.650, 467.650, 462.700, 467.700 may not be used; small control stations limited to 5 watts.

FRS Frequencies

Authorized bandwidth: 12.5 kHz. Channels 1-14: Power limit: 0.5 watts ERP

462.5625 /5875 /6125 /6375 /6625 /6875 /7125 (shared with GMRS)

467.5625 /5875 /6125 /6375 /6625 /6875 /7125

CB Frequencies

Ch	MHz	Ch	MHz	Ch	MHz	Ch	MHz	Ch	MHz
1	26.965	2	26.975	3	26.985	4	27.005	5	27.015
6	27.025	7	27.035	8	27.055	9	27.065	10	27.075
11	27.085	12	27.105	13	27.115	14	27.125	15	27.135
16	27.155	17	27.165	18	27.175	19	27.185	20	27.205
21	27.215	22	27.225	23*	27.255	24	27.235	25	27.245
26	27.265	27	27.275	28	27.285	29	27.295	30	27.305
31	27.315	32	27.325	33	27.335	34	27.345	35	27.355
36	27.365	37	27.375	38	27.385	39	27.395	40	27.405
*	26.995	*	27.045	*	27.095	*	27.145	*	27.195
* Remote Control Channels									

Common Business Frequencies

IS=Special Industrial IB=Business

27.49	IB	Itinerant
35.04	IB	Itinerant
43.0400	IS	Itinerant
151.5050	IS	Itinerant
151.6250	IB	RED DOT Itinerant
151.9550	IB	PURPLE DOT
152.8700	IS	Itinerant
154.5700	IB	BLUE DOT (also MURS)
154.6000	IB	GREEN DOT (also MURS)
158.4000	IS	Itinerant
451.8000	IS	Itinerant
456.8000	IS	Itinerant
464.5000	IB	BROWN DOT Itinerant 35w.
464.5500	IB	YELLOW DOT Itinerant 35w.
467.7625	IB	J DOT
467.8125	IB	K DOT
467.8500	IB	SILVER STAR
467.8750	IB	GOLD STAR
467.9000	IB	RED STAR
467.9250	IB	BLUE STAR
469.5000	IB	Simplex or input to 464.500 if repeater. Itinerant 35 w. max
469.5500	IB	Simplex or input to 464.550 if repeater. Itinerant 35 w. max

Railroad Frequencies

160.215(ch.007)-161.565(ch.097), every 15 kHz

*Interstitial narrowband channels between ch. 002-097 are offset 7.5 kHz.

161.205 Railroad Police Mutual Aid (channel 073)

Ch. 002-006 are used in Canada only:

(2) 159.810 (3) 159.930 (4) 160.050 (5) 160.185 (6) 160.200

452.325 / 457.325
452.375 / 457.375
452.425 / 457.425
452.475 / 457.475

452.775 / 457.775
452.825 / 457.825
452.875 / 452.875
452.900 / 457.900

452.8500
452.8375 - low power
452.8625 - low power
452.8875 - low power

(*Telemetry/Remote Control/Remote Indicator frequencies omitted)

SAR (Search and Rescue) Frequencies

Land SAR

Typical frequencies are: 155.160, .175, .205, .220, .235, .265, .280, or .295
If CTCSS is required try 127.3 Hz (3A).

Air SAR

3023, 5680, 8364 kHz upper sideband (lifeboat/survival craft),
4125 kHz upper sideband (distress/safety with ships and coast stations)
121.5 MHz emergency and distress
122.9 MHz SAR secondary & training
123.1 MHz SAR primary

Water SAR

156.300 (VHF Marine ch. 06) Safety and SAR
156.450 (VHF Marine ch. 09) Non-commercial supplementary calling
156.800 (VHF Marine ch. 16) DISTRESS and calling
156.850 (VHF Marine ch. 17) State & Local Government Maritime Control
157.100 (VHF Marine ch. 1022) Coast Guard Liaison

VHF Marine Channels

6, 9, 15, 16, 1021, 1022 (USCG Liaison), 1023, 1081, 1083

USCG Auxiliary

138.475, 142.825, 143.475, 149.200, 150.700

USCG/DOD Joint SAR

345.0 MHz AM initial contact, 282.8 MHz AM working

Military SAR

40.50 wideband FM	US Army/USN SAR
138.450 AM, 138.750 AM	USAF SAR

Maritime HF and VHF Distress Frequencies

Global Maritime Distress & Safety System, Digital Selective Calling (DSC) & Radiotelephone Channels - **for use only by vessels and coast stations authorized in the Maritime Services** (FCC Part 80, NTIA 7.5 and 8.2.29). These are not nationwide interoperability channels, and are not for land-based public safety agencies. These frequencies may be programmed only into radios certificated for Part 80 operations, and only by a person holding a First or Second Class Radiotelegraph Operator's Certificate, Radiotelegraph Operator License, or General Radiotelephone Operator License.

The simplex DSC frequencies except 2187.5 and 16804.5 kHz are monitored by the US Coast Guard and are used for digital alerting and calling for distress, urgency and safety. Once the DSC call has been sent, the corresponding radiotelephone frequency is used for voice communications.

The simplex voice frequencies are used for distress and safety communications, and except for 2182 and 16420 kHz are monitored by the USCG. Frequencies are monitored according to propagation; not all frequencies are monitored at all times. These radiotelephone channels use upper sideband (USB - 2K80J3E); the frequency shown is the suppressed carrier reference frequency. VHF channel 16 uses wideband FM (16K0F3E or 16K0G3E).

DSC	Voice
* 2187.5 kHz	* 2182 kHz
4207.5 kHz	4125 kHz
6312.0 kHz	6215 kHz
8414.5 kHz	8291 kHz
12577.0 kHz	12290 kHz
* 16804.5 kHz	* 16420 kHz
156.525 MHz (Channel 70)	156.800 MHz (channel 16)
* International distress channel that is not monitored by USCG	

HF Disaster Communications

Fixed, Base, Mobile		Fixed	
2326	I	5135	A
2411		5140	A, I
2414		5192	I
2419		5195	I
2422		7477	A
2439		7480	A
2463		7802	D
2466		7805	I
2471		7932	
2474		7935	C, D
2487			
2511			
2535			
2569			
2587			
2801			
2804	A		
2812			

- Carrier frequencies in kHz. A=Alternate channel I=Interstate coordination C=Conterminous US D=Daytime Operations Only
- **May be licensed only to the central governments of the 50 states and 6 US territories.** See FCC rules 90.264, 90.20(d)(6), and 90.129(m).
- Emissions: Only 2K80J3E (USB), 100HA1A and those emission types listed in §90.237(g) are permitted.

HF Long Distance Communications

Fixed, Base, Mobile		Fixed (including itinerant)			
2289		5046.6	E	7480.1	
2292		5052.6	E	7483.1	
2395		5055.6	E	7486.1	E
2398		5061.6	W	7549.1	D
3170		5067.6		7552.1	
4538.6	N	5074.6	E	7555.1	W
4548.6	N	5099.1		7558.1	W
4575		5102.1		7559.1	W
4610.5		5313.6		7562.1	W
4613.5				7697.1	
4634.5		6800.1	N		
4637.5		6803.1			
4647		6806.1	W		
		6855.1	N,M		
		6858.1	N		
		6861.1	W		
		6885.1	N		
		6888.1	N		

- Carrier frequencies in kHz.
- **D** = Daytime Operations Only, **N** = Night Operations Only, **E** = East of 108° West Longitude (WL), **M** = West of the Mississippi River, **W** = West of 90° WL.
- **May be licensed for repair of telecommunications circuits, power & pipeline distribution etc.** See FCC rules 90.266, 90.35(c)(1), and 90.129(o).
- Emissions: Only 2K80J3E (USB), 100HA1A, 100HA1B, and those emission types listed in §90.237(g) are permitted.

Standard Time and Frequency Broadcasts

Radio station WWV (Fort Collins, Colorado), WWVH (Kauai, Hawaii), and CHU (Ontario, Canada) broadcast continuous time signals on precise frequencies. Because the broadcasts occur simultaneously on several HF frequencies at high power, at least one of the signals should be receivable at all times throughout the US and Canada. This can be useful for testing HF receivers and antennas, and for selecting frequencies based on currently observable propagation.

Frequencies (MHz)		
WWV	WWVH	CHU
2.500	2.500	3.330
5.000	5.000	7.850
10.000	10.000	14.670
15.000	15.000	
20.000		
25.000		
Double Sideband AM	Double Sideband AM	Full Carrier USB
Male Voice	Female Voice	English and French

Standard Time by Telephone

1-303-499-7111 - WWV (Colorado)1-808-335-4363 - WWVH (Hawaii)

1-202-762-1401 , 1-202-762-1069 (DSN 762-1401, 762-1069) - Washington, DC

1-719-567-6742 (DSN 560-6742) - Colorado Springs, CO

The Washington DC and Colorado Springs CO lines alternate between local (EST/EDT or MST/MDT) and UTC (Z) time.

Amateur Radio Emergency Frequencies

These frequencies (except 5167.5 kHz) are not available for licensing to Public Safety agencies. An Amateur Radio Operator License of the appropriate class is required in order to transmit on these frequencies.

Emergency Center of Activity Frequencies - emergency communications networks in North/Central/South America and the Caribbean are encouraged to establish their operations within 20 kHz +/- of these frequencies (kHz):

3750 or 3985 LSB		7060, 7240, or 7290 LSB
14300 USB	18160 USB	21360 USB

US Government stations and RACES stations may exchange emergency communications on any Amateur frequency. DHS (including FEMA) and USCG stations, among others, have frequency authorizations aligned with the five Amateur Service secondary channels at 5 MHz:

Carrier Frequency (kHz)	Center Frequency (kHz)
5330.5	5332.0
5346.5	5348.0
5357.0	5358.5
5371.5	5373.0
5403.5	5405.0

Alaska Emergency Frequency - 5167.5 kHz USB carrier frequency, 5168.9 kHz assigned (center) frequency – may be used in or within 50 nautical miles of Alaska for emergency communications, including exercises. Interoperability with Part 90 Private Land Mobile Radio Service stations is authorized.

Amateur Radio Emergency Frequencies (continued)

Automatic Link Establishment (ALE) http://HFLink.net

Emergency/Disaster Relief Interoperation Voice Channels (kHz, USB*):

Netcall: HFL	
1996.0	14346.0
3996.0	18117.5
5371.5	21432.5
7296.0	28312.5

Text Message Channels (kHz, USB*):

Netcall: HFN	
1843.0	14109.0
3596.0	18106.0
5357.0	21096.0
7102.0	28146.0
10145.5	

* Carrier reference frequency (center of ALE signal is offset +1625 Hz)

Maritime Mobile Service Net (and others): 14300 kHz USB

http://mmsn.org

Hurricane Watch Net: 14325 kHz USB http://www.hwn.org

National Hurricane Center, during hurricanes (kHz):

14325 USB - primary		7268 LSB - alternate
3815 LSB - Caribbean	3950 LSB - North Florida	3940 LSB - South Florida

http://w4ehw.fiu.edu IRLP Node: 9219, EchoLink Conference: Wx-Talk

Amateur Radio Calling Frequencies

Band	Frequency (MHz)	Mode
80 Meters	3.885	AM
40 Meters	7.29	AM
20 Meters	14.286	AM
6 Meters	50.125	SSB
6 Meters	52.525	FM Simplex
6 Meters	52.54	FM Simplex
6 Meters	50.62	Digital (packet)
2 Meters	144.2	SSB
2 Meters	146.52	FM Simplex
1.25 Meters	222.1	CW/SSB
70 Centimeters	432.1	CW/SSB
70 Centimeters	446	FM Simplex
33 Centimeters	902.1	CW/SSB
33 Centimeters	903.1	CW/SSB
33 Centimeters	927.5	FM Simplex
23 Centimeters	1294.5	FM simplex
23 Centimeters	1296.1	CW/SSB

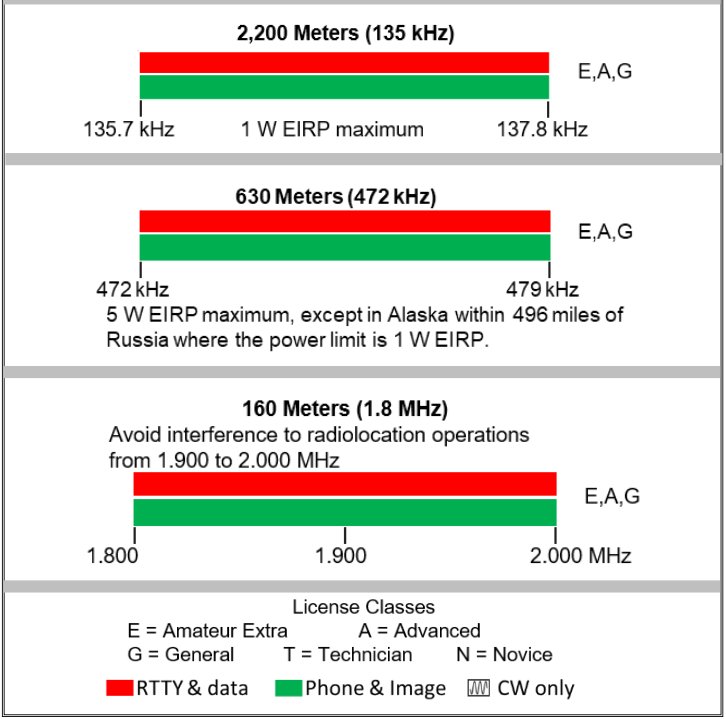
These are not Public Safety frequencies – an Amateur Radio Operator license is required to use them.

Amateur Radio Repeater Coordinators

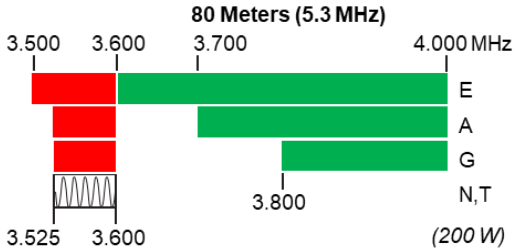
http://www.arrl.org/files/file/Coordinators/Participating%20Coordinators.pdf

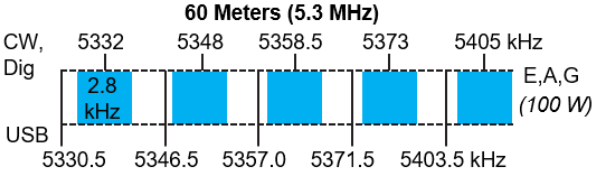
Amateur Radio Bands (US)

Amateurs wishing to operate on either 2,200 or 630 meters must first register with the Utilities Technology Council online at https://utc.org/plc-database-amateur-notification-process/
You need only register once for each band.



Amateur Radio Bands (US) – continued

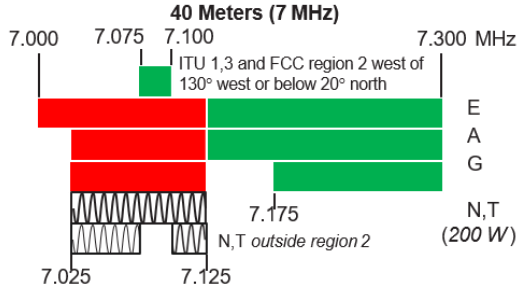




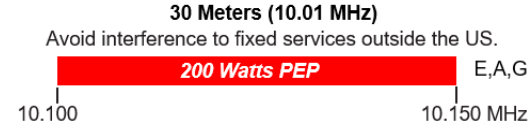
General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated power (ERP) of 100 W PEP relative to a half-wave dipole. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III. Only one signal at a time is permitted on any channel.

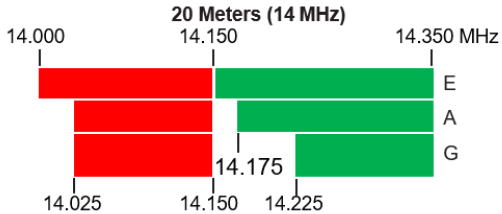
RTTY & data Phone & Image CW only

Amateur Radio Bands (US) – continued



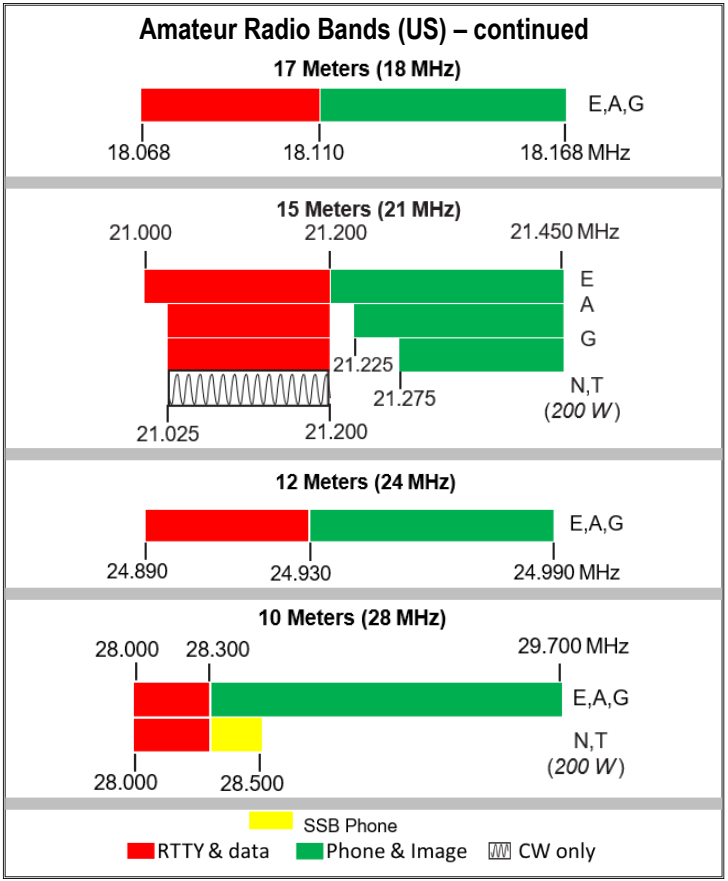
See Sections 97.305(c), 97.307(f)(11) and 97.301(e). These exemptions do not apply to stations in the continental US.



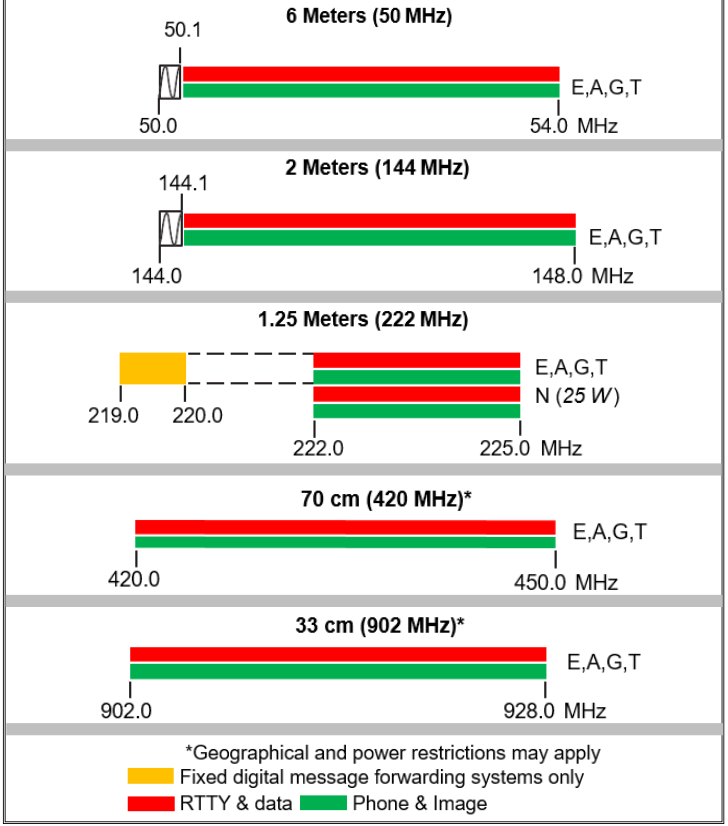


RTTY & data Phone & Image CW only

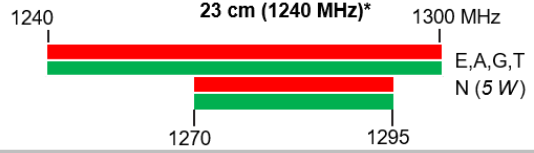
Amateur Radio Bands (US) – continued



Amateur Radio Bands (US) – continued



Amateur Radio Bands (US) – continued



Automatically Controlled Digital Stations.

A station may be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the 28.120-28.189 MHz, 24.925-24.930 MHz, 21.090-21.100 MHz, 18.105-18.110 MHz, 14.0950-14.0995 MHz, 14.1005-14.112 MHz, 10.140-10.150 MHz, 7.100-7.105 MHz, or 3.585-3.600 MHz segments provided that:

(1) The station is responding to interrogation by a station under local or remote control; and

(2) No transmission from the automatically controlled station occupies a bandwidth of more than 500 Hz.

This rule section does not apply to an auxiliary station, a beacon station, a repeater station, an earth station, a space station, or a space telecommand station.

(FCC rule 97.221)

Automatically controlled digital stations may operate on all authorized frequencies above 50.1 MHz when the control operator is present at the control point, in which case the 500 Hz bandwidth limitation does not apply.

Amateur Radio Bands (US) – continued

All licensees except Novice are authorized all modes on the following frequencies:	
2300-2310 MHz	47.0-47.2 GHz
2390-2450 MHz	76.0-81.0 GHz
3300-3500 MHz	122.25-123.0 GHz
5650-5925 MHz	134-141 GHz
10.0-10.5 GHz	241-250 GHz
24.0-24.25 GHz	All above 275 GHz

Amateur Radio Power Limits (US)

FCC Rule 97.313

(a) An amateur station must use the minimum transmitter power necessary to carry out the desired communications.

(b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

[60 meters: 100W PEP ERP; 30 meters: 200W PEP; additional restrictions apply under certain conditions, and to Novice and Technician licensees.]

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

EMERGENCY MEDICAL PROCEDURES

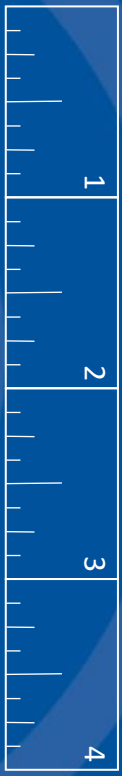
ICS 206 – Block 8 – "Dutch Creek Protocol"

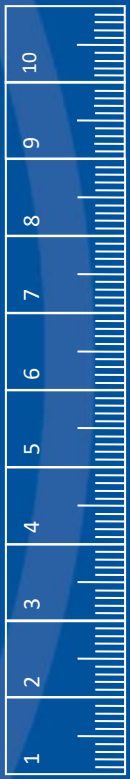
In the event of a medical emergency, provide the following information to the Communications Unit.

1. Declare the nature of the emergency.
   a. Medical injury/illness?
   b. If injury/illness, is it Life Threatening?
2. If Life Threatening, then request that the designated frequency be cleared for emergency traffic.
3. Identify the on-scene Point of Contact (POC) by Resource and Last name (i.e. POC is TFLD Smith).
4. Identify nature of incident, number injured, patient assessment(s) and location (geographic and GPS coordinates).
5. Identify on-scene medical personnel by position and name (i.e. EMT Jones).
6. Identify preferred method of patient transport.
7. Request any additional resources and/or equipment needed.
8. Document all information received and transmitted on the radio or phone.
9. Identify any changes in the on-scene Point of Contact or medical personnel as they occur.

To download or request copies of the NIFOG, please visit
https://www.dhs.gov/publication/fog-documents

ISBN 978-1-4028-9462-6





Homeland Security

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

ISBN 978-1-4028-9462-6