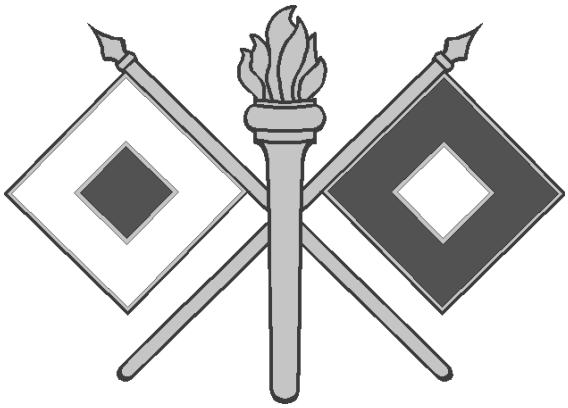

Grid-Down Communications Volume 1

by Sparks

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- Acknowledgments:

  HH6 & Heiress Apparent, J.P. Martin, Ticom, SFC Steve Barry (Ret.), CA/WRSA, Dan Morgan, John Mosby, Kerodin, Richard M. Nixon (deceased), and everyone else who wished to remain anonymous.

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Considerations For Grid-Down Communications

- The lack of viable broadcast news media even at the present situation mandates that you conduct communications monitoring activities in order to get an accurate picture of activities in your area of operations (AO). During a grid-down scenario, this capability will become even more important. **If you do nothing else in the way of radio communications, you must at the very least have an adequate communications monitoring setup**.
- Your communications equipment will need to be capable of operating independent of the power grid. The lack of consistent reliable electric utility service in a grid-down scenario means that you will have to produce your own power for communications. This equates to rechargeable batteries and alternative power systems. Fortunately there are several solutions available to address this consideration.
- The limited quantity of electricity from self-generation means that you should use the lowest amount of RF power needed to establish reliable communications. Ham radio has a subset of low-power communications known as QRP, and many hobbyists use this technique exclusively. QRP radios also have other advantages that make them appealing for grid-down communications.
- Many grid-down scenarios will have you operating in field locations. Your equipment should be portable or at least easily transportable. This applies to most QRP radios, by the way.
- Commercial electronic repair facilities will not be available in a long-term grid-down scenario. At best you may have access to a retired electronic repair technician or advanced hobbyist with a small personal collection of common parts and basic test equipment. Some of your equipment should be capable of being repaired under these conditions. This means the use of common components, either vacuum tubes or discrete solid state devices, with point-to-point wiring or simple thru-hole PC Boards. This is typical radio construction up to the 1980s, and is still done with homebrew rigs.
- Interestingly enough, the concepts of QRP (low-power), off-grid operation, portable communications equipment, and homebrew gear are all interconnected and very popular among a significant segment of the amateur radio community to the point of several activities such as SOTA (Summits On The Air) catering to hams who are into this sort of thing.
- Socio-political effects of a grid-down scenario may make it necessary for you to implement some form of communications security (COMSEC). Depending on the specific type and severity of the scenario, you may be facing threats ranging from bandits with a police scanner to a professional signals intelligence (SIGINT) asset.

The Plan

1. The first, and continuous, thing you should do is work on your communications/electronics skill set.
2. Set up a communications monitoring post. **This is more important than being able to talk on the air to other people**, and even if you have no interest in getting your ham license you should at the very least have the capability to listen in to what's being said on the airwaves.
3. **Never trust anyone else's infrastructure**. Things like 2 meter ham repeater networks are great until they go down. Think simplex, and think NVIS.
4. Establish your intra-group communications.
5. Establish your communications networks with neighboring allied groups (interoperability).
6. Establish communications with nationwide communications networks.

This portable communications setup follows the first five steps of The Plan.

1. The individual that assembled this kit learned what he needed to do it properly.
2. It has adequate communications monitoring capability for the user's AO.
3. It's off-grid capable.
4. It handles intra-group communications.
5. It has interoperability with neighboring groups.

With the addition of a portable HF rig, it would complete all six steps.

VHF/UHF Radio Communications Monitoring

A common "police scanner" is one of the most potentially useful tools a survivalist could have. Scanners have come a long way from bulky, crystal-controlled affairs with a handful of channels. Contemporary scanners fit in the palm of your hand, have a thousand keyboard-programmable channels, and have wide-band frequency coverage from 100 Khz. To 2+ Ghz. Certain models even have the ability to follow communications on trunked radio systems used by government and business, and can demodulate APCO-25 (P-25) digital modulation now becoming popular on both conventional and trunked radio systems. For the uninitiated, a scanner is a VHF/UHF communications receiver that has the ability to step through multiple channels or "scan", stopping on a frequency it detects traffic on. Scanners monitor frequencies used by government agencies, the military, public safety, emergency services, utility companies, businesses, and wireless telecommunications devices. Some of the more deluxe units even cover the "HF" shortwave region. While the use of mobile data systems and encryption is on the rise, there is still plenty of activity to be monitored for the foreseeable future.

Equipment

Generally speaking, the purpose of a full-scale communications monitoring set-up would be the following:

- RF spectrum search for new frequencies and fingerprint of local RF spectrum
- Monitoring of applicable local & regional RF activity
- Monitoring of local "indicator" frequencies that provide notification of unusual events or activity
- Monitoring of 1-50 "priority" frequencies of interest
- Detection and monitoring of nearby RF activity (Close Call scanning)
- Identification of previously unidentified RF activity
- Recording of select RF communications

With the exception of the newer models that feature P-25 demodulation and 2+ GHz. frequency coverage, 90% of your equipment needs can be acquired at a significant savings by purchasing it used. There is always Ebay, but I much prefer checking out local hamfests, ham-oriented electronics stores, and pawnshops. There is no way you would, for example, be able to buy a mint condition Icom R-10 for $100 or a $75 Radio Shack PRO-43 off Ebay. Yet, that is exactly the price my friends and I have paid for them at local pawnshops.

There are some specific models of scanners that deserve specific mention. The first two are the classic Radio Shack PRO-2004/2005/2006 and PRO-43 base and handheld scanners. These units are considered to be the ones that started it all in respect to custom modifying scanner receivers, and were the focus of the Scanner Modification Handbooks written by the late Bill Cheek. Out of the three base units, the last in the series, the PRO-2006, is considered the "primo" unit. Another highly regarded unit is the Radio Shack PRO-26 handheld that featured full 25-1300 MHz. coverage when properly modified. Two other notable scanners are the Radio Shack PRO-2035 and PRO-2042. While post-1994 units, they were the first units to have prompted the discovery of the virtual downconverter mod, and were considered some of the last units that were easily customizable. Of the two, the PRO-2042 is considered the better unit. The Uniden/Bearcat BC-780XLT is yet another unit that should appear in used equipment circles and worth a look at. Icom and AOR communications receivers for the most part are always worth acquiring

when found on the used equipment market, despite their high resale price. There exist many sites on the Internet that contain equipment reviews, and I recommend checking them out when you have a specific piece of equipment in mind.

Radio Shack PRO-2006
The "hacker's scanner" that started it all for many of us...

As far as specific recommendations are concerned, that would depend on the communications systems that are being used in your area. For example, Southern California would have vastly different requirements than upstate New York. Look for models that can operate off commonly available AA batteries, as opposed to models which require a proprietary battery pack. With the use of rechargeable batteries and a small solar charger, the former can be kept powered up sans electrical infrastructure almost indefinitely.

For those of you who are beginners to the monitoring hobby, what scanner to buy is a little confusing. The short answer is: Buy one that can monitor your local communications systems of interest. This information can generally be found at the Radio Reference Website[1]. Radio systems will be either conventional or trunked. Besides being conventional or trunked, they can be analog or digital. If the system is digital, it could be APCO P25 CAI[2], Harris Open Sky, Mototrbo, DMR, NXDN, or a few other lesser-used modulation schemes. Finally the system can also be encrypted. If the system uses encryption, you are out of luck.

Let's start with an analog conventional system. This is a base, mobiles/portables, and maybe a repeater. You are dealing with one or two frequencies, and any scanner can monitor them. Digital conventional works the same, except instead of good-old analog FM the system uses a digital modulation scheme. Currently, the only digital modulation you can monitor with a scanner is APCO P25 CAI, which is a common public-safety standard. DMR, NXDN, and a few other modes can be monitored with a USB SDR[3] and the right software. If the system uses anything else, or this encrypted, then you are out of luck.

Trunking systems use multiple frequencies. One is typically assigned as a "control channel", and different agencies are assigned "talkgroups". When a unit comes on the air with a specific talkgroup, the system assigns everyone on the talkgroup to a certain frequency in the system. The most common system is Motorola Smartnet, although there are also EDACS, LTR, and other systems. The three systems that a "Trunktracker" scanner or USB SDR can selectively monitor are Motorola, EDACS, and LTR. When I say "selectively monitor", I mean follow talkgroup activity on a specific talkgroup as it goes from frequency to frequency on the system. While you cannot follow talkgroups on other systems, you can still scan the individual channels conventionally and monitor them that way. Digital trunking works the same way, except that the RF modulation is digital instead of analog FM. A digital trunktracker or USB SDR will be able to selectively monitor these systems.

To summarize:

- If the radio system is analog conventional, you are fine with a basic scanner.

1 http://www.radioreference.com/

2 Common Air Interface

3 A software defined radio running off a PC's USB port.

- If the radio system is analog trunked, then you could get by with a basic scanner, but a Trunktracker or USB SDR is nice so you can follow talkgroups. However...
- You can only follow talkgroups on a Motorola, EDACS, or LTR system.
- If the system is conventional P25 digital, then you will need a Digital Trunktracker or USB SDR.
- If the system is trunked P25 digital, then you will need a Digital Trunktracker. Although I have heard some reports of USB SDRs being used with trunked system monitoring software such as Unitrunker.
- If the system is DMR or NXDN, then you can use a USB SDR.
- If any system uses encryption, then you are out of luck.

If you either cannot afford the $500 for a digital trunktracker, or live in an area that has a system you cannot monitor such as Open-Sky, don't fret. There are still useful frequencies that you can monitor with a scanner, or you can use one of the new USB SDRs.

Scanners Versus Communications Receivers Versus USB SDRs

It used to be that the line between police scanners and communications receivers was well defined. Police scanners covered from 25 or 30 MHz. to at least 512 MHz. The then top of the line police scanner, the Radio Shack PRO-2004 had a frequency coverage from 25-1300 MHz. minus the analog cellular phone band (before you clipped the diode) and the UHF TV broadcast band. Scanners also had large memory channel capacity and the means to rapidly cycle through them looking for activity. Communications receivers were considered the domain of the HF bands, and were often called shortwave receivers. Their frequency coverage was from around 100 KHz. to 30 MHz. They were designed for tuning through the shortwave spectrum and sitting on a particular frequency for a period of time. Their channel memories were intended for ease of recall as opposed to scanning for activity. Icom did make a VHF/UHF communications receiver, the R-7000. It boasted excellent receive performance and 25-2000 MHz. frequency coverage. Many radio shops I have been in used one as a piece of test equipment. Most scanner hobbyists eschewed it however because for the purpose of monitoring the locals their Bearcat BC-200 or Radio Shack PRO-34 worked better.

Towards the late 1990s, the line between shortwave communications receivers and police scanners blurred with the introduction of wide-band receivers that covered the HF, VHF, and UHF bands. The classic representative examples of these receivers were the Icom R-8500 and AOR AR-3000 wide-band communications receivers. For handheld receivers it was the Icom R-10 and AOR AR-8000. These units had frequency coverage from 100 KHz. to 2 GHz. with adequate performance. Being communications receivers however their were not as well suited for typical VHF/UHF monitoring scenarios. During this period of time we also saw the introduction of police scanners capable of following communications on trunked radio systems, such as the pioneering Uniden Bearcat BC-235XLT. Many an Icom R-10 found its way to a hamfest or pawnshop with a $100 price tag on it because some scanner hobbyist bought it and attempted to use it as a police scanner instead of wringing out its full potential as a wideband communications receiver.

Communications receivers are now coming back into vogue among hobbyists with USB "stick" type receivers such as the Funcube Dongle[4] and RTL-SDR[5]. These "receivers" plug into a computer's USB port and use the computer's USB audio device in combination with software to demodulate all sorts of modes. Most, if not

4 http://www.funcubedongle.com/

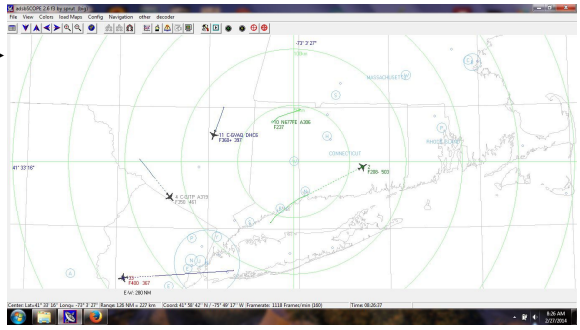
5 http://www.rtl-sdr.com/

all, of this software is open source. At the time of this writing, the available modes included:

- P25 Phase 1
- ProVoice EDACS Digital voice
- X2-TDMA
- DMR/MOTOTRBO
- NXDN - 9600 baud (12.5 kHz) NEXEDGE and 4800 baud (6.25 kHz) NEXEDGE/IDAS
- D-STAR
- C4FM modulation
- GFSK modulation (including GMSK and other filtered 2/4 level FSK)
- QPSK modulation (sometimes marketed as "LSM")

The use of the computer as a demodulator has enabled hobbyists to use the USB SDRs for all sorts of applications, including:

- Listening to unencrypted Police/Ambulance/Fire/EMS conversations.
- Listening to aircraft traffic control conversations.
- Tracking aircraft positions like a radar with ADSB decoding. ▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶



- Decoding aircraft ACARS short messages.
- Scanning trunking radio conversations.
- Decoding unencrypted digital voice transmissions.
- Tracking maritime boat positions like a radar with AIS decoding.
- Decoding POCSAG/FLEX pager traffic.
- Scanning for cordless phones and baby monitors.
- Tracking and receiving meteorological agency launched weather balloon data.
- Tracking your own self launched high altitude balloon for payload recovery.
- Receiving wireless temperature sensors and wireless power meter sensors.
- Listening to VHF amateur radio.
- Decoding ham radio APRS packets.
- Watching analogue broadcast TV.
- Sniffing GSM signals.
- Using rtl-sdr on your Android device as a portable radio scanner.
- Receiving GPS signals and decoding them.
- Using rtl-sdr as a spectrum analyzer.
- Receiving NOAA weather satellite images.
- Listening to satellites and the ISS.
- Radio astronomy.
- Monitoring meteor scatter.

- Listening to FM radio, and decoding RDS information.
- Listening to DAB broadcast radio.
- Use rtl-sdr as a panadapter for your traditional hardware radio.
- Decoding taxi mobile data terminal signals.
- Use rtl-sdr as a true random number generator.

What Do I Buy?

The big question asked among survivalists interested in picking up some intercept gear is "Which one is best?" At present there are four basic categories of hobbyist signal intercept equipment:

- Police Scanners – These would be VHF/UHF receivers featuring generalized frequency coverage of 25-1300+ MHz., multiple memories, and high speed scanning capability, typically 50-100 channels per second. Higher-end models may also feature P25 digital modulation reception, "trunk tracking" to more easily monitor communications on trunked radio systems, "Close Call" reception capability for detecting and monitoring near-field communications, and CTCSS/DCS tone decoding capability to help identify and selectively monitor specific users on a shared frequency.
- Wideband Communications Receivers – Featuring continuous frequency coverage of 100 KHz. to 2+ GHz., and generally designed for searching the RF spectrum for whatever is out there. Unlike police scanners, wideband communications receivers feature intermediate frequency (IF) outputs for spectrum scopes and data decoding equipment. Receiver performance is usually better than police scanners, but scanning capability is not at police scanner levels.
- Shortwave (HF) Receivers – A communications receiver with 100 KHz. to 30 MHz. frequency coverage. These receivers are specifically designed for dedicated HF reception. As a result they will usually outperform a wideband communications receiver.
- USB SDR Receivers – These are VHF/UHF receivers that plug into a computer's USB port. They look like a standard USB audio device, and use computer software to demodulate the signal into an intelligible format.

Police scanners used to be commonly available from Radio Shack, but GRE, the manufacturer of most Radio Shack branded scanners, is for all practical purposes no longer in business. Some Radio Shack stores have some remaining legacy stock, or have started selling Uniden scanners. In the case of the latter, Radio Shack is asking full price and a better deal can be found elsewhere. You will have to find a local electronics store or ham shop, or purchase via mail order. Additionally you my find them at a local truck/CB shop.

Older but perfectly serviceable models are also available used at hamfests, pawn shops, and often at tag sales and flea markets in predominantly rural areas. For monitoring local public safety and other LMR frequencies of interest, this would be the recommended piece of equipment. The sophistication level of the unit would depend on the local communications systems you wish to monitor.

Wideband communications receivers are generally only available new from dealers in amateur radio equipment. Hamfests are a good source of used wideband communications receivers. They are generally too specialized a piece of electronics to be found via non-techie second-hand sources, although I have found them confused with police scanners at pawn shops. If you decided to get into serious electronic interception and investigation or communications monitoring beyond the basic local traffic monitoring, then you will eventually want one. This is a much more advanced piece of equipment and the tool of choice for finding and investigating electromagnetic emissions regardless of what frequency they might be

on or its purpose. For simply monitoring the locals they will do the job, but a less expensive police scanner serves that purpose much better.

If you want to check out long-distance communications, then get yourself a shortwave receiver as it will outperform a wideband communications receiver by a considerable margin. Low-end shortwave receivers are available from common consumer electronics outlets such as Radio Shack, but to really appreciate what's out there from 100 KHz. to 30 MHz. I would get a high-end receiver made by one of the ham manufacturers such as Icom, Kenwood, or Yaesu. Older tube gear from such greats at Hallicrafters, Johnson Viking, and Hammurlund also work very well and often have better audio then the new stuff. High-end shortwave receivers are available from the same places you get ham gear, either a retail ham outlet or a hamfest.

USB SDRs are a specialized tool for certain applications you should be interested in. At ~$20 the cost is so low that it would be foolish for you to not get one an experiment with it. At present, it is the only receiver that will demodulate DMR, NXDN, and other digital modes that are seeing increased use by non-public safety (business and industrial) land mobile radio users. Since many of those users are involved in the maintenance and operation of critical infrastructure, they are a priority communications monitoring target. USB SDRs are also the first time in years that something with “full 800 MHz. coverage” has been made available to the general public.

Full 800 MHz. Reception

Back before the advent of Advanced Mobile Phone Service (AMPS) in the 800 MHz. region and when the 800 MHz. land mobile band (including cellular phones) belonged to TV channels 60-69. Mobile phones used a handful of channels in the VHF and UHF land mobile bands. Mobile phone service was then called IMTS (Improved Mobile Telephone Service), and few people could afford it. The few users were well aware of the fact that people could listen in, and either spoke accordingly or didn't care.

When cellular phones came out, the FCC reallocated TV channels 60-69 for land mobile service and 666 cellular phone channels (later expanded to 832). Now mobile phone service became more affordable, and a larger segment of the population purchased them. Privacy concerns were raised, and congress passed the Electronic Communications Privacy Act that made listening to mobile phone communications illegal. At the time even the U.S. Justice Department stated that there was no way the ECPA could be enforced, but sellers of mobile phone service could now tell their potential customers that there was a law protecting the privacy of their unencrypted radio communications. If I recall correctly there was no law prohibiting the sales of cellular-capable scanner receivers, but manufacturers cooperated by manufacturing receivers with this frequency coverage blocked. What was known among hobbyists is that the firmware was programmed to block coverage if a certain data line on the receiver's microprocessor was active. This was so they could easily manufacture and sell full-coverage units to other countries. By cutting that particular data line, usually done by clipping the diode attached to the line, full 800 Mhz. coverage was restored.

This charade went on for a few years until the declining IQ of scanner dweebs and the increase in cellular phone usage resulted in a few instances of people getting caught doing stupid things as a result of what they heard from monitoring cellular phone conversations. It came out in public that the whole cellular privacy thing was a sham from the onset of the ECPA, and the Feds reacted by taking action against the special interest groups that would give them the least amount of hassle. The FCC in April, 1994 declared that they would not provide certification of any scanning receiver capable of being readily modified to receive cellular phone signals. Manufacturers redesigned their receivers, and other than some more complex (than clipping a diode) "virtual downconverter" modifications in a few models, that was the end of scanner cellular mods.

The relevance of all this to the present state of monitoring is that mobile phones have gone digital, and there now exists a surplus of analog cellular phones ranging from 3-watt bag phones about the size of a hardcover book, to portables that put out 300-500 milliwats. There are also decommissioned AMPS base stations available from various electronic surplus outfits. This obsolete equipment is being converted for various applications ranging from electronic surveillance to covert communications systems. As of this writing it is not illegal to monitor communications of this nature, but currently manufactured receivers can not cover the frequency ranges. At present the use of a receiver with full 800 MHz. coverage is not for monitoring mobile phones, but for the more interesting stuff that's hiding in the same frequency range.

Due to the increase in trunked and P-25 digital radio systems, many of the average scanner dweebs are trading in their old equipment to be able to afford the new generation of digital trunktracker scanners. Since digital mobile phone systems eliminated all those "juicy" (read: boring to anyone with an IQ above 70) conversations that used to occur in the cellular phone band, they felt no need to keep the equipment;, especially when the local police had switched over to ASTRO trunking. This has resulted in an increase in the availability of older scanners with full 800 MHz. coverage.

The list below contains all the Radio Shack and Uniden/Bearcat scanners that I was able to find a mod for continuous 800 MHz. reception. In addition to this list, Icom and AOR receivers made before 1994 are capable of being modified if they don't already have full coverage. Use this list when you are looking for equipment at hamfests and pawnshops. When going the used equipment route, I'd say about eighty percent of the time when you find a model on this list it has already had the mod done to it. The models in boldface type are particularly desirable. The ones listed with a thumbs-up are the best.

Radio Shack Handheld Scanners

👍**PRO-26** (Shown at right.)
PRO-34
PRO-37
PRO-39
👍**PRO-43** (not the 20-0300A model)
PRO-46

Radio Shack Base/Mobile Scanners

PRO-2004
PRO-2005
👍**PRO-2006**
PRO-2022
PRO-2026 (not the 20-0148B model)
PRO-2030
PRO-2032
PRO-2035 (virtual downconverter)
PRO-2042 (virtual downconverter)

Bearcat Handheld Scanners

BC-200/205XLT
BC-2500XLT

Bearcat Base/Mobile Scanners

BC-760XLT
BC-780XLT (virtual downconverter)
BC-800XLT (factory default)
BC-855XLT
BC-8500 (virtual down-converter)

As mentioned previously, the new USB SDRs have full 800 MHz. coverage. While they will demodulate FM like any other receiver and be able to detect and monitor

older AMPS devices being repurposed, their ability to look at a piece of spectrum with and act like a panadapter/poor man's spectrum analyzer enables them to detect GSM and CDMA signals on the 800 MHz. mobile phone band. Many surveillance devices such as GPS trackers use this band to communicate back to the surveillance operator. Being able to detect activity on this band is essential for counter-surveillance.

Antennas

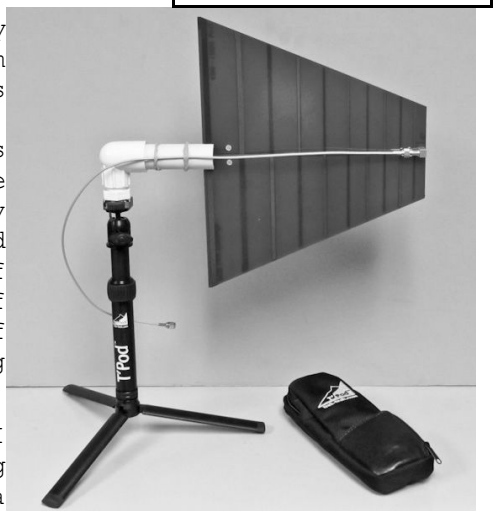
Discone Antenna

Now that you have some receivers to play with, you will need some antennas. The antenna system will make or break your monitoring setup, although you can get away with more things receiving than you can when transmitting, especially when it comes to stealth installations. My advice to the beginner is to first get a copy of the ARRL Antenna Book. It has the best overall coverage of antennas in general. This should be your second radio book purchase after you have the ARRL Handbook.

Many individuals opt for a discone antenna for VHF/UHF monitoring. Discones have wide frequency coverage, but little gain. They can also be used for transmitting on multiple ham bands. Having a discone on your roof tells everyone what you are doing. However they can be placed on a camera tripod of similar mount and used indoors. Due to the short (<10 meters) wavelengths involved, high-performance VHF/UHF antennas are physically small in size compared to frequencies below 30 MHz., especially at VHF-high band and above.

RS# 20-176
Scanner Antenna

While I am generally loath to recommend Radio Shack for anything, they still have a few good items remaining for sale in their store. One of them is the RS# 20-176 Outdoor Scanner Antenna. It's spec'd out for 108-1300 MHz. frequency coverage, with peak performance at 152-470 MHz. For the price this is one of the better monitor antennas out there, especially if you are concentrating on the VHF-high and UHF bands. The antenna is 20" high and will easily fit in most attics and crawlspaces. When it comes to covert listening posts, you will come to appreciate attics and ceiling crawlspaces. The antenna is $30, and while you could build one for less money there are times when you just have to grab something off the shelf from a local retail source that will get the job done. Keep this antenna in mind.



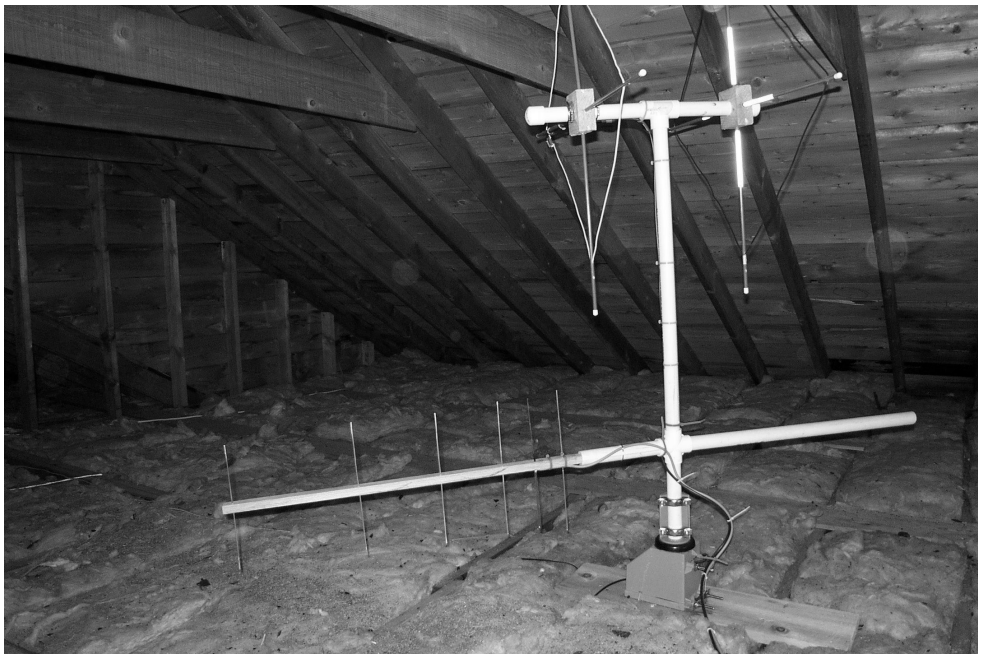
For discreet monitoring of higher frequency ranges, I would recommend the PC board antennas from WA5VJB of Kent Electronics[6]. There are several models available with frequency coverage ranges of 400-1000, 850-6500, 900-2500, and 2100-11000 MHz. This covers many UHF and microwave bands of interest. These antennas are etched on a PC board, and have a very low profile. These are directional antennas, and intended to be aimed at the monitoring location of interest. I however have found that they receive off the back end (or maybe it was the signal itself scattering) to work well for more local monitoring regardless of where the antenna was aimed.

In practice on the UHF and 800 MHz. bands I found these to significantly increase monitoring distance, even when simply mounted on a small camera

6 http://wa5vjb.com/

tripod set up inside and aimed out a window. The price is very reasonable for what you get, and I would suggest acquiring at least the 400-1000 MHz. and 850-6500 MHz. models for your listening post, along with a small camera tripod mount. These are among some of the best UHF monitoring antennas I have used.

In addition to offering PCB antennas for sale, WA5VJB's web site has a reference section[7] containing a wealth of information on antenna systems At the very least you will want to download his paper "Cheap Yagi Antennas."



"When it comes to covert listening posts, you will come to appreciate attics and ceiling crawlspaces."

7 http://www.wa5vjb.com/references.html

Basic Communications Monitoring Techniques

In the United States, most radio license and allocation data is public knowledge. The FCC maintains a list of all non-federal government license holders with frequency data, and it is supplemented with more specific data from hobbyist sites such as Radio Reference. There are two websites that you should bookmark:

http://fjallfoss.fcc.gov/General_Menu_Reports/ - FCC General Menu Reports. Contains FCC license data.

http://www.radioreference.com/ - Radio Reference. This is one of the most popular scanner hobbyist websites.

Between those websites, you will find 90% of the data you need to conduct a monitoring exercise in the United States. It is simply a matter of looking up the information for the area you are operating in, and programming your equipment.

Search Techniques

There are three basic techniques you use when searching for communications activity. They are **spectrum searches**, **band/sector searches**, and **point searches**. Each has it's own advantages, disadvantages, and applications.

A **spectrum search** is the detailed exploration and mapping of the entire frequency coverage range of a particular receiver. I recommend you do this at least once, and periodically afterwards. Spectrum searches take a long time to do properly, but they will provide the most detailed picture of what you can receive at your monitoring post.

A variation of the spectrum search is the **near-field search** using the Close Call function on a police scanner. This is a spectrum search that is limited to signals in your nearby area, about a couple hundred feet for portable radios. Nearby signals, regardless of their frequency, are always a matter of concern until their identity and nature is ascertained. **If you only own one police scanner for whatever reason(s), make sure it has the Close Call function.**

A **band/sector search** is similar to a spectrum search, but only covers part of the receiver's frequency coverage range. Since spectrum allocation data is public information in the United States, this is the second most common search method you will be using to to discover frequencies for specific targets.

A **point search** is the long-term monitoring of specific frequencies. License data for non-Federal Government users is public information, and available online. This is the method you will be using the most, as you will be able to acquire 90% of your targets' frequency data ahead of time.

Covert frequencies are often (but not always) on the same band as the target's licensed frequencies. If your local police department's dispatch channel is on VHF-high band, then it is a good bet their unlisted tactical channel is also there. Using allocation data available in Part 90 of the FCC Regulations (47CFR90), you can perform a band/sector search of the proper band.

Frequency bands can also be determined by looking at the antennas on vehicles, unless the vehicle has a disguised antenna, and on handheld radios.

Frequency Band By Mobile Antenna

- VHF-low band
  60 to 100 inch whip.
  35-inch whip with a 5-inch coil on the bottom.
- VHF-high band
  18-inch whip.
  40-inch whip with a 3-inch coil on the bottom.

- UHF band
  6-inch whip.
  35-inch whip with a plastic band in the middle.
- 800 MHz.
  3-inch whip.
  13-inch whip with a "pig tail" coil in the middle.

Frequency Band By Handheld Antenna

- VHF-low band
  Roughly one foot long.
- VHF-high band
  About six inches long and about as thick as your index or middle finger.
  NB: There exist "stubby" VHF-high band antennas that can be confused with those of higher frequency ranges.
- UHF band
  6 inches long and slender compared to the VHF-high band antenna.
  3 inches long.
- 800 Mhz.
  About 1.5 inches long.
  About 1 foot long with two different thicknesses.

******* It is strongly suggested that you order the catalogs of various antenna manufacturers to get a visual idea of what antennas on each of the bands look like.

Ideally, when doing a band/sector search you should search a range that covers three to five seconds, and with the scanner's fastest speed. This seems to be the average duration for a radio transmission. Let us say you are searching the VHF-High band with a scanner that does 50 steps a second. Channel spacing for VHF-high band is 5 KHz. You should search your target areas in sweeps of 750 KHz. to 1.25 MHz. Search a range for one to two weeks at different times, to catch everything in that range.

If you can safely get within visual range of the target, use a Close Call scanner. This item replaced frequency counters for all of us who liked to do "on scene" signal sleuthing. The target will key up, and within a second you will have the emitter's frequency and be hearing their communications. Expect a detection range of 100 feet for a 1W portable, 250 feet for a 4W portable, a half mile for a 25W mobile, and a few miles for a 100W base station.

Spread Spectrum

Certain users use encrypted or spread spectrum (frequency hopping) communications. Until recently, it was thought that receiving spread spectrum communications (FHSS) was beyond the ability of the average hobbyist, but with the right equipment and under the right conditions it is possible to detect and monitor FHSS communications.[8] The Ticom Zine article predated the availability of inexpensive USB RTL SDRs, so I would expect that the difficulty level of monitoring spread spectrum communications will continue to go down.

I made an observation while using the spectrum scope on an AOR AR8200 in the 902-928 MHz. band. There is a lot of FHSS activity in the 902 band. I noticed that the spectrum scope was registering consistent hits on certain frequencies in the band. Upon monitoring the frequencies in question, I would consistently hear a quick "pop" on them. This is indicative a FHSS signal momentarily landing on a

8 *"Experiments in Spread Spectrum Interception"*, Technical Intelligence Communications (TICOM) Zine, Issue #1 - http://gbppr.dyndns.org/2600/TAP/cybertek/TICOM_Zine_1.pdf

frequency. I have not tried this on other wideband receivers with a spectrum scope, but it shows that FHSS activity can at least be detected at a distance.

In urban or suburban terrain, spread spectrum communications on certain bands, such as Part 15 or ISM, are commonplace. Even in rural terrain utility companies use FHSS on the 902 band for telemetry and SCADA applications, but with directional antennas. In these instances, the detection of FHSS activity on certain bands is not a cause of major concern. In wilderness terrain where there is no apparent infrastructure that needs such support, the detection of FHSS communications in their usual parts of the spectrum is more interesting. Regardless of where you are, detection of FHSS signals in the 30-88, 138-144, 162-174, or 225-420 MHz. bands is a matter of serious interest.

Encryption

Encrypted communications present a low to almost impossible technical difficulty in regards to cracking them, and are also illegal to intercept under the Electronic Communications Privacy Act. Encrypted communications system users will sometimes have equipment difficulties and operate in the clear. A patient listener will wait for this opportunity. One can also determine what unencrypted entities work with the encrypted system user and monitor them to get a picture of what might be going on.

Introduction to Signal Analysis

I will assume that you, in the course of your communications monitoring endeavors, have come across a genuine unidentified ("unid") user while searching the spectrum. You've checked all the scanner frequency lists, e-mail lists, web sites, and online forum postings and have come up with nothing. You wish to identify the unid, and determine the extent of its communications network. To do this, you ask the following questions:

- Frequency (or talkgroup/subfleet if monitoring a trunked system)?
- PL/DPL tone, if any? Single PL/DPL used, or multiple?
- NAC if P25?
- Encrypted or clear? Type of encryption: digital or analog?
- How many stations do you hear?
- How do they identify themselves?
- Signal strength of stations communicating?
- What are they talking about?

The first four characteristics are noted as soon as you discover the unid. You will have some initial information about the others, but as time goes on you will acquire more information. What you should be doing now is noting what information you do have on the unid. Some people like using a computer database, others like 3x5 index cards. The more info you have, the easier it’ll be to identify the unid.

The frequency in question can help tell you the approximate range, extent and purpose of the unid’s communications net. For example, the VHF low-band would likely be used for regional communications between base stations and maybe mobile units. UHF on the other hand, would be for short-range tactical-type communications between several mobiles and portables. UHF portables are limited to a few miles. A VHF low-band base station can communicate a few hundred miles under the right circumstances. What other identified users operate on nearby frequencies?

PL/DPL tones and NACs are other identifiers. Knowing the PL/DPL tone or NAC of an unid enables you to cross-reference it to other frequencies. If a police

department uses a certain PL on their repeater, and an unid with surveillance activity is noted on the same band with the same PL, then it's quite possibly an unlisted channel for that police department. Knowing how many different PL/DPL tones are in use on a given frequency tells you approximately how many different nets, or distinct groups of communicators, are active on that freq. On a low-power portable frequency such as 154.600 MHz., users will use a "unique" PL/DPL tone so they don't have to hear everyone else. There are only a limited number of PL/DPL tones however, so duplication by different nets is inevitable. Other users won't want to spend the extra money for radios with PL/DPL capability, run without it, and tolerate the other users on the channel breaking their squelch. If you hear an unid running DPL, then you can be reasonably certain they are running real "commercial land mobile" equipment as few ham rigs have DPL. NACs serve the same purpose as PL/DPL for P25 radio systems. Of interest is the fact that even on an encrypted P25 system, the NAC is unencrypted.

Most radio communications businesses maintain commercial trunked radio systems and the occasional community repeater. The license for the system is in their name, and they rent airtime to various businesses and organizations. The individual users will not be licensed, instead running under the radio shop's license. Each subscriber will be assigned his or her own talkgroup on the system, or PL/DPL tone on the repeater. Motorola sold all their commercial SMR systems to Nextel who took them off the air and replaced them with iDEN (digital) systems. This prompted many radio users to seek out alternatives to Nextel. Many radio shops have set up LTR trunked systems, which have replaced their community repeaters for the most part. LTR is an open protocol. This not only means a wide availability of equipment for the business offering these services, but equipment for the monitoring enthusiast as well. There are also a few commercial SMRs running the GE/Ericsson EDACS system on 800 MHz. Each system can have several dozen users on it, making them a nice challenge for the monitoring hobbyist who wishes to map them out.

If an unid is encrypted, you will at least know whether or not the encryption method is analog or digital. If they are using a simple single-frequency inversion method, then it is possible, although illegal, to decrypt their communications and proceed. If they are using something advanced such as DVP, DES, or Rolling Code then you will not be able to monitor the actual communications. You will still at least be able to note how often the frequency sees activity, and the signal strengths of the stations communicating. Voice encryption is often subject to failure, and you might catch a station operating in the clear if you monitor long enough. DIY-types should note that single band frequency inversion is the same system used in the Ramsey Electronics SS-70A.

At this point, you have all the immediate characteristics of the unid noted down. The rest is just a matter of time. The remaining questions you have in identifying the user are:

- How many stations do you hear?
- How do they identify themselves?
- Signal strength of stations communicating?
- What are they talking about?

All these will eventually answer the main question, "Who am I listening to?" The best thing to do at this point is take a receiver and dedicate it to the given frequency. You can acquire basic 16-50 channel scanners for almost nothing at flea markets, pawn shops, and hamfests for this purpose. If you want 24 hour monitoring of the frequency, attach a VOX-operated tape recorder to the scanner. Many scanners come equipped with a "tape out" jack for easy connection. Otherwise, go to Radio Shack and pick up one of the suction cup telephone microphones. This is attached to a telephone receiver by the earphone to record phone calls. Attach it near the speaker of the scanner. Experiment to find the best place to attach it to the scanner. For those of you who really want to get into things, the late Bill

Cheek's Scanner Modification Handbooks contain a wealth of information on modifying your scanner to make communications monitoring easier. You can add event counters to see how many times the frequency breaks squelch, time-stamping for monitored communications, and a whole host of other enhancements.

You will be able to initially discern IDs used on the frequency and the signal strength (even if approximate) of the stations on the net. You will also know what they are saying if it's in a language you can understand, although you might get a little tripped-up on any specialized jargon. Log it all down. Eventually you'll also be able to recognize the voices of the various people on the frequency, and match them to IDs. The signal strength of each user will tell you how approximately how far away they are from your location, and whether they are base or mobile/portable stations. Consistent signal strength will indicate a base station or repeater. Mobile and portable stations will have varying signal strengths and often "mobile flutter" on their signal.

When listening to an unid with the intent of identifying it, two things you should listen for are locations and specialized trade jargon. They can be cross-referenced to assist in identifying the user. Street maps of your nearby locales are good reference to have. I don't advocate "call chasing", going to the site of an incident that you've heard on your scanner. This can be dangerous, and complicates matters for public safety personnel who are working the incident. However, if you've determined you are listening to an obviously civilian unid on a trunked system or community repeater who was just sent on a service call to a location that's a few blocks away from you, it would be a different matter. It would be worthwhile to take the dog for a quick walk to see who you are listening to. On that note, information you discover on community repeaters or trunked systems is transitory in nature. The talkgroup or PL may belong to a different business next month.

If you listen long enough and pay attention to the communications you are receiving, you will identify the user. The amount of time will vary with the nature of the user, and how often they are on the air. Once you identify the user, the rest is up to you. You can become quite intimate with the operations of a business by monitoring their communications. Monitoring local public safety communications will often give you a better handle on what's going on in your community than the local newspaper. The possibilities are endless. As an intellectual exercise your communications monitoring endeavors will be delving into such diverse areas as electronics, geography, sociology, research skills, and current events. At any rate, communications monitoring analysis is far better a pastime than sitting in front of the television. Chances are you'll have some questions regarding communications systems or activities in your locale that could be answered by using communications monitoring analysis. Some questions that might come to mind are:

- Who are the users of local community repeaters and SMR systems?
- What are high crime areas in my community?
- What are the most common crimes in my community?
- What is the reliability of the local utility infrastructure (electrical, telephone, CATV, gas)?
- "X" is obviously employing radio communications, but no license is listed for them. What's their frequency?
- What frequencies and/or radio systems are the local public safety agencies using other than the publicly listed ones?

Communications Monitoring Notes

- In most places, some form of emergency medical services dispatch is done on 462.950 and 462.975 MHz. which are also known respectively as MED-9 and MED-10. Due to the myriad of commercial ambulance services and community EMS agencies all using different radio systems, the MED channels will probably remain analog FM for some time. In most medium-sized and larger cities, there is a constant stream of traffic on EMS channels. Most of it consists of routine calls.
- Due to the variety of communications systems that could be used by various public safety and emergency services agencies in a region, mutual-aid, interoperability, and emergency management agency frequencies are generally analog and unencrypted. These frequencies generally remain unused unless there is a major incident occurring, so they good indicator frequencies.
- Volunteer fire departments and ambulance corps whose members carry voice pagers will have their dispatch channel analog and unencrypted. This is because members also have scanners in addition to their pager that they listen to for call-outs. Fire departments in general have been slow to adopt P25.
- Fire departments are a useful monitoring target as the frequencies are only active when something is happening, and they are first responders to any disaster situation. Many areas maintain a regional/county dispatch center that handles all departments in a locale on a common frequency. Mutual-aid/intercity frequencies are useful for indications of incidents requiring multiple department response. Response and mitigation operations are often moved off to tactical/"fireground" frequencies.
- VHF aeronautical and marine band frequencies are analog and unencrypted. They are often a good indicator of an incident involving aircraft and nautical craft. The two primary frequencies of interest are the aviation emergency/”Guard” channel of 121.500 MHz. and Marine Channel 16, which is the calling and emergency frequency, at 156.800 MHz.
- Many bus and taxi companies still operate on conventional analog systems. They are useful for indications of incidents on the roads. Taxi drivers are especially known for making various comments over the air about interesting things they see on the road. Taxi companies in urban areas are often concerned with their calls getting stolen by the competition, so encryption and the use of mobile data services is not uncommon.
- Public works departments and utility companies generally consist of routine traffic until something happens. Then they are full of information about disaster response, and services recovery. I personally find that the routine traffic of utility companies provides an interesting picture of the local infrastructure. Public works departments and utilities are required monitoring after many types of heavy weather.

  Public works departments are generally slow to upgrade their equipment, and often reuse surplus radios from their municipality's police and fire departments. This means that in most cases you'll be able to monitor them with you basic analog, non-trunking police scanner. While FCC licenses can be looked up for specific localities, they traditionally operate in the following frequency ranges:

  33.20 – 33.10 MHz. (20 KHz. spacing)
  37.90 – 37.98 MHz. (20 KHz. spacing)
  39.06 – 39.98 MHz. (20 KHz. spacing)
  45.00 – 46.00 MHz. (20 KHz. spacing)
  47.00 – 47.40 MHz. (20 KHz. spacing)
  150.9950 – 151.1375 (7.5 KHz. spacing)

153.7400 – 154.1225 (7.5 KHz. spacing)
154.9850 – 155.1525 (7.5 KHz. spacing)
155.7150 – 156.2400 (7.5 KHz. spacing)
158.745 – 159.2025 (7.5 KHz. spacing)
453.0000 – 454.0000 (12.5 KHz. spacing – Paired with mobiles at 458.0000-459.0000 MHz.)

- Most utility services in the US, especially in rural areas, are still on VHF low-band due to having a need to communicate over distant regions. This enables you to monitor a large area with just a few frequencies, provided you have an adequate antenna. Try searching through these frequency ranges:

  37.46 - 37.86 MHz. (20 KHz. spacing)
  47.68 - 48.54 MHz. (20 KHz. spacing)
  153.4100 - 153.7325 MHz. (7.5 KHz. spacing)
  158.1300 - 158.2725 MHz. (7.5 KHz. spacing)
  451.0000 - 452.0000 MHz. (12.5 Khz. spacing - Paired with mobiles at 456.0000 - 457.0000 MHz.)

- Police departments are probably the least desirable monitoring target. Many agencies are sensitive to being monitored and are encrypting their system. Even on unencrypted systems, most of the radio traffic is mundane. Your best bets for PD monitoring before and during a disaster are the interoperability and mutual-aid frequencies as they are only active during a major incident.

- If your police department is running encryption, monitor the frequencies used for car-to-car, surveillance, and repeater input. If the usage for specific frequencies is unknown, monitor what's listed for mobile/portable operation in their FCC license. You may not be able to hear what's being said, but you will at least have an indication something is going down in your neighborhood when you hear traffic. Also keep in mind that encryption sometimes fails or gets accidentally shut off.

- The Internet is a great source for scanner frequencies. A quick Google search should find what you need, or check the frequency database at Radio Reference[9].

Portable Radio Frequencies

This list contains frequencies that are assigned by the FCC for low power or itinerant users, license free frequencies (FRS, MURS, and Part 15), and other frequencies that have been reported to usually have low power communications on them. Frequencies often identified by a common designation (i.e. "dot" frequencies) are so noted. The "dot" designators come from the practice of equipment manufacturers putting little colored circle or star stickers on radios that are equipped with certain common frequencies. Consequently, the "dot" frequencies are among the more active ones on the list.

VHF-Low

In the VHF low band we have a few business/low power channels, two itinerants, and the classic 49 MHz. Part 15 frequencies. The 49 Mhz. frequencies were originally the domain of cordless phones, .hands-free. walkie-talkies, and baby monitors. Judging from the phones on sale at local department stores, cordless phone have all migrated to 900 MHz., 2.4 GHz., and higher. The walkie-talkies have been supplanted by the superior FRS radios. Some baby monitors have been reported, but even those are going to 900 MHz.

30.84
33.12
33.14
33.40
35.02
35.04 – Itinerant

9See http://www.radioreference.com/.

43.04 – Itinerant
49.830 - Part 15
49.845 - Part 15
49.860 - Part 15
49.875 - Part 15
49.890 - Part 15

VHF-High

The VHF-High and UHF Business bands are where most portable radio activity is these days. These are frequency bands of the license-free MURS and FRS radio services, and of all the inexpensive Ritron and Motorola "job site" portables available from Home Depot and Grainger. There portables operating on GMRS repeater output frequencies available from places like Wal-Mart and Target Stores for $50/pair. While licensing is required to operate on GMRS, it is thought that many users of these radios neglect to do so. There are also a few frequencies in the 169-172 Mhz. range that are used for wireless microphones. **These are the most active frequency ranges for portable radios.**

Not listed, but also of definite interest are the VHF Marine Band frequencies between 156.25-157.425 MHz. Despite being a violation of FCC regulations, many individuals use VHF Marine portables on land, especially if they are more than 100 miles or so from a navigable waterway. If you are near a navigable waterway, the non-commercial and government channels often carry interesting traffic.

151.505 – Itinerant
151.5125
151.625 - Itinerant, Red Dot
151.655
151.685
151.700
151.715
151.745
151.775
151.805
151.820 – MURS
151.835
151.865
151.880 – MURS
151.895
151.925
151.940 – MURS
151.955 - Purple Dot
152.885
152.900
152.945
153.005
154.490
154.515
154.5275
154.540
154.5475
154.570 –MURS/Blue Dot
154.600 - MURS, Green Dot
158.400 – Itinerant
158.4075
169.445 - Wireless Mics
169.505 -Wireless Mics
170.245 - Wireless Mics
170.305 -Wireless Mics
171.045 - Wireless Mics
171.105 -Wireless Mics
171.845 - Wireless Mics
171.905 -Wireless Mics

UHF

451.1875
451.2375
451.2875
451.3375
451.4375
451.5375
451.6375
451.800 – Itinerant
452.3125
452.5375
452.4125
452.5125
452.7625
452.8625
456.1875
456.2375
456.2875
456.3375
456.4375
456.5375
456.6375
457.3125
457.4125
457.5125
457.525
457.5375
457.550
457.5125
457.5625
457.575

457.5875
457.600
457.6125
457.7625
457.8625
461.0375
461.0625
461.0875
461.1125
461.1375
461.1625
461.1875
461.2125
461.2375
461.2625
461.2875
461.3125
461.3375
461.3625
462.1875
462.4625
462.4875
462.5125
462.550 – GMRS
462.5625 – FRS1
462.575 - White Dot-GMRS
462.5875 – FRS2
462.600 – GMRS
462.6125 – FRS3
462.625 - Black Dot-GMRS
462.6375 – FRS4
462.650 – GMRS
462.6625 – FRS5
462.675 - Orange Dot-GMRS
462.6875 – FRS6
462.700 – GMRS
462.7125 – FRS7
462.725 – GMRS
462.7625
462.7875
462.8125
462.8375
462.8625
462.8875
462.9125
463.2625
464.325
464.4875
464.500 -Itinerant/Brown Dot
464.5125
464.5375
464.550 –Itinerant/Yellow Dot
464.5625
464.600
464.700
464.825
464.9125
466.0375
466.0625
466.0875
466.1125
466.1375
466.1625
466.1875
466.2125
466.2375
466.2625
466.2875
466.3125
466.3375
466.3625
467.1875
467.4625
467.4875
467.5125
467.5625 – FRS8
467.5875 – FRS9
467.6125 – FRS10
467.6375 – FRS11
467.6625 – FRS12
467.6875 – FRS13
467.7125 – FRS14
467.750
467.7625 - J Dot
467.775
467.7875
467.800
467.8125 - K Dot
467.825
467.8375
467.8625
467.850 - Silver Star
467.875 - Gold Star
467.8875
467.900 - Red Star
467.9125
467.925 - Blue Star
469.2625
469.4875
469.500
469.5125
469.5375
469.550
469.5625

800 MHz.

The 800 MHz. land mobile band is mostly home to public safety agencies (both conventional and trunked), and a small number of business/industrial users. The entire 851-856 MHz. region has potential for portable use, especially in urban areas. The 902-928 MHz. band is not only a license-free band, but is also an amateur radio band. In addition to cordless phones (that are moving up to 2.4 and

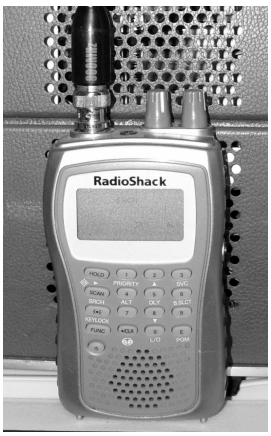
5.8 GHz.), you will also find baby monitors (including .two way. ones), wireless headsets/microphones, fast-food restaurant order window systems, wireless cameras (now mostly at 2.4 GHz.), wireless data systems, toll-road transponders (ITS systems), amateur radio operations, and who knows what else.

851.0125
853.4875
853.9875 - Public safety mobiles and portables. The entire 853-854 MHz. section sees use.
902-928 - Part 15

Got Visual?

***** If you have a visual on the portable radio user, use a police scanner with Close Call.** As long as you are within 250 feet or so, the near-field detection function will acquire the frequency in a couple seconds. If you don't have even a basic scanner with Close Call, pick one up. The Close Call will also detect mobiles and base stations at a longer distance.

Above Left - Uniden BC-125. Entry-level scanner with Close Call. No 800 MHz. coverage.
Above Right - Uniden BC-346. Analog Trunktracker scanner with Close Call and 800 MHz. band coverage.



Left:
Radio Shack PRO-83
"Signal Stalker"

aka
Uniden BC-92XLT
"Close Call"

The scanner that revolutionized near-field signal detection.

The Bubba Detector

Credit for the name goes to MSG Dan Morgan who runs the blog at http://danmorgan76.wordpress.com/. If you are not reading it on a frequent basis, you are wrong. The Bubba Detector is a small, portable wideband communications receiver that is programmed up with every conceivable VHF/UHF portable radio frequency. That includes my portable frequency list, CB, MURS, FRS, GMRS, and VHF Marine Band. The Icom and AOR portable radios are a popular model used for this application. These receivers have at least 1000 memory channels which is enough to program in the necessary frequencies.

Icom IC-R5 Wideband Receiver and TL-29 knife.
A popular combination with SOT-A types.

While a Close Call scanner can perform a quick spectrum search and acquire a signal within a second or two, it has the disadvantage of being limited to a range of a couple hundred feet for detecting portable radios. By doing a point search of all known common portable radio frequencies with a wideband receiver, that detection range can be extended to a couple of miles, or even greater if a gain-type antenna is used.

The smaller Icom (R-2, R-5, R-6) portable receivers are the more popular models for this application.

Radio Services Available For Use

There are a number of radio communications services available for grid-down communications. Some require you to get a license from the FCC, while others are license-free. The licensed bands are:

- GMRS (General Mobile Radio Service)
- Amateur Radio

The license-free bands are:

- CB (Citizens Band)
- FRS (Family Radio Service)
- MURS (Multiple Use Radio Service)

There are also additional provisions under Part 15 of the FCC Regulations that allow for limited license-free operation. This is the reg that permits such things as FM Wireless Microphones, Baby Monitors, Cordless Phones, 902 MHz. Band, and Low Frequency Experimenter (LowFer)hobbyist communications.

A major controversy among preppers and III%ers involves the matter of FCC Licenses. Extreme libertarian and anarchist types feel that getting "permission" to use the free airwaves is wrong, and disparage those who get licensed. My opinion is that becoming a skilled communications operator requires practice. You would not buy a rifle, throw it in the safe until TSHTF, and then take it out expecting to be an expert shot. Radio is the same way. While it may be true that licenses won't matter during WROL, we have not reached that point yet. To get up to speed with commo, you need to get on the air. Without the ham license, no one will talk to you, and some will go out of their way to find you and turn you in to the FCC. Posturing and libertarian free-airwave rants aside tough guy, that's a hassle you don't need.

For those of you who don't wish, for whatever reason, to get a ham or GMRS license, you can avail yourself of the more limited license-free bands, and still have local communications capability.

Radio Communications For Dummies – Sparks' Version

When we went to BCT (Basic Training for your civilians) in the Army, we learned several basic, yet important, tasks relating to communications. We learned the phonetic alphabet, how to use an SOI (Signal Operating Instructions) which is a list of frequencies and codes, basic radiotelephone procedure, and how to operate field phones and the squad radio, which at the time was the PRC-77. That was the "communicate" part of the "shoot-move-communicate" trinity that gets hammered into your head throughout Basic. Now this was in Basic Training, so **everyone** who was in the Army learned this.

After basic training, we went to AIT – Advanced Individual Training. That's where you learn the skills specific to your MOS – Military Occupational Specialty. Your MOS is your job in the Army. Those of us with Communications-related MOSes learned more specific and advanced communications skills, whether you were doing single-channel, multi-channel, field wire, or maintenance. However, even if you were an clerk or a truck driver you still had learned those basic communications skills during your stay in BCT.

The point to all this is that while everyone should have some commo basics down, not everyone is going to be, or is cut out to be, an uber commo operator. However, there are some things that I'm not an expert at which is why we form a team of people with different skill sets to complement one another. On that note, I have to recommend Don Paul's[10] books Everybody's Outdoor Survival Guide, and Great Livin' In Grubby Times.

So it all depends on what you want to do, and what your resources are. Let's run through a few scenarios.

- ***I don't have much cash, but I've got plenty of time, and am willing to learn whatever I can. I am either technically inclined, or can do a good job faking it, and have no problems with getting a ham ticket.***

  For starters, you need to check out this guy's website for inspiration: http://www.neoanderthal.com/wa7mlh.html. He lives in a cabin in the woods, and has built his own gear from parts he picked up cheap at hamfests. And his other hobbies are fly fishing and primitive skills! Get yourself a used copy of the ARRL Handbook for a few bucks. The knowledge in that book is invaluable. Join the local ham club and find yourself an elmer. Your elmer will help you get on the air with equipment that meets your budget. Build your own gear and test equipment, or find stuff at hamfests that isn't too broken which you can fix up.

  If you look closely at WA7MLH's pictures, you can see the books in his reference library. They are:

  1. **ARRL Handbook** – I believe that's a 1988 edition based on the color of the spine. I happen to have that year too, and I think I paid $5 or $10 for it at a hamfest.
  2. **Solid State Design For The Radio Amateur** – This is discontinued, and the ones being sold on Amazon are way overpriced. Search around at hamfests and you'll find one for $5 or so. Otherwise, this is a good book to have. If you're good with a search engine, you'll find a PDF version…
  3. **Introduction To Radio Frequency Design** – Another discontinued ARRL title. I don't own it. Some people like it, some people don't. According to some reviews, it doesn't cover enough practical DIY stuff.

10 http://www.survival-books.com/

4. **Experimental Methods In RF Design** – This is the updated version of **Solid State Design For The Radio Amateur.** It's $50 new, but Amazon has some used ones for less. Lots of good info in this one. Pay attention to the info about portable rigs. The authors are heavily into adventure radio stuff.

If you're willing to invest the time in learning a bit about electronics and DIY, you can put together a good station without having to spend a lot of money.

- ***I'm not interested in getting my ham license. I've got some money to spend on commo gear, but nothing elaborate.***

Get yourself some FRS radios and CB gear, and you are set. Ideally one FRS radio for every member of your family/team, mobile CBs in each car, and a base CB. I've found the two best brands of FRS radio to be Motorola and Midland. For CB gear, I like Cobra and Uniden.

FRS Radio Choices: Motorola Talkabout MT350R or Midland GTX895

CB Radio Choices: Cobra 148GTL, Uniden President series, Uniden PRO-510. Actually any Uniden or Cobra radio is good.

CB Mobile Antennas: 102" stainless steel whip, Wilson 1000, or K40

CB Base Antennas: Antron A99

Find a local truck stop, such as TA[11], for CB gear. FRS radios can be had just about anywhere. You might even get lucky and have a CB shop nearby. Ask around.

- ***I've got the cash, and have no problems with getting my ham ticket. I want to buy my gear new, and get it over with. What do I get if I want a transportable base station/portable unit for field use?***

Get yourself an Icom IC-7200 if you want a transportable base, or an Elecraft KX-3 if you want a portable. Get or build an NVIS antenna. Get on the air. You are set.

- ***All the members of my team have a Technician class ham license, and we want rugged portables for an intra-team radio.***

I recommend the Yaesu FT-60. It covers the two most common VHF/UHF FM ham bands (2 meters & 70cm). They are rugged, have all the usual accessories, are easily modified for outband operation for when we reach WROL, and **have a AA alkaline battery pack available for them**. There are probably other radios out there from Icom and Kenwood that are good, but I've used these and therefore am comfortable recommending them.

I don't recommend you any of the cheap Chinese-made HTs such as the Woxun, Puxing, Baofeng, et. al. China is our enemy, and after evaluating one for a few years I have my doubts as to long-term durability. If you can't afford the FT-60 then hit the hamfests for a gently used HT.

- ***My team doesn't want to get their ham license, but we want something better than FRS radios. What do we buy?***

Go with an MURS radio, or with the 900 MHz. Motorola DTRs. For MURS you can buy a Dakota Alert M538-HT from http://www.murs-radio.com/ or go with the Motorola RMM2050. The VHF MURS band is better for rural/wilderness terrain. The DTRs are better for urban terrain.

11 http://www.tatravelcenters.com/

CB – Citizens Band

There was a time when the only option for legal license-free communications was Citizen's Band. Those of us who were seriously into communications went the extra mile and acquired our ham licenses, but even after getting the ticket we still used CB for its de-facto "jungle telegraph" capability. On the highway, it was unlikely that you would ever get a speed-trap report on 146.52 MHz, but all you needed to do was listen on Channel 19 and the information would usually come to you unsolicited. Mobile and base CBs provide some decent communications capability. Depending on your location, you can routinely achieve a 20-mile range communicating between a base station and mobiles with good antennas.

According to the FCC, CB is "a private, two-way, short distance voice communications service for personal or business activities of the general public." CB uses forty channels around 27 MHz. in AM or SSB mode with power limits of 4 watts carrier power on AM, or 12 watts peak envelope power on SSB. Although it is illegal to communicate with stations more than 155.3 miles away on CB, any ham who has worked the Ten-meter band will tell you that 12 watts is more than enough to achieve world-wide communications when the band is open.

Even if you are a lone wolf with absolute minimal interest in RF transmitting capability, you should have at least one decent 12V capable base/mobile rig with a decent antenna, preferably one with SSB capability. The ready availability, lack of individual license requirement sheer number in circulation, and significant range advantage over FRS handhelds will make this the post-TEOTWAWKI communications mode of choice among for the average person.

11 Meter "Freeband"

The "Freeband" refers to the frequency ranges just above and below the standard CB band channels, or 25-26.965 MHz. and 27.405-28 MHz. Despite being a violation of FCC Regulations in the US, this band is very popular with radio communications hobbyists who want to get off the the regular CB channels. Typically, the following equipment is used:

1. Modified CB radios.
2. Ham "10 meter" SSB radio with expanded frequency mod.
3. Export CB SSB radio, usually with "ABCDEF" Band switch.
4. Ham HF SSB radio with "MARS/CAP" mod.
5. Commercial land mobile, Marine, or Aeronautical HF SSB radio.
6. Military surplus HF SSB radio/HF manpack transceiver.

I am aware of at least one group of survivalists who use 11 Meter Freeband for their communications, although I would not recommend operating on Freeband in times before WROL. However, the capability is easy enough to acquire, and I would definitely advise having some gear that covers this frequency range. Just use it only for listening.

FRS – Family Radio Service

The FCC authorized FRS (Family Radio Service) in 1996 as "a private, two-way, very short distance voice communications service for facilitating family and group activities." FRS uses 14 channels around 460 MHz. in narrow-band FM mode with a power limit of .500 milliwatts (1/2 watt) effective radiated power into a permanently attached antenna. You cannot use an external antenna with a FRS radio. A half-watt FM on UHF will give you about a one or two mile range tops unless you're talking between two mountaintops. If your group is in need of inexpensive short-range tactical intra-group communications, you can pick up FRS radios for about $20 each in quantity. FRS radios are plug and play. You insert batteries, select a channel, and start talking.

The FRS radios you see these days have 22 channels. They are actually cover both the FRS and GMRS bands. The extra 8 channels belong to the General Mobile Radio Service, and require a license from the FCC to legally operate on. FRS channels (1-7) are also shared with GMRS. A GMRS license allows one to run higher power than FRS for longer-range communications. The more expensive FRS radios advertise that they have "38 privacy codes" (or more) for a total of "532 channels of communications" (or more). This is a gimmick, and those radios only have the same 14 frequencies as any other FRS radio. The "privacy codes" are simply a subaudible tone or digital code, aka CTCSS/PL or DCS/DPL, that is transmitted under your audio. When used, it keeps you from hearing communications on your frequency not using the same tone as you. It's mostly used as a courtesy and a means of filtering out other parties who are using the same frequency from breaking your squelch. They don't offer any communications security. People with police scanners, and FRS radios that aren't using a "privacy code" can still hear you.

MURS – Multi-Use Radio Service

MURS is an interesting animal with a lot of potential. MURS operates in the VHF-high band on 5 frequencies: 151.82, 151.88, 151.94, 154.57, and 154.60 MHz. The last two were once low-power business band frequencies that were part of a group known as "color" or "dot" frequencies. The freq of 154.57 was "blue dot", and 154.60 was "green dot". This scheme is from manufacturers placing little circle-shaped stickers on the radio to indicate common low-power frequencies. The 154 MHz channels see regular traffic from previously licensed users, and others. The 151 MHz. channels have seen some increase in activity over the years, but are still fairly quiet for the most part, especially in rural areas.

MURS handhelds are on the market starting at about $100 each. In spite of it having only 5 frequencies instead of CB's 40 and FRS's 14, there are some nice things you can do with it. MURS is allowed 2 watts output, which is really about the same as CB, and much more than FRS. You can run external antennas like CB, and a ¼-wave antenna is only 18" long instead of 104". This makes nice high-gain antennas on MURS much more manageable than on CB. That 45" whip antenna that only performed moderately on CB is now a 5/8 wave on MURS that gives you 3 dB of gain; doubling your radiated power output. You can also adopt some of the tricks hams use on their two-meter band (144-148 MHz.) to squeeze extra range out of those two watts of RF.

Here is where things get complicated. FCC regulations specify that radios must be specifically type-certified for MURS (47CFR95) to be legal. The currently available MURS-legal radios such as the Motorola RMM2050 and Dakota Alert M538-HT all have fixed rubber-duck style antennas. Operating reprogrammed business-band (Part 90) or "MARS/CAP" modified 2 meter rigs is technically illegal. Some of you who have frequented the communications sections of certain survivalist forums have undoubtedly been told this by some of their more hamsexy denizens.

The FCC created MURS in response to the complaints they were getting about unlicensed users on the blue dot and green dot frequencies, much the same way they they eliminated individual licenses for CB when the number of unlicensed users exceeded licensed users. Consequently, it is the opinion of many that active enforcement of MURS regulations has a very low priority with the FCC. Many MURS users have been observed running surplus LMR or modified ham gear, often in excess of the 2 watt power limit imposed on MURS by the FCC. An online search of FCC Enforcement actions at the time of this writing showed one Notice Of Apparent Liability For Forfeiture issued against a business in California for selling non-certified radios advertised for use on MURS. Go figure.

One MURS item of interest is the Dakota Alert[12] MAT (MURS Alert Transmitter), shown here with their MURS HT. It is a passive infrared sensor that transmits on the MURS band. If you've listened to the frequencies, you've probably heard them announce "Alert Zone One."

The MAT can be programmed for any of the five MURS frequencies with any of the 38 standard CTCSS tones. It has four different zone messages. The MAT also has an external BNC jack for its antenna connection. You could hook up a small Yagi antenna to increase your range and add some directionality to the signal. This could be a handy item for monitoring activity in a remote location, especially if your group uses MURS for intra-unit comms.

12 https://www.dakotaalert.com/

902-928 MHz.

The 902 Band as I call it is a relatively new addition for license-free wireless communications. It is also known to ham radio operators as the 33cm Band. It covers the frequency range of 902-928 MHz. and is shared by many different users. In this band you will find ham radio operators, older cordless phones, wireless cameras and microphones, baby monitors, older wireless networking and data communications equipment, RFID, other FCC Part 15, and various users in the Industrial Scientific & Medical (ISM) radio service. Over the years, the 902 Band has become a catch-all for any number of different radio users.

Motorola makes the "DTR" series of handheld radios that operate in the 902 Band using Frequency Hopping Spread-Spectrum (FHSS) communications. Instead of a radio channel being a single frequency as it is on FRS, GMRS, MURS, or CB a spread-spectrum channel is actually a group of frequencies that the radio hops through in a predetermined algorithm. This means that police scanners, including the near-field Signal Stalker type units, will not be able to intercept the signal from these units. There are three models available. From low to high-tier they are DTR-410, DTR-550, and DTR-650. The two you should look for are the DTR-550 and DTR-650. You should also look for the optional keypads that connect to the radios for extended text messaging capability. They are a solid, mil-spec, easy to use radio that requires no license.

Field performance of these radios is very good, although 900 MHz. favors urban and suburban terrain over rural. The average range in rugged terrain with stock antennas was a quarter mile. That's still the distance of 4 1/2 football fields. Car to car from inside the vehicle was a mile. Inside a building, we managed to communicate 50 floors before the signal degraded. That's exceptional considering Motorola specs the range to 30 floors. Out in open flat suburban terrain we managed a two mile range with these radios. These radios far exceeded my expectations, and I would not hesitate to use them if my AO was predominately urban.

The DTR-550 and DTR-650 have detachable antennas. The stock rubber duck antenna can be substituted with a mobile or base antenna for increased effective radiated power. Since the 902-928 MHz. band sees a lot of point-to-point telemetry and control applications, there is a plethora of antennas available. One of the more interesting examples for this radio would be the PC Board yagi and log-periodic antennas made by Kent Electronics.

Also on the 902 Band are data transceivers used for SCADA and other telemetry communications in utility and industrial applications. While these units use proprietary hopping schemes and data protocols that are unique to each make and model, their user interface is usually either standard Ethernet or RS-232. For secure data applications, especially if supplemented with encrypted communications software, they would be useful for point-to-point applications between base locations and offer greater communications range than 802.11 WiFi equipment. They are something you should keep your eyes open for at hamfests.

Amateur (Ham) Radio

The best source of information for getting your amateur radio license comes from the American Radio Relay League (ARRL).[13] Their website is goldmine of information for anyone interested in getting their ham ticket. The license structure has changed significantly since I was first licensed over twenty years ago. Proficiency in Morse code (CW) is no longer required for any class of license, and there are only three classes of license: Technician, General, and Extra. The entry-level Technician class offers all VHF, UHF, and microwave ham band operating privileges. The next level is General class, and offers the majority of shortwave (HF) bands. Extra class is the highest level, and offers the remaining portions of the HF bands not open to General class. The pool of test questions for each class is published and available online. If your recall is good enough, you can simply memorize the test pool questions for all three tests and walk away from having no ham license to an Extra in a single sitting. Most people however require a few weeks of studying per test. In my wife's case, she took a week of studying to pass the Technician class, and three weeks after that for her General.

Ham radio is a multi-facted hobby, and there are some facets that you'll want to concentrate on. One of the easiest facets to start with is EMCOMM[14] through RACES[15], ARES[16], or Skywarn. In most places, all three organizations are handled by the same club. RACES is an actual official government function sponsored by an area's emergency management office for emergency disaster communications via ham radio. ARES is similar, but operates through the ARRL as opposed to the local government. Skywarn is sponsored by the National Weather Service and ARES for severe weather reporting. I have found that many hams involved with these three functions are not only a wealth of information on disaster communications, but are also often survivalists. RACES, ARES, and Skywarn are organizational as opposed to technical facets of amateur radio. There are also technical aspects of the hobby that are well suited for survivalists.

QRP is one of the aspects of the hobby that falls into our criteria for grid-down communciations. QRP is an aspect of ham radio in which hams communicate using low power (under 5 watts) radios. QRP equipment can be small, battery operated, and often home-brew. One of the most notable characteristics of QRP operation is the extensive use of CW. When I got my Novice ticket in 1984, CW proficiency was a requirement for an amateur radio license. I did a little CW operating after first getting my ticket, but at the time it held little interest for me. These days I've been slowly dusting off my extremely rusty CW skills as I find myself increasingly interested in operating QRP. CW is no longer a requirement to get any level of ham license, but knowing how to send and receive code is very usefulas a survivalist skill, especially since you could fit an entire QRP station in the pockets of a BDU jacket. You can put together a QRP station that fits in two tuna cans for under $100[17]. I have used the "Tuna Tin" transmitters, as they are called, as a test with survivalist newbies to see who is serious about communications. Individuals who fail to see the utility of an inexpensive pocket-sized transmitter-receiver combination that runs off of a couple of 9-volt batteries automatically fail the test.

Many survivalist hams are fond of older tube-type equipment, known affectionately as "boatanchors". Boatanchors do have some features that make them suitable for survivalist communications. Schematics for them are readily

13 http://www.arrl.org

14 Emergency Communications

15 Radio Amateur Civil Emergency Services

16 Amateur Radio Emergency Services

17 Website at http://www.qrpme.com/

available. Just about every boatanchor manual I've examined included a full schematic of the radio in question. The technology is easily repairable with hobbyist resources. A workbench of basic test equipment and tools is all that you need, along with some spare parts and RF knowledge. Tube gear is also more resistant to effects of electromagnetic pulse (EMP) which is a concern among some survivalists.

While disaster communications is a major aspect of amateur radio, certain survivalist-related aspects of the hobby remain a minority form of specialization. Most EMCOMM types put together a basic HF and 2-meter VHF station, erect nominal antennas, and concentrate on the operation and public service aspects of EMCOMM. Survivalist-oriented aspects of the hobby such as QRP, CW, boatanchors, and home-brew electronics don't enter into their participation of the hobby. One of the nice things about the Internet, especially as it relates to ham radio, is that you can interact with a greater variety of fellow hams than you would if you were limited to your local ham club, as I was back in the mid 1980s. For example, I know of one local ham who plays with military surplus radios, and his specialization is different than mine as he focuses on older military aircraft rigs. There are however numerous lists catering to the military radio enthusiasts, and on one such list I found about a dozen members who hail from New England and get together regularly at NEAR-Fest[18] (formerly Hosstraders). Some of them have been getting together at Hosstraders long before I was licensed twenty-five years ago.

So where does this bring the novice survivalist ham, and what should you do? That depends on how much you want to get into amateur radio as a hobby. I'm an old-school hardware hacker, like tinkering with electronics, and believe that technological skills are are very important part of survivalism. Other survivalists, yourself included, may feel that communications are important, but are involved in enough related hobbies at present to preclude starting with electronics. Get your ham ticket, and get in with a local EMCOMM-oriented club. But a copy of the ARRL Handbook and ARRL Antenna Book. Pick yourself up some basic gear. Get up on HF, 2-meters, and 6-meters if you can. Your communications needs are now set and you can talk with other hams. Get your EMCOMM practice with your club during disaster drills and public service events. This is all stuff you'll need no matter where you decide to go in the hobby afterward, if anywhere. Once you've done all that, if you want to expand to other aspects of the hobby, pick something that piques your interest whether it's QRP, boatanchors, or whatever. Use the Internet to do research, make regional (maybe hopefully local) contacts with hams who have the same interest, and go from there.

QRP Radios

One of the quintessential QRP rigs is the Yaesu FT-817. This radio is battery operated, fits in a LBE SAW or MOLLE radio pouch, and covers all major amateur radio bands. In addition to full HF band coverage, this radio also covers the 6m, 2m, and 70cm VHF & UHF bands.

The original FT-817 has been out since 2001 and the current FT-817ND version since 2004. Despite being over 10 years old and supplanted by other rigs as the "QRP radio of choice," it still maintains a strong following in the amateur radio community. Until recently it was my "to go" rig for HF, and still maintains a role as my primary VHF/UHF radio due to it being the only "portable" on the market capable of SSB and CW operation on the VHF and UHF bands.

18 This is the best hamfest in New England!!! Their website is at http://www.near-fest.com/.

The FT-817's current draw on receive is 450mA, which is 3 times or more as much as other HF QRP transceivers in its category. As a comparison the current "state of the art" pulls 150mA, and I have a basic QRP CW "kit" radio that pulls about 50mA. You want as low a current draw on receive as possible, as it enables you to listen longer when operating on batteries. If you put these figures to actual time, with the standard 12V 7AH "gel cell" battery that is the staple of QRP ops you will get about 8 hours of receive with a FT-817, 23 hours with the current "state of the art", and 70 hours with my CW "kit" radio.

The FT-817 averages about $670 new for the current FT-817ND version. Used ones sell for $400 to $500+ depending on what accessories are included in the offer.

The current state of the art is the Elecraft KX-3. If I were to buy a QRP radio new this is the one I would get. This has supplanted the Yaesu FT-817 as the radio of choice among QRP ops. This radio covers the HF and 6m ham bands with a maximum power output of 10 watts. It weighs 1½ pounds and its dimensions are 3.5"Hx7.4"Wx1.6"D. It literally is the size of a large paperback book. Like the FT-817 this radio features an internal battery pack that will accept 8 AA batteries, or can be run off 12V DC. For those wanting additional VHF capability in this radio, an optional internal module is available for the 2 meter band.

The stock KX-3 costs $1000 new, and it is unlikely that you will find used ones anytime soon. Even if you did come across one used by someone who tried QRP and didn't like it you would still wind up paying close to that amount. Additional options such as the 2 meter module or antenna tuning unit cost extra. If I were buying my first (QRP) rig, I would go for this one unless it was absolutely impossible to afford it. Here is the setup I would get for using the KX-3 as a combination fixed/mobile platform:

- Elecraft KX-3, with the following options:
  - KXFL3 Roofing Dual Bandwidth Filter for SSB/CW/DATA
  - KXAT3 Internal, Wide-Range 20-W Automatic Antenna Tuner
  - KXPD3 Attached Precision Keyer Paddle
  - KXBC3 NiMH Charger
- Elecraft KXPA-100 100 Watt Amplifier, with:
  - KXAT100 Wide-Range 100-W ATU

You will also need a 13.8V DC power supply capable of at least 30 Amps (or a deep-cycle battery capable of handing a 25 amp load for a period of time), and antennas. This is a complete station that is ready to go. If you eliminated the 100 watt amplifier you can get buy with a significantly smaller power supply or battery. At high power, the KX-3 draws about 2 amps.

Many hams complain about the intense menu-driven functionality of the modern rigs and desire something simpler in operation. Admittedly, rigs such as the Yaesu FT-817ND and Elecraft KX-3 get complicated when delving in the numerous menu settings for various radio functions. Fortunately there are many nice rigs out there that are just basic radios that admirably do the job they're supposed to with efficiency and little fanfare. Despite their simplicity, many of these radios are very high-performance. If you are looking for a good basic radio, one of them might be for you.

This is a 40-meter band (7 MHz.) QRP CW transceiver, made by Oak Hills Research[19]. It cost me $50 at a local hamfest and included a power supply. The current model[20] sells for $150 new in kit form, which is still pretty reasonable. To get on the air all you have to do is attach a homemade dipole and a CW key. 40 meters is a very popular QRP and survivalist band. You can always find someone down in the "Watering Hole" around 7030/7040 KHz. to make a contact with. It uses discrete components on a single sided PC-Board, so you can fix it if it breaks. This is the type of right you keep an eye open for at hamfests.

My QRP "go-to" rig these days is the SG-2020 made by SGC. Here it's shown with one of my favorite auto-tuners, the LDG Z-11Pro. The SG-2020 is a basic 20 watt HF field radio with an uncomplicated front panel that's very easy to operate. SGC has a reputation for making top-quality HF multi-mission HF radio gear. While they are no longer manufacturing transceivers, used SGC radios are an excellent used equipment value, when you can find them. Their owners tend to hold onto them. SGC still makes an excellent line of antenna tuners intended for field use and austere conditions.

Boatanchor Radios, Military Surplus, and Older Gear

The classic Gonset Communicator, aka "Gooney Box". Available in six and two meter band versions. A popular Cold War-era Civil Defense radio.

There are some models of boatanchor gear that are of particular interest to survivalist hams, such as the early mobile and "portable" rigs that run on 12V DC. The best-known of these were manufactured by Gonset, whose "Gooney Box" radios were used by Civil Defense organizations. Heathkit rigs are another popular boatanchor. As the name implies, these radios were sold as kits that were then built by the ham operator. In addition to radios, Heathkit also made kits for all sorts of test equipment.

Many older boatanchor rigs date from a time before the now common single-sideband (SSB) mode of operation was used on the HF bands. These rigs have CW and AM modes of operation. While CW is becoming an esoteric mode on HF, its use is still considered acceptable by the majority of amateur radio community at large. AM operation on the other hand is thought to be less so by some. This is a position I strongly disagree with as I feel that AM operation has a definite place on the ham bands for a number of reasons, especially when it comes to survivalist communications.

In my brief interactions with the "AM Window"[21] ham community, I have found them to be extremely

19 http://www.ohr.com/

20 http://www.ohr.com/ohr100a.htm

adept from a technical standpoint, always willing to help a beginner get a vintage AM boatanchor station on the air, and in possession of a more robust sense of humor than many others in the ham community. There is also a big crossover among many AM Window hams with military surplus "green radios", and other survivalist-type hobbies. I suspect that if the collapse ever occurs, these guys will be keeping their "Armageddon Modulation" rigs on the air long long after the more-modern gear has died.

In a similar vein, many survivalist hams are also into military surplus, or "green" radios. Milsurp radios typically cover the HF bands and the VHF six meter ham band. Military radios are extremely rugged and hardened against the effects of EMP. Many older tube-type milsurp radios also qualify as boatanchors. Much like their civilian brethren, full schematics and repair information are available in the radio's Technical Manual (TM). The older TMs are considered by many to contain a comprehensive education in radio theory and circuitry. Military surplus was the way that many amateur radio operators got on the air during the 1950s and 1960s with rigs such as the ARC-5. Just like the AM boatanchor gear, milsurp radios remain a growing, but still small subculture within the amateur radio community.

Many consider the Collins KWM-2 and KWM-2A (aka US Military AN/FRC-93) HF Transceivers to be among the best boatanchor-type radios for survivalist use. This was the standard military HF CW/SSB rig of choice from the 1960s until the 1990s. A carrying case, the CC-2, is also available for transporting the rig. Collins enthusiasts consider the KWM-2A to be the more preferable of the two. This rig goes anywhere from $600-$2000 on Ebay depending on model, condition, and accessories. If you wanted a solid Milspec boatanchor for the HF bands, this would an example of one to get, especially if you can get the carrying case.

One of the nice things about the older gear is that you can fix it with commonly available tubes and discrete circuits. Consider these radios the same as the old stick-shift you used to drive. The one that you could fix with a screwdriver, a set of pliers, and socket wrench set. They are uncomplicated and straightforward in operation. Prime examples of these radios are the "hybrids" made by Kenwood and Yaesu. These were solid state radios with tube finals. From Yaesu, we had the FT-101 series[22] (above right). Kenwood[23] also had an entire series of hybrid radios, represented here by the TS-830S (above left).

21 See http://www.amwindow.org/

22 See http://www.foxtango.org/

23 See http://frrl.wordpress.com/2008/08/03/blast-from-the-past-our-kenwood-hybrid-collection/

Rig Recommendations

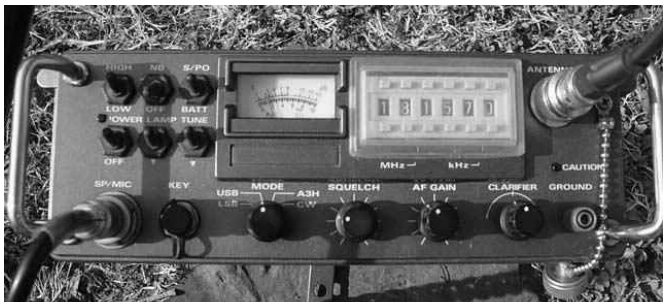
There are way too many makes and models of ham gear for a complete list. If you are interested in a specific radio, your best bet is to check the radio reviews at http://www.eham.net/reviews/. However, here is a short list of various rigs I think you should keep an eye out for.

HF Gear

- SGC SG2000 and SG2020. The SG2000 is a base station, and the SG2020 is for portable/transportable ops. SGC made marine-grade gear that is rugged and reliable. Unfortunately they no longer make it, and used gear is hard to come by.
- Yaesu FT-817, FT-857, FT-847, and FT-897.
- Icom IC-7200
- Grab any used 40M or 80M QRP CW rig you can for under $100. They're portable, use discrete components, and can be maintained easily. Some of the old-school analog filters on the higher-quality rigs are top-notch.
- **Anything** from Ten-Tec is good.
- Elecraft KX-3 is the current choice for a good low-power field radio, but all Elecraft radios are good.

Older HF Rigs

- Kenwood TS-440, TS-130, TS-830, and TS-870.



- Yaesu FT-101, FT-7 (right), FT-70 (left), FT-450, and FT-77.
- Alinco DX-70
- **Anything** from Icom. Visit http://www.ab4oj.com/icom/oldicom.html.
- **Anything** from Collins. For our purposes the KWM-2 or KWM-2A would be best.
- Drake TR-3 and TR-4
- Atlas 210X. This is one of the more underrated radios of the early solid-state era.

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VHF Radios

Here are some alternatives to the current crop of China-made HTs. Just about any ~1980s-1990s+ vintage HT is a better choice then those.

- Icom IC-2AT
- Icom IC-02AT
- Yaesu FT-50
- **Yaesu FT-60** - Still in production. The best choice for a rugged 2m/70cm squad radio for those of you who want to run ham gear.
- Alinco DJ-V5
- Standard C528
- Motorola JT1000
- GE MPA (hamflashed)
- Bendix King PRC-127
- Alinco DJ-580
- Cherokee AH50 – 6 Meter handheld
- Kenwood TH21AT
- Yaesu FT23
- Alinco DJ-C5
- Alinco DJ-G29T – This is a dual band 222/902 MHz. ham HT. A good choice for those of you who a using the ham bands, but want to operate somewhere off the beaten path. (Shown at right.)

- Gonset Communicator – The original VHF Civil Defense radio. It runs AM simplex, but it's a tube rig that will run on 12V DC. In an extreme grid-down situation, this may be one of the few VHF rigs you can keep up and running.
- Drake TR-22/Kenwood TR2200G – Both the same radio. This is another underrated model that can be found dirt-cheap at hamnfests. This is a AA battery/12V-powered 1 watt portable with and internal pull-up whip antenna and 12 crystal-controlled channels. Most are found with a selection of local repeater and simplex frequencies in them, and many have had an aftermarket PL/CTCSS tone encoder board installed. This is another vintage sold-state radio that is easily repaired, and uncomplicated in operation.

These are just a few makes and models of radios that are reasonably priced on the used market, and would possibly suit your needs.

Appendix

- **FCC Frequency Allocations**
- **“Communications” from US Army Field Manual FM 31-20, Special Forces Operational Techniques**

Signature. The signature shall include the name and title of the person originating the message.

(c) *Public Safety frequencies.* (1) The following table indicates frequencies available for assignment to Public Safety stations, together with the class of station(s) to which they are normally assigned, the specific assignment limitations which are explained in paragraph (d) of this section, and the certified frequency coordinator for each frequency:

(2)(i) The letter symbol(s) listed in the Coordinator column of the frequency table in paragraph (c)(3) of this section specifies the frequency coordinator(s) for each frequency as follows:

PF—Fire Coordinator
PH—Highway Maintenance Coordinator
PM—Emergency Medical Coordinator
PO—Forestry-Conservation Coordinator
PP—Police Coordinator
PS—Special Emergency Coordinator
PX—Any Public Safety Coordinator, except the Special Emergency Coordinator

(ii) Frequencies without any coordinator specified may be coordinated by any coordinator certified in the Public Safety Pool.

(3) *Frequencies.*

PUBLIC SAFETY POOL FREQUENCY TABLE

Frequency or band	Class of station(s)	Limitations	Coordinator
Kilohertz			
530 to 1700	Base (T.I.S.)	1	PX
1610	Base (T.I.S.)	1	PX
1722	do	2, 3	PP
1730	do	2, 3	PP
2212	do	4	PO
2226	do	4	PO
2236	do	4	PO
2244	do	4	PO
2366	do	2, 4	PP
2382	do	2	PP
2390	do	2, 4	PP
2406	do	2	PP
2430	do	2	PP
2442	do	2	PP
2450	do	2	PP
2458	do	2	PP
2482	do	2	PP
2490	do	2, 3	PP
2726	do	5	PX, PS
3201	do		PS
2000 to 3000	Fixed	75	PS
2000 to 10,000	Fixed, base, or mobile.	6, 89	PX.
Megahertz			
30.86	Base or mobile	7	PO
30.90	do	7	PO
30.94	do	7	PO
30.98	do	7	PO
31.02	do	7	PO
31.06	do	7, 8, 9	PO
31.10	do	7, 8, 9	PO
31.14	do	7, 8, 9	PO
31.18	do	8, 9	PO
31.22	do	8, 9	PO
31.26	do	8, 9	PO
31.30	do	8, 9	PO
31.34	do	8, 9	PO
31.38	do	8, 9	PO
31.42	do	8, 9	PO
31.46	do	8, 9	PO
31.50	do	8, 9	PO
31.54	do	8, 9	PO
31.58	do	8, 9	PO
31.62	do	8, 9	PO
31.66	do	8, 9	PO
31.70	do	8, 9	PO
31.74	do	8, 9	PO
31.78	do	8, 9	PO
31.82	do	8, 9	PO
31.86	do	8, 9	PO
31.90	do	8, 9	PO
31.94	do	8, 9	PO
31.98	do	8, 9	PO
33.02	do	10	PH, PS
33.04	do		PS
33.06	do	10	PH, PS
33.08	do		PS
33.10	do	10	PH, PS
33.42	Mobile or fixed	11	PF
33.44	Base or mobile		PF
33.46	Mobile		PF
33.48	Base or mobile		PF
33.50	Mobile		PF
33.52	Base or mobile		PF
33.54	Mobile		PF
33.56	Base or mobile		PF
33.58	Mobile		PF
33.60	Base or mobile		PF
33.62	Mobile		PF
33.64	Base or mobile		PF
33.66	Mobile		PF
33.68	Base or mobile		PF
33.70	do		PF
33.72	do		PF
33.74	do		PF
33.76	do		PF
33.78	do		PF
33.80	do		PF
33.82	do		PF
33.84	do		PF
33.86	do		PF
33.88	do		PF
33.90	do		PF
33.92	do		PF
33.94	do		PF
33.96	do		PF
33.98	do		PF
35.02	Mobile	12, 78	PS
35.64	Base	13	PS
35.68	do	13	PS
37.02	Mobile		PP
37.04	Base or mobile		PP
37.06	do		PP
37.08	do		PP
37.10	do		PX
37.12	do		PP
37.14	do		PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
37.16	do		PP
37.18	do		PX
37.20	do		PP
37.22	do		PP
37.24	do		PP
37.26	do		PX
37.28	do		PP
37.30	do		PP
37.32	do		PP
37.34	Mobile		PP
37.36	Base or mobile		PP
37.38	Mobile		PP
37.40	Base or mobile		PP
37.42	Mobile		PP
37.90	Base or mobile	10	PH, PS
37.92	do		PH
37.94	do	10	PH, PS
37.96	do		PH
37.98	do	10	PH, PS
39.02	do		PP
39.04	do		PP
39.06	do	14	PX
39.08	do		PP
39.10	do		PX
39.12	do		PP
39.14	do		PP
39.16	do		PP
39.18	do		PX
39.20	do		PP
39.22	do		PP
39.24	do		PP
39.26	Mobile		PP
39.28	Base or mobile		PP
39.30	Mobile		PP
39.32	Base or mobile		PP
39.34	Mobile		PP
39.36	Base or mobile		PP
39.38	Mobile		PP
39.40	Base or mobile		PP
39.42	do		PP
39.44	do		PP
39.46	do	15	PP
39.48	do		PP
39.50	do		PX
39.52	do		PP
39.54	do		PP
39.56	do		PP
39.58	do		PX
39.60	do		PP
39.62	do		PP
39.64	do		PP
39.66	Mobile		PP
39.68	Base or mobile		PP
39.70	Mobile		PP
39.72	Base or mobile		PP
39.74	Mobile		PP
39.76	Base or mobile		PP
39.78	Mobile		PP
39.80	Base or mobile		PP
39.82	do		PX
39.84	do		PP
39.86	do		PP
39.88	do		PP
39.90	do		PX
39.92	do		PP
39.94	do		PP
39.96	do		PP
39.98	do		PX
42.02	do	2, 3, 16	PP
42.04	do	2, 3, 16	PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
42.06	do	2, 3, 16	PP
42.08	do	2, 3, 16	PP
42.10	do	2, 3, 16	PP
42.12	do	2, 3, 16	PP
42.14	do	2, 3, 16	PP
42.16	do	2, 3, 16	PP
42.18	Mobile	2, 16	PP
42.20	do	2, 16	PP
42.22	do	2, 16	PP
42.24	do	2, 16	PP
42.26	do	2, 16	PP
42.28	do	2, 16	PP
42.30	do	2, 16	PP
42.32	Base or mobile	2, 3, 16	PP
42.34	do	2, 3, 16	PP
42.36	do	2, 3, 16	PP
42.38	do	2, 3, 16	PP
42.40	do	2, 3, 16, 17.	PP
42.42	do	2, 3, 16	PP
42.44	do	2, 3, 16	PP
42.46	do	2, 3, 16	PP
42.48	do	2, 3, 16	PP
42.50	do	2, 3, 16	PP
42.52	do	2, 3, 16	PP
42.54	do	2, 3, 16	PP
42.56	do	2, 3, 16	PP
42.58	do	2, 3, 16	PP
42.60	do	2, 3, 16	PP
42.62	do	2, 3, 16	PP
42.64	do	2, 3, 16	PP
42.66	Mobile	2, 16	PP
42.68	do	2, 16	PP
42.70	do	2, 16	PP
42.72	do	2, 16	PP
42.74	do	2, 16	PP
42.76	do	2, 16	PP
42.78	do	2, 16	PP
42.80	Base or mobile	13	PP
42.82	do	2, 3, 16	PP
42.84	do	2, 3, 16	PP
42.86	do	2, 3, 16	PP
42.88	do	2, 3, 16	PP
42.90	do	2, 3, 16	PP
42.92	do	2, 3, 16	PP
42.94	do	2, 3, 16	PP
43.64	Base	13, 18	PS
43.68	do	13	PS
44.62	Base or mobile	2, 3, 16	PP
44.64	do		PO
44.66	do	2, 3, 16	PP
44.68	do		PO
44.70	do	2, 3, 16	PP
44.72	do		PO
44.74	do	2, 3, 16	PP
44.76	do		PO
44.78	Mobile	2, 16	PP
44.80	Base or mobile		PO
44.82	Mobile	2, 16	PP
44.84	Base or mobile		PO
44.86	Mobile	2, 16	PP
44.88	Base or mobile		PO
44.90	Mobile	2, 16	PP
44.92	Base or mobile		PO
44.94	do	2, 3, 16	PP
44.96	do		PO
44.98	do	2, 3, 16	PP
45.00	do		PO
45.02	do	2, 3, 16	PP
45.04	do		PO

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
45.06	do	2, 3, 16	PP
45.08	do		PX
45.10	do		PP
45.12	do		PX
45.14	do		PP
45.16	do		PX
45.18	do		PP
45.20	do		PX
45.22	do		PP
45.24	do		PX
45.26	Mobile		PP
45.28	Base or mobile		PX
45.30	Mobile		PP
45.32	Base or mobile		PX
45.34	Mobile		PP
45.36	Base or mobile		PX
45.38	Mobile		PP
45.40	Base or mobile		PX
45.42	do		PP
45.44	do		PX
45.46	do		PP
45.48	do		PX
45.50	do		PP
45.52	do		PX
45.54	do		PP
45.56	do		PX
45.58	do		PP
45.60	do		PX
45.62	do		PP
45.64	do		PX
45.66	do		PP
45.68	do		PH
45.70	do		PP
45.72	do		PH
45.74	Mobile		PP
45.76	Base or mobile		PH
45.78	Mobile		PP
45.80	Base or mobile		PH
45.82	Mobile		PP
45.84	Base or mobile		PH
45.86	do	15	PP
45.88	do	19	PF
45.90	do	20	PP
45.92	do	10	PS
45.94	do		PP
45.96	do	10	PS
45.98	do		PP
46.00	do	10	PS
46.02	do		PP
46.04	do	10	PS
46.06	do		PF
46.08	do		PF
46.10	do		PF
46.12	do		PF
46.14	do		PF
46.16	do		PF
46.18	do		PF
46.20	do		PF
46.22	Mobile		PF
46.24	do		PF
46.26	do		PF
46.28	do		PF
46.30	Mobile or fixed	11	PF
46.32	Mobile		PF
46.34	do		PF
46.36	Base or mobile		PF
46.38	do		PF
46.40	do		PF
46.42	do		PF
46.44	do		PF

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
46.46	do		PF
46.48	do		PF
46.50	do		PF
46.52	do		PX
46.54	do		PX
46.56	do		PX
46.58	do		PX
47.02	do	21, 22	PH
47.04	do	21, 22	PH
47.06	do	21, 22	PH
47.08	do	21, 22	PH
47.10	do	21, 22	PH
47.12	do	21, 22	PH
47.14	do	21, 22	PH
47.16	do	21, 22	PH
47.18	do	21, 22	PH
47.20	do	21, 22	PH
47.22	do	21, 22	PH
47.24	do	21, 22	PH
47.26	do	21, 22	PH
47.28	do	21, 22	PH
47.30	do	21, 22	PH
47.32	do	21, 22	PH
47.34	do	21, 22	PH
47.36	do	21, 22	PH
47.38	do	21, 22	PH
47.40	do	21, 22	PH
47.42	do	10, 23	PS
47.46	do	10	PS
47.50	do	10	PS
47.54	do	10	PS
47.58	do	10	PS
47.62	do	10	PS
47.66	do	10	PS
72.00 to 76.00	Operational fixed.	24	
72.44	Mobile	25	PF
72.48	do	25	PF
72.52	do	25	PF
72.56	do	25	PF
72.6	do	25	PF
75.44	do	25	PF
75.48	do	25	PF
75.52	do	25	PF
75.56	do	25	PF
75.6	do	25	PF
150 to 170	Base or mobile	26	
150.775	Mobile	87	PM.
150.7825	do	88	PM
150.790	do	87	PM.
150.7975	do	88	PM.
150.805	do		PM
150.995	Base or mobile	28	PH
151.0025	do	27, 28	PH
151.010	do	28	PH
151.0175	do	28	PH
151.025	do	28	PH
151.0325	do	27, 28	PH
151.040	do	28	PH
151.0475	do	27, 28	PH
151.055	do	28	PH
151.0625	do	27, 28	PH
151.070	do	28	PH
151.0775	do	27, 28	PH
151.085	do	28	PH
151.0925	do	27, 28	PH
151.100	do	28	PH
151.1075	do	27, 28	PH
151.115	do	28	PH
151.1225	do	27, 28	PH

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
151.130	do	28, 81	PH
151.1375	do	27, 28, 80	PH
151.145	do	28, 81	PO
151.1525	do	27, 28	PO
151.160	do	28	PO
151.1675	do	27, 28	PO
151.175	do	28	PO
151.1825	do	27, 28	PO
151.190	do	28	PO
151.1975	do	27, 28	PO
151.205	do	28	PO
151.2125	do	27, 28	PO
151.220	do	28	PO
151.2275	do	27, 28	PO
151.235	do	28	PO
151.2425	do	27, 28	PO
151.250	do	28	PO
151.2575	do	27, 28	PO
151.265	do	28	PO
151.2725	do	27, 28	PO
151.280	do	28	PO
151.2875	do	27, 28	PO
151.295	do	28	PO
151.3025	do	27, 28	PO
151.310	do	28	PO
151.3175	do	27, 28	PO
151.325	do	28	PO
151.3325	do	27, 28	PO
151.340	do	28	PO
151.3475	do	27, 28	PO
151.355	do	28	PO
151.3625	do	27, 28	PO
151.370	do	28	PO
151.3775	do	2728	PO
151.385	do	28	PO
151.3925	do	27, 28	PO
151.400	do	28	PO
151.4075	do	27, 28	PO
151.415	do	28	PO
151.4225	do	27, 28	PO
151.430	do	28	PO
151.4375	do	27, 28	PO
151.445	do	28	PO
151.4525	do	27, 28	PO
151.460	do	28	PO
151.4675	do	27, 28	PO
151.475	do	28	PO
151.4825	do	27, 28	PO
151.490	do	7, 28	PO
151.4975	do	7, 27, 28	PO
152.0075	Base	13, 29, 30	PS
153.740	Mobile		PX
153.7475	do	27	PX
153.755	do		PX
153.7625	do	27	PX
153.770	do		PF
153.7775	do	27	PF
153.785	do		PX
153.7925	do	27	PX
153.800	do		PX
153.8075	do	27	PX
153.815	do		PX
153.8225	do	27	PX
153.830	do	31	PF
153.8375	do	27, 31	PF
153.845	do		PX
153.8525	do	27	PX
153.860	do		PX
153.8675	do	27	PX
153.875	do		PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
153.8825	do	27	PX
153.890	do		PF
153.8975	do	27	PF
153.905	do		PX
153.9125	do	27	PX
153.920	do		PX
153.9275	do	27	PX
153.935	do		PX
153.9425	do	27	PX
153.950	do		PF
153.9575	do	27	PF
153.965	do		PX
153.9725	do	27	PX
153.980	do		PX
153.9875	do	27	PX
153.995	do		PX
154.0025	do	27	PX
154.010	do		PF
154.0175	do	27	PF
154.025	Base or mobile		PX
154.0325	do	27	PX
154.040	do	28	PX
154.0475	do	27, 28	PX
154.055	do	28	PX
154.0625	do	27, 28	PX
154.070	Mobile	28	PF
154.0775	do	27, 28	PF
154.085	Base or mobile	28	PX
154.0925	do	2728	PX
154.100	do	28	PX
154.1075	do	27, 28	PX
154.115	do	28	PX
154.1225	do	27, 28	PX
154.130	do	28	PF
154.1375	do	27, 28	PF
154.145	do	28	PF
154.1525	do	27, 28	PF
154.160	do	28	PF
154.1675	do	27, 28	PF
154.175	do	28	PF
154.1825	do	27, 28	PF
154.190	do	28	PF
154.1975	do	27, 28	PF
154.205	do	28	PF
154.2125	do	27, 28	PF
154.220	do	28	PF
154.2275	do	27, 28	PF
154.235	do	28	PF
154.2425	do	27, 28	PF
154.250	do	28	PF
154.2575	do	27, 28	PF
154.265	do	19, 28	PF
154.2725	do	19, 27, 28	PF
154.280	do	19, 28	PF
154.2875	do	19, 27, 28	PF
154.295	do	19, 28	PF
154.3025	do	19, 27, 28	PF
154.310	do	28	PF
154.3175	do	27, 28	PF
154.325	do	28	PF
154.3325	do	27, 28	PF
154.340	do	28	PF
154.3475	do	27, 28	PF
154.355	do	28	PF
154.3625	do	27, 28	PF
154.370	do	28	PF
154.3775	do	27, 28	PF
154.385	do	28	PF
154.3925	do	27, 28	PF
154.400	do	28	PF

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
154.4075	do	27, 28	PF
154.415	do	28	PF
154.4225	do	27, 28	PF
154.430	do	28	PF
154.4375	do	27, 28	PF
154.445	do	28, 81	PF
154.4525	do	27, 28, 80.	PF
154.45625	Fixed or mobile	32, 33, 34, 35.	PX
154.46375	do	33, 34, 35, 36, 37.	PX
154.47125	do	33, 34, 35, 36.	PX
154.47875	do	33, 34, 35, 37.	PX
154.650	Mobile		PP
154.6575	do	27	PP
154.665	Base or mobile	16	PP
154.6725	do	16, 27	PP
154.680	do	16	PP
154.6875	do	16, 27	PP
154.695	do	16	PP
154.7025	do	16, 27	PP
154.710	Mobile		PP
154.7175	do	27	PP
154.725	Base or mobile		PP
154.7325	do	27	PP
154.740	do		PP
154.7475	do	27	PP
154.755	do		PP
154.7625	do	27	PP
154.770	Mobile		PP
154.7775	do	27	PP
154.785	Base or mobile		PP
154.7925	do	27	PP
154.800	do		PP
154.8075	do	27	PP
154.815	do		PP
154.8225	do	27	PP
154.830	Mobile		PP
154.8375	do	27	PP
154.845	Base or mobile		PP
154.8525	do	27	PP
154.860	do		PP
154.8675	do	27	PP
154.875	do		PP
154.8825	do	27	PP
154.890	Mobile		PP
154.8975	do	27	PP
154.905	Base or mobile	16	PP
154.9125	do	16	PP
154.920	do	16	PP
154.9275	do	16, 27	PP
154.935	do	16	PP
154.9425	do	16, 27	PP
154.950	Mobile		PP
154.9575	do	27	PP
154.965	Base or mobile		PX
154.9725	do	27	PX
154.980	do		PX
154.9875	do	27	PX
154.995	do		PX
155.0025	do	27	PX
155.010	do		PP
155.0175	do	27	PP
155.025	do		PX
155.0325	do	27	PX
155.040	do		PX
155.0475	do	27	PX
155.055	do		PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
155.0625	do	27	PX
155.070	do		PP
155.0775	do	27	PP
155.085	do		PX
155.0925	do	27	PX
155.100	do		PX
155.1075	do	27	PX
155.115	do		PX
155.1225	do	27	PX
155.130	do		PP
155.1375	do	27	PP
155.145	do		PX
155.1525	do	27	PX
155.160	do	10	PS
155.1675	do	10, 27	PS
155.175	do	10	PS
155.1825	do	10, 27	PS
155.190	do		PP
155.1975	do	27	PP
155.205	do	10	PS
155.2125	do	10, 27	PS
155.220	do	10	PS
155.2275	do	10, 27	PS
155.235	do	10	PS
155.2425	do	10, 27	PS
155.250	do		PP
155.2575	do	27	PP
155.265	do	10	PS
155.2725	do	10, 27	PS
155.280	do	10	PS
155.2875	do	10, 27	PS
155.295	do	10	PS
155.3025	do	10, 27	PS
155.310	do		PP
155.3175	do	27	PP
155.325	do	10, 39	PM
155.3325	do	27, 10, 39	PM
155.340	do	39, 40	PM
155.3475	do	27, 39, 40	PM
155.355	do	10, 39	PM
155.3625	do	27, 10, 39	PM
155.370	do		PP
155.3775	do	27	PP
155.385	do	10, 39	PM
155.3925	do	27, 10, 39	PM
155.400	do	10, 39	PM
155.4075	do	27, 10, 39	PM
155.415	do		PP
155.4225	do	27	PP
155.430	do		PP
155.4375	do	27	PP
155.445	do	16	PP
155.4525	do	16, 27	PP
155.460	do	16	PP
155.4675	do	16, 27	PP
155.475	do	41	PP
155.4825	do	27, 41	PP
155.490	do		PP
155.4975	do	27	PP
155.505	do	16	PP
155.5125	do	16, 27	PP
155.520	do		PP
155.5275	do	27	PP
155.535	do		PP
155.5425	do	27	PP
155.550	do		PP
155.5575	do	27	PP
155.565	do		PP
155.5725	do	27	PP
155.580	do		PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
155.5875	do	27	PP
155.595	do		PP
155.6025	do	27	PP
155.610	do		PP
155.6175	do	27	PP
155.625	do		PP
155.6325	do	27	PP
155.640	do		PP
155.6475	do	27	PP
155.655	do		PP
155.6625	do	27	PP
155.670	do		PP
155.6775	do	27	PP
155.685	do		PP
155.6925	do	27	PP
155.700	do		PP
155.7075	do	27	PP
155.715	do		PX
155.7225	do	27	PX
155.730	do		PP
155.7375	do	27	PP
155.745	do	81	PX
155.7525	do	27, 80, 83	PX
155.760	do	81	PX
155.7675	do	27	PX
155.775	do		PX
155.7825	do	27	PX
155.790	do		PP
155.7975	do	27	PP
155.805	do		PX
155.8125	do	27	PX
155.820	do		PX
155.8275	do	27	PX
155.835	do		PX
155.8425	do	27	PX
155.850	Mobile		PP
155.8575	do	27	PP
155.865	Base or mobile		PX
155.8725	do	27	PX
155.880	do		PX
155.8875	do	27	PX
155.895	do		PX
155.9025	do	27	PX
155.910	Mobile		PP
155.9175	do	27	PP
155.925	Base or mobile		PX
155.9325	do	27	PX
155.940	do		PX
155.9475	do	27	PX
155.955	do		PX
155.9625	do	27	PX
155.970	Mobile		PP
155.9775	do	27	PP
155.985	do		PX
155.9925	do	27	PX
156.000	do		PX
156.0075	do	27	PX
156.015	do		PX
156.0225	do	27	PX
156.030	do		PP
156.0375	do	27	PP
156.045	do	42	PH
156.0525	do	27, 42	PH
156.060	do	42	PH
156.0675	do	27, 42	PH
156.075	do		PH
156.0825	do	27	PH
156.090	do		PP
156.0975	do	27	PP
156.105	Base or mobile		PH

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
156.1125	do	27	PH
156.120	do		PH
156.1275	do	27	PH
156.135	do		PH
156.1425	do	27	PH
156.150	Mobile		PP
156.1575	do	27	PP
156.165	Base or mobile	42	PH
156.1725	do	27, 42	PH
156.180	do	42	PH
156.1875	do	27, 42	PH
156.195	do		PH
156.2025	do	27	PH
156.210	do		PP
156.2175	do	27	PP
156.225	do		PH
156.2325	do	27, 10	PH
156.240	do	79	PH
157.450	Base	13, 30, 45	PS
158.7225	Base or Mobile	44	PP
158.730	do	81	PP
158.7375	do	27, 80	PP
158.745	do	81	PX
158.7525	do	27	PX
158.760	do		PX
158.7675	do	27	PX
158.775	do		PX
158.7825	do	27	PX
158.790	do		PP
158.7975	do	27	PP
158.805	do		PX
158.8125	do	27	PX
158.820	do		PX
158.8275	do		PX
158.835	do		PX
158.8425	do	27	PX
158.850	do		PP
158.8575	do	27	PP
158.865	Mobile		PX
158.8725	do	27	PX
158.880	do		PX
158.8875	do		PX
158.895	do		PX
158.9025	do	27	PX
158.910	do		PP
158.9175	do	27	PP
158.925	do		PX
158.9325	do	27	PX
158.940	do		PX
158.9475	do		PX
158.955	do		PX
158.9625	do	27	PX
158.970	do		PP
158.9775	do	27	PP
158.985	do		PH
158.9925	do	27	PH
159.000	do		PH
159.0075	do	27	PH
159.015	do		PH
159.0225	do	27	PH
159.030	do		PP
159.0375	do	27	PP
159.045	do		PH
159.0525	do	27	PH
159.060	do		PH
159.0675	do	27	PH
159.075	do		PH
159.0825	do	27	PH
159.090	Base or mobile		PP
159.0975	do	27	PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
159.105	do		PH
159.1125	do	27	PH
159.120	do		PH
159.1275	do	27	PH
159.135	do		PH
159.1425	do	27	PH
159.150	do		PP
159.1575	do	27	PP
159.165	do		PH
159.1725	do	27	PH
159.180	do		PH
159.1875	do	27	PH
159.195	do		PH
159.2025	do	27	PH
159.210	do		PP
159.2175	do	27	PP
159.225	do		PO
159.2325	do	27	PO
159.240	do	46	PO
159.2475	do	27, 46	PO
159.255	do	46	PO
159.2625	do	27, 46	PO
159.270	do	46	PO
159.2775	do	27, 46	PO
159.285	do	46	PO
159.2925	do	27, 46	PO
159.300	do	46	PO
159.3075	do	27, 46	PO
159.315	do	46	PO
159.3225	do	27, 46	PO
159.330	do	46	PO
159.3375	do	27, 46	PO
159.345	do	46	PO
159.3525	do	27, 46	PO
159.360	do	46	PO
159.3675	do	27, 46	PO
159.375	do	46	PO
159.3825	do	27, 46	PO
159.390	do	46	PO
159.3975	do	27, 46	PO
159.405	do	46	PO
159.4125	do	27, 46	PO
159.420	do	46	PO
159.4275	do	27, 46	PO
159.435	do	46	PO
159.4425	do	27, 46	PO
159.450	do		PO
159.4575	do	27	PO
159.465	do	81	PO
159.4725	do	80	PO
163.250	Base	13, 30	PS
166.250	Base or mobile	47	PF
169 to 172	Mobile or operational fixed.	48.	
170.150	Base or mobile	47	PF
170.425	do	9, 49	PO.
170.475	do	9, 49	PO.
170.575	do	9, 49	PO.
171.425	do	9, 49	PO.
171.475	do	9, 49	PO.
171.575	do	9, 49	PO.
172.225	do	9, 49	PO.
172.275	do	9, 49	PO.
172.375	do	9, 49	PO.
173.075	do	53	PP
173.20375	Fixed or mobile	33, 34, 35, 36.	PX
173.210	do	34, 35, 36, 54.	PX
173.2375	do	32, 33, 34, 35.	PX
173.2625	do	32, 33, 34, 35.	PX
173.2875	do	32, 33, 34, 35.	PX
173.3125	do	32, 33, 34, 35.	PX
173.3375	do	32, 33, 34, 35.	PX
173.3625	do	32, 33, 34, 35.	PX
173.390	do	34, 35, 36, 54.	PX
173.39625	do	33, 34, 35, 36.	PX
220 to 222	Base or mobile	55.	
220.8025	Base	55	
220.8075	do	55	
220.8125	do	55	
220.8175	do	55	
220.8225	do	55	
220.8275	do	55	
220.8325	do	55	
220.8375	do	55	
220.8425	do	55	
220.8475	do	55	
220.9025	do	55	PM
220.9075	do	55	PM
220.9125	do	55	PM
220.9175	do	55	PM
220.9225	do	55	PM
221.8025	Mobile	55	
221.8075	do	55	
221.8125	do	55	
221.8175	do	55	
221.8225	do	55	
221.8275	do	55	
221.8325	do	55	
221.8375	do	55	
221.8425	do	55	
221.8475	do	55	
221.9025	do	55	PM
221.9075	do	55	PM
221.9125	do	55	PM
221.9175	do	55	PM
221.9225	do	55	PM
406 to 416	Operational fixed.	48.	
450 to 470	Fixed, base, or mobile.	26, 56	
453.0125	Mobile	57, 78	PX
453.03125	Base or mobile	44, 49, 62, 84.	PM
453.0375	do	27, 59, 62, 84.	PX
453.04375	do	44, 49, 62, 84.	PM
453.050	do		PX
453.05625	do	44, 84	PX
453.0625	do	27, 84	PX
453.06875	do	44, 84	PX
453.075	Central control, fixed base, or mobile.	58, 59, 60, 61, 62.	PM
453.08125	Base or mobile	44, 59, 62, 84.	PM
453.0875	do	27, 59, 62, 84.	PX
453.09375	do	44, 59, 62, 84.	PM
453.100	do		PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
453.10625	do	44, 84	PX
453.1125	do	27, 84	PX
453.11875	do	44, 84	PX
453.125	Central control, fixed base, or mobile.	58, 59, 60, 61, 62.	PM
453.13125	Base or mobile	44, 59, 62, 84.	PM
453.1375	do	27, 59, 62, 84.	PX
453.14375	do	44, 59, 62, 84.	PM
453.150	do		PX
453.15625	do	44	PX
453.1625	do	27	PX
453.16875	do	44	PX
453.175	Central control, fixed base, or mobile.	58, 59, 60, 61, 62.	PM
453.18125	Base or mobile	44, 59, 62	PM
453.1875	do	27, 59, 62	PX
453.19375	do	44, 59, 62	PM
453.200	do	81	PX
453.20625	do	44, 82	PX
453.2125	do	27, 80, 83	PX
453.21875	do	44, 82	PX
453.225	do	81	PX
453.23125	do	44	PX
453.2375	do	27	PX
453.24375	do	44	PX
453.250	do		PX
453.25625	do	44	PX
453.2625	do	27	PX
453.26875	do	44	PX
453.275	do		PX
453.28125	do	44	PX
453.2875	do	27	PX
453.29375	do	44	PX
453.300	do		PX
453.30625	do	44	PX
453.3125	do	27	PX
453.31875	do	44	PX
453.325	do		PX
453.33125	do	44	PX
453.3375	do	27	PX
453.34375	do	44	PX
453.350	do		PX
453.35625	do	44	PX
453.3625	do	27	PX
453.36875	do	44	PX
453.375	do		PX
453.38125	do	44	PX
453.3875	do	27	PX
453.39375	do	44	PX
453.400	do		PX
453.40625	do	44	PX
453.4125	do	27	PX
453.41875	do	44	PX
453.425	do		PX
453.43125	do	44	PX
453.4375	do	27	PX
453.44375	do	44	PX
453.450	do	81	PX
453.45625	do	44, 82	PX
453.4625	do	27, 80	PX
453.46875	do	44, 82	PX
453.475	do	81	PX
453.48125	do	44	PX
453.4875	do	27	PX
453.49375	do	44	PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
453.500	do		PX
453.50625	do	44	PX
453.5125	do	27	PX
453.51875	do	44	PX
453.525	do		PX
453.53125	do	44	PX
453.5375	do	27	PX
453.54375	do	44	PX
453.550	do		PX
453.55625	do	44	PX
453.5625	do	27	PX
453.56875	do	44	PX
453.575	do		PX
453.58125	do	44	PX
453.5875	do	27	PX
453.59375	do	44	PX
453.600	do		PX
453.60625	do	44	PX
453.6125	do	27	PX
453.61875	do	44	PX
453.625	do		PX
453.63125	do	44	PX
453.6375	do	27	PX
453.64375	do	44	PX
453.650	do		PX
453.65625	do	44	PX
453.6625	do	27	PX
453.66875	do	44	PX
453.675	do		PX
453.68125	do	44	PX
453.6875	do	27	PX
453.69375	do	44	PX
453.700	do	81	PX
453.70625	do	44, 82	PX
453.7125	do	27, 80	PX
453.71875	do	44, 82	PX
453.725	do	81	PX
453.73125	do	44	PX
453.7375	do	27	PX
453.74375	do	44	PX
453.750	do		PX
453.75625	do	44	PX
453.7625	do	27	PX
453.76875	do	44	PX
453.775	do		PX
453.78125	do	44	PX
453.7875	do	27	PX
453.79375	do	44	PX
453.800	do		PX
453.80625	do	44	PX
453.8125	do	27	PX
453.81875	do	44	PX
453.825	do		PX
453.83125	do	44	PX
453.8375	do	27	PX
453.84375	do	44	PX
453.850	do	81	PX
453.85625	do	44, 82	PX
453.8625	do	27, 80	PX
453.86875	do	44, 82	PX
453.875	do	81	PX
453.88125	do	44, 84	PX
453.8875	do	27, 84	PX
453.89375	do	44, 84	PX
453.900	do		PX
453.90625	do	44, 84	PX
453.9125	do	27, 84	PX
453.91875	do	44, 84	PX
453.925	do		PX
453.93125	do	44, 84	PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
453.9375	do	27, 84	PX
453.94375	do	44, 84	PX
453.950	do		PX
453.95625	do	44, 84	PX
453.9625	do	27, 84	PX
453.96875	do	44, 84	PX
453.975	do		PX
453.98125	do	44, 84	PX
453.9875	do	27, 84	PX
453.99375	do	44, 84	PX
458.0125	Mobile	57	PS
458.025	Central control, fixed base, or mobile.	58, 59, 61, 62, 63.	PM
458.03125	Mobile	44, 59, 61, 62, 84.	PM
458.0375	do	27, 59, 61, 62, 84.	PX
458.04375	do	44, 59, 61, 62, 84.	PM
458.050	do		PX
458.05625	do	44, 84	PX
458.0625	do	27, 84	PX
458.06875	do	44, 84	PX
458.075	Central control, fixed base, or mobile.	58, 59, 61, 62, 63.	PM
458.08125	Mobile	44, 59, 61, 62, 84.	PM
458.0875	do	27, 59, 61, 62, 84.	PX
458.09375	do	44, 59, 61, 62, 84.	PM
458.100	do		PX
458.10625	do	44, 84	PX
458.1125	do	27, 84	PX
458.11875	do	44, 84	PX
458.125	Central control, fixed base, or mobile.	58, 59, 61, 62, 63.	PM
458.13125	Mobile	44, 59, 61, 62, 84.	PM
458.1375	do	27, 59, 61, 62, 84.	PX
458.14375	do	44, 59, 61, 62, 84.	PM
458.150	do		PX
458.15625	do	44	PX
458.1625	do	27	PX
458.16875	do	44	PX
458.175	Central control, fixed base, or mobile.	58, 59, 61, 62, 63.	PM
458.18125	Mobile	44, 59, 61, 62.	PM
458.1875	do	27, 59, 61, 62.	PX
458.19375	do	44, 59, 61, 62.	PM
458.200	do	81	PX
458.20625	do	44, 82	PX
458.2125	do	27, 80, 83	PX
458.21875	do	44, 82	PX
458.225	do	81	PX
458.23125	do	44	PX
458.2375	do	27	PX
458.24375	do	44	PX
458.250	do		PX
458.25625	do	44	PX
458.2625	do	27	PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
458.26875	do	44	PX
458.275	do		PX
458.28125	do	44	PX
458.2875	do	27	PX
458.29375	do	44	PX
458.300	do		PX
458.30625	do	44	PX
458.3125	do	27	PX
458.31875	do	44	PX
458.325	do		PX
458.33125	do	44	PX
458.3375	do	27	PX
458.34375	do	44	PX
458.350	do		PX
458.35625	do	44	PX
458.3625	do	27	PX
458.36875	do	44	PX
458.375	do		PX
458.38125	do	44	PX
458.3875	do	27	PX
458.39375	do	44	PX
458.400	do		PX
458.40625	do	44	PX
458.4125	do	27	PX
458.41875	do	44	PX
458.425	do		PX
458.43125	do	44	PX
458.4375	do	27	PX
458.44375	do	44	PX
458.450	do	81	PX
458.45625	do	44, 82	PX
458.4625	do	27, 80	PX
458.46875	do	44, 82	PX
458.475	do	81	PX
458.48125	do	44	PX
458.4875	do	27	PX
458.49375	do	44	PX
458.500	do		PX
458.50625	do	44	PX
458.5125	do	27	PX
458.51875	do	44	PX
458.525	do		PX
458.53125	do	44	PX
458.5375	do	27	PX
458.54375	do	44	PX
458.550	do		PX
458.55625	do	44	PX
458.5625	do	27	PX
458.56875	do	44	PX
458.575	do		PX
458.58125	do	44	PX
458.5875	do	27	PX
458.59375	do	44	PX
458.600	do		PX
458.60625	do	44	PX
458.6125	do	27	PX
458.61875	do	44	PX
458.625	do		PX
458.63125	do	44	PX
458.6375	do	27	PX
458.64375	do	44	PX
458.650	do		PX
458.65625	do	44	PX
458.6625	do	27	PX
458.66875	do	44	PX
458.675	do		PX
458.68125	do	44	PX
458.6875	do	27	PX
458.69375	do	44	PX
458.700	do		PX

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
458.70625	do	44	PX
458.7125	do	27	PX
458.71875	do	44	PX
458.725	do		PX
458.73125	do	44	PX
458.7375	do	27	PX
458.74375	do	44	PX
458.750	do		PX
458.75625	do	44	PX
458.7625	do	27	PX
458.76875	do	44	PX
458.775	do		PX
458.78125	do	44	PX
458.7875	do	27	PX
458.79375	do	44	PX
458.800	do		PX
458.80625	do	44	PX
458.8125	do	27	PX
458.81875	do	44	PX
458.825	do		PX
458.83125	do	44	PX
458.8375	do	27	PX
458.84375	do	44	PX
458.850	do	81	PX
458.85625	do	44, 82	PX
458.8625	do	27, 80	PX
458.86875	do	44, 82	PX
458.875	do	81	PX
458.88125	do	44, 84	PX
458.8875	do	27, 84	PX
458.89375	do	44, 84	PX
458.900	do		PX
458.90625	do	44, 84	PX
458.9125	do	27, 84	PX
458.91875	do	44, 84	PX
458.925	do		PX
458.93125	do	44, 84	PX
458.9375	do	27, 84	PX
458.94375	do	44, 84	PX
458.950	do		PX
458.95625	do	44, 84	PX
458.9625	do	27, 84	PX
458.96875	do	44, 84	PX
458.975	do		PX
458.98125	do	44, 84	PX
458.9875	do	27, 84	PX
458.99375	do	44, 84	PX
460.0125	do	27, 64	PP
460.01875	Base or mobile	44	PP
460.025	do		PP
460.03125	do	44	PP
460.0375	do	27	PP
460.04375	do	44	PP
460.050	do		PP
460.05625	do	44	PP
460.0625	do	27	PP
460.06875	do	44	PP
460.075	do		PP
460.08125	do	44	PP
460.0875	do	27	PP
460.09375	do	44	PP
460.100	do		PP
460.10625	do	44	PP
460.1125	do	27	PP
460.11875	do	44	PP
460.125	do		PP
460.13125	do	44	PP
460.1375	do	27	PP
460.14375	do	44	PP
460.150	do		PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
460.15625	do	44	PP
460.1625	do	27	PP
460.16875	do	44	PP
460.175	do		PP
460.18125	do	44	PP
460.1875	do	27	PP
460.19375	do	44	PP
460.200	do		PP
460.20625	do	44	PP
460.2125	do	27	PP
460.21875	do	44	PP
460.225	do		PP
460.23125	do	44	PP
460.2375	do	27	PP
460.24375	do	44	PP
460.250	do		PP
460.25625	do	44	PP
460.2625	do	27	PP
460.26875	do	44	PP
460.275	do		PP
460.28125	do	44	PP
460.2875	do	27	PP
460.29375	do	44	PP
460.300	do		PP
460.30625	do	44	PP
460.3125	do	27	PP
460.31875	do	44	PP
460.325	do		PP
460.33125	do	44	PP
460.3375	do	27	PP
460.34375	do	44	PP
460.350	do		PP
460.35625	do	44	PP
460.3625	do	27	PP
460.36875	do	44	PP
460.375	do		PP
460.38125	do	44	PP
460.3875	do	27	PP
460.39375	do	44	PP
460.400	do		PP
460.40625	do	44	PP
460.4125	do	27	PP
460.41875	do	44	PP
460.425	do		PP
460.43125	do	44	PP
460.4375	do	27	PP
460.44375	do	44	PP
460.450	do		PP
460.45625	do	44	PP
460.4625	do	27	PP
460.46875	do	44	PP
460.475	do		PP
460.48125	do	44, 84	PP
460.4875	do	27, 84	PP
460.49375	do	44, 84	PP
460.500	do		PP
460.50625	do	44, 84	PP
460.5125	do	27, 84	PP
460.51875	do	44, 84	PP
460.525	do		PP, PF, PM
460.53125	do	44, 84	PP, PF, PM
460.5375	do	27, 84	PP, PF, PM
460.54375	do	44, 84	PP, PF, PM
460.550	do		PP, PF, PM
460.55625	do	44, 84	PP, PF, PM

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
460.5625	do	27, 84	PP, PF, PM
460.56875	do	44, 84	PP, PF, PM
460.575	do		PF
460.58125	do	44	PF
460.5875	do	27	PF
460.59375	do	44	PF
460.600	do		PF
460.60625	do	44	PF
460.6125	do	27	PF
460.61875	do	44	PF
460.625	do		PF
460.63125	do	44	PF
460.6375	do	27	PF
460.64375	do	44	PF
462.9375	do	57	PF
462.950	do	38, 65	PM
462.95625	do	10, 44, 65	PM
462.9625	do	27, 10, 65	PM
462.96875	do	10, 44, 65	PM
462.975	do	10, 65	PM
462.98125	do	10, 44, 65	PM
462.9875	do	27, 10, 65	PM
462.99375	do	10, 44, 65	PM
463.000	do	59, 66, 67	PM
463.00625	do	44, 59, 66, 67.	PM
463.0125	do	27, 59, 66, 67.	PM
463.01875	do	44, 59, 66, 67.	PM
463.025	do	59, 66, 67	PM
463.03125	do	44, 59, 66, 67.	PM
463.0375	do	27, 59, 66, 67.	PM
463.04375	do	44, 59, 66, 67.	PM
463.050	do	59, 66, 67	PM
463.05625	do	44, 59, 66, 67.	PM
463.0625	do	27, 59, 66, 67.	PM
463.06875	do	44, 59, 66, 67.	PM
463.075	do	59, 66, 76	PM
463.08125	do	44, 59, 66, 76.	PM
463.0875	do	27, 59, 66, 76.	PM
463.09375	do	44, 59, 66, 76.	PM
463.100	do	59, 66, 76	PM
463.10625	do	44, 59, 66, 76.	PM
463.1125	do	27, 59, 66, 76.	PM
463.11875	do	44, 59, 66, 76.	PM
463.125	do	59, 66, 76	PM
463.13125	do	44, 59, 66, 76.	PM
463.1375	do	27, 59, 66, 76.	PM
463.14375	do	44, 59, 66, 76.	PM
463.150	do	59, 66, 76	PM
463.15625	do	44, 59, 66, 76.	PM
463.1625	do	27, 59, 66, 76.	PM
463.16875	do	44, 59, 66, 76.	PM
463.175	do	59, 66, 76	PM
463.18125	do	44, 59, 66, 76.	PM
463.1875	do	27, 59, 66, 76.	PM
463.19375	do	44, 59, 66, 76.	PM
465.0125	Mobile	57	PP
465.025	do		PP
465.03125	do	44	PP
465.0375	do	27	PP
465.04375	do	44	PP
465.050	do		PP
465.05625	do	44	PP
465.0625	do	27	PP
465.06875	do	44	PP
465.075	do		PP
465.08125	do	44	PP
465.0875	do	27	PP
465.09375	do	44	PP
465.100	do		PP
465.10625	do	44	PP
465.1125	do	27	PP
465.11875	do	44	PP
465.125	do		PP
465.13125	do	44	PP
465.1375	do	27	PP
465.14375	do	44	PP
465.150	do		PP
465.15625	do	44	PP
465.1625	do	27	PP
465.16875	do	44	PP
465.175	do		PP
465.18125	do	44	PP
465.1875	do	27	PP
465.19375	do	44	PP
465.200	do		PP
465.20625	do	44	PP
465.2125	do	27	PP
465.21875	do	44	PP
465.225	do		PP
465.23125	do	44	PP
465.2375	do	27	PP
465.24375	do	44	PP
465.250	do		PP
465.25625	do	44	PP
465.2625	do	27	PP
465.26875	do	44	PP
465.275	do		PP
465.28125	do	44	PP
465.2875	do	27	PP
465.29375	do	44	PP
465.300	do		PP
465.30625	do	44	PP
465.3125	do	27	PP
465.31875	do	44	PP
465.325	do		PP
465.33125	do	44	PP
465.3375	do	27	PP
465.34375	do	44	PP
465.350	do		PP
465.35625	do	44	PP
465.3625	do	27	PP
465.36875	do	44	PP
465.375	do		PP
465.38125	do	44	PP

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
465.3875	...do	27	PP
465.39375	...do	44	PP
465.400	...do		PP
465.40625	...do	44	PP
465.4125	...do	27	PP
465.41875	...do	44	PP
465.425	...do		PP
465.43125	...do	44	PP
465.4375	...do	27	PP
465.44375	...do	44	PP
465.450	...do		PP
465.45625	...do	44	PP
465.4625	...do	27	PP
465.46875	...do	44	PP
465.475	...do		PP
465.48125	...do	44, 84	PP
465.4875	...do	27, 84	PP
465.49375	...do	44, 84	PP
465.500	...do		PP
465.50625	...do	44, 84	PP
465.5125	...do	27, 84	PP
465.51875	...do	44, 84	PP
465.525	...do		PP, PF, PM
465.53125	...do	44, 84	PP, PF, PM
465.5375	...do	27, 84	PP, PF, PM
465.54375	...do	44, 84	PP, PF, PM
465.550	Base or mobile		PP, PF, PM
465.55625	...do	44, 84	PP, PF, PM
465.5625	...do	27, 84	PP, PF, PM
465.56875	...do	44, 84	PP, PF, PM
465.575	Mobile		PF
465.58125	...do	44	PF
465.5875	...do	27	PF
465.59375	...do	44	PF
465.600	...do		PF
465.60625	...do	44	PF
465.6125	...do	27	PF
465.61875	...do	44	PF
465.625	...do		PF
465.63125	...do	44	PF
465.6375	...do	27	PF
465.64375	...do	44	PF
467.9375	...do	57	PS
467.950	...do	38, 65	PM
467.95625	...do	38, 44, 65	PM
467.9625	...do	27, 38, 65	PM
467.96875	...do	38, 44, 65	PM
467.975	...do	38, 65	PM
467.98125	...do	38, 44, 65	PM
467.9875	...do	27, 38, 65	PM
467.99375	...do	38, 44, 65	PM
468.000	...do	59, 66, 67	PM
468.00625	...do	44, 59, 66, 67.	PM
468.0125	...do	27, 59, 66, 67.	PM
468.01875	...do	44, 59, 66, 67.	PM
468.025	...do	59, 66, 67	PM
468.03125	...do	44, 59, 66, 67.	PM
468.0375	...do	27, 59, 66, 67.	PM

PUBLIC SAFETY POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
468.04375	...do	44, 59, 66, 67.	PM
468.050	...do	59, 66, 67	PM
468.05625	...do	44, 59, 66, 67.	PM
468.0625	...do	27, 59, 66, 67.	PM
468.06875	...do	44, 59, 66, 67.	PM
468.075	...do	59, 66, 76	PM
468.08125	...do	44, 59, 66, 76.	PM
468.0875	...do	27, 59, 66, 76.	PM
468.09375	...do	44, 59, 66, 76.	PM
468.100	...do	59, 66, 76	PM
468.10625	...do	44, 59, 66, 76.	PM
468.1125	...do	27, 59, 66, 76.	PM
468.11875	...do	44, 59, 66, 76.	PM
468.125	...do	59, 66, 76	PM
468.13125	...do	44, 59, 66, 76.	PM
468.1375	...do	27, 59, 66, 76.	PM
468.14375	...do	44, 59, 66, 76.	PM
468.150	...do	59, 66, 76	PM
468.15625	...do	44, 59, 66, 76.	PM
468.1625	...do	27, 59, 66, 76.	PM
468.16875	...do	44, 59, 66, 76.	PM
468.175	...do	59, 66, 76	PM
468.18125	...do	44, 59, 66, 76.	PM
468.1875	...do	27, 59, 66, 76.	PM
468.19375	...do	44, 59, 66, 76.	PM
470 to 512	Base or mobile	68.	
763 to 775	Base, mobile	77	PX
793 to 805	Mobile	77	PX
806 to 817	...do	69.	
851 to 862	Base or mobile	69	
928 and above	Operational fixed.	70.	
929 to 930	Base only	71.	
1,427 to 1,432	Base, mobile or operational fixed.	O='xl'≤72.	
2,450 to 2,500	Base or mobile	73.	
4940 to 4990	Fixed, base or mobile.	85	
5850–5925	Base or mobile	86	Not applicable.
10,550 to 10,680.	...do	74.	

(d) Explanation of assignment limitations appearing in the frequency table of paragraph (c)(3) of this section:

(1) This frequency is available for use by Travelers' Information Stations in accordance with § 90.242.

(2) The frequency is available for assignment only in accordance with a geographical assignment plan.

(3) Base stations operating on this frequency and rendering service to state police mobile units may be authorized to use a maximum output power in excess of the maximum indicated in § 90.205 but not in excess of 7500 watts: Provided, That such operation is secondary to other stations.

(4) The use of this frequency is on a secondary basis to any Canadian station.

(5) In addition to base and mobile stations, this frequency may be assigned to fixed stations on a secondary basis to base or mobile stations. Upon a showing of need, the use of a second frequency in the band 2505–3500 kHz may be made available to governmental entities through appropriate arrangements with Federal Government agencies for restricted area use on a shared basis with maximum power output, emission, and hours of operation determined on the basis of the technical conditions involved in using the selected frequency in the particular area.

(6) Only the central governments of the fifty individual States, the District of Columbia, and the insular areas of the Commonwealth of the Northern Mariana Islands, the Commonwealth of Puerto Rico, and the unincorporated territories of American Samoa, Guam and the United States Virgin Islands are eligible to be licensed to use this spectrum, and then only for disaster communications purposes. Licensees may not use this spectrum to provide operational communications circuits. See also, § 90.264.

(7) This frequency is shared with the Industrial/Business Pool.

(8) This frequency is available for assignment only in accordance with a geographical assignment plan. This frequency may be used for conservation activities on a secondary basis to any station using the frequency for forest fire prevention, detection, and suppression.

(9) This frequency is reserved primarily for assignment to state licensees. Assignments to other licensees will be made only where the frequency is required for coordinated operation with the State system to which the frequency is assigned. Any request for such assignment must be supported by a statement from the State system concerned, indicating that the assignment is necessary for coordination of activities.

(10) A licensee regularly conducting two-way communication operations on this frequency may, on a secondary basis, also transmit one-way alert-paging signals to ambulance and rescue squad personnel.

(11) The maximum output power of any transmitter authorized to operate on this frequency shall not exceed 10 watts.

(12) This frequency is available in this service only to persons eligible under the provisions of paragraph (a)(2)(v) of this section for operation of transmitters having a maximum power output of three watts using A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emission. This frequency is also available in the Industrial/Business Pool on a co-equal basis with the Public Safety licensees.

(13) This frequency will be assigned only for one-way paging communications to mobile receivers. Transmissions for the purpose of activating or controlling remote objects on this frequency are not authorized.

(14) The maximum output power of any transmitter authorized to operate on this frequency, after June 1, 1956, shall not exceed two watts. Licensees holding a valid authorization as of June 1, 1956, for base or mobile station operation on this frequency, with a power in excess of two watts, may continue to be authorized for such operation without regard to this power limitation.

(15) This frequency is reserved for assignment to stations for intersystem operations only: Provided, however, That licensees holding a valid authorization to use this frequency for local base or mobile operations as of June 1, 1956, may continue to be authorized for such use.

(16) This frequency is reserved primarily for assignment to state police licensees. Assignments to other police

licensees will be made only where the frequency is required for coordinated operation with the state police system to which the frequency is assigned. Any request for such assignment must be supported by a statement from the state police system concerned indicating that the assignment is necessary for coordination of police activities.

(17) In the State of Alaska only, the frequency 42.40 MHz is available for assignment on a primary basis to stations in the Common Carrier Rural Radio Service utilizing meteor burst communications. The frequency may be used by private radio stations for meteor burst communications on a secondary, noninterference basis. Usage shall be in accordance with part 22 of this chapter or part 90. Stations utilizing meteor burst communications shall not cause harmful interference to stations of other radio services operating in accordance with the allocation table.

(18) No new licenses will be granted for one-way paging under §90.487 for use on this frequency after August 1, 1980. This frequency is available to persons eligible for station licenses under the provisions of paragraph (a)(2)(v) of this section on a co-equal basis with one-way paging users under §90.487 prior to August 1, 1985, and on a primary basis after August 1, 1985. Only A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, G2D emissions and power not exceeding 10 watts will be authorized. Antennas having gain greater than 0 dBd will not be authorized. Transmissions shall not exceed two seconds duration.

(19) This frequency is reserved for assignment to stations in this service for intersystem operations only and these operations must be primarily base-mobile communications.

(20) In the State of Alaska only, the frequency 45.90 MHz is available for assignment on a primary basis to private land mobile radio stations utilizing meteor burst communications. The frequency may be used by common carrier stations for meteor burst communications on a secondary, noninterference basis. Usage shall be in accordance with part 22 of this chapter and part 90. Stations utilizing meteor burst communications shall not cause harmful interference to stations of other radio services operating in accordance with the allocation table.

(21) This frequency will be assigned only in accordance with a geographical assignment plan and is reserved primarily for assignment to Highway maintenance systems operated by states. The use of this frequency by other Highway maintenance licensees will be authorized only where such use is necessary to coordinate activities with the particular state to which the frequency is assigned. Any request for such use must be supported by a statement from the state concerned.

(22) Notwithstanding the provisions of paragraph (d)(21) of this section, this frequency may be used by any licensees in the Public Safety Pool without a separate license for the purpose of operating self-powered vehicle detectors for traffic control and safety purposes, on a secondary basis, in accordance with §90.269.

(23) Thus frequency is reserved for assignment only to national organizations eligible for disaster relief operations under paragraph (a)(2)(vii) of this section.

(24) Assignment and use of frequencies in the band 72–76 MHz are governed by §90.257 for operational-fixed stations and by §90.241 for emergency call box operations. Specific frequencies are listed at §90.257(a)(1).

(25) This frequency is available to Public Safety Pool licensees for fire call box operations on a shared basis in Industrial/Business Pool. All communications on this frequency must be conducted with persons or organizations charged with specific fire protection responsibility. All operations on this frequency are subject to the provisions of §90.257(b).

(26) Assignment of frequencies in this band are subject to the provisions of §90.173. Licensees as of August 18, 1995 who operate systems in the 150–170 MHz band that are 2.5 kHz removed from regularly assignable frequencies may continue to operate on a secondary, non-interference basis after August 1, 2003.

(27) This frequency will be assigned with an authorized bandwidth not to exceed 11.25 kHz. In the 450–470 MHz

band, secondary telemetry operations pursuant to §90.238(e) will be authorized on this frequency.

(28) This frequency is not available for assignment in this service in Puerto Rico or the Virgin Islands.

(29) This frequency is removed by 22.5 kHz from frequencies assigned to other radio services. Utilization of this frequency may result in, as well as be subject to, interference under certain operating conditions. In considering the use of this frequency, adjacent channel operations should be taken into consideration. If interference occurs, the licensee may be required to take the necessary steps to resolve the problem. See §90.173(b).

(30) This frequency will be authorized a channel bandwidth of 25 kHz.

(31) The maximum output power of any transmitter authorized to operate on this frequency shall not exceed 100 watts. Stations authorized prior to July 15, 1992 for fixed operations will be permitted to continue such operations, but at a maximum transmitter power output of 10 watts.

(32) The maximum effective radiated power (ERP) may not exceed 20 watts for fixed stations and 2 watts for mobile stations. The height of the antenna system may not exceed 15.24 meters (50 ft.) above ground. All such operation is on a secondary basis to adjacent channel land mobile operations.

(33) For FM transmitters, the sum of the highest modulating frequency in Hertz and the amount of the frequency deviation or swing in Hertz may not exceed 2800 Hz and the maximum deviation may not exceed 2.5 kHz. For AM transmitters, the highest modulation frequency may not exceed 2000 Hz. The carrier frequency must be maintained within .0005 percent of the center of the frequency band, and the authorized bandwidth may not exceed 6 kHz.

(34) This frequency is available on a shared basis with the Industrial/Business Pool for remote control and telemetry operations.

(35) Operational fixed stations must employ directional antennas having a front-to-back ratio of at least 20 dB. Omnidirectional antennas having unity gain may be employed for stations communicating with at least three receiving locations separated by 160 degrees of azimuth.

(36) The maximum power output of the transmitter may not exceed 50 watts for fixed stations and 1 watt for mobile stations. A1A, A1D, A2B, A2D, F1B, F1D, F2D, G1B, G1D, G2B, or G2D emission may be authorized.

(37) Use of this frequency is limited to stations located at least 120.7 km (75 miles) from the center of any urbanized area of 200,000 or more population (U.S. Census of Population 1970). Operation is on a secondary basis to licensees of the Industrial/Business Pool.

(38) [Reserved]

(39) In addition to other authorized uses, the use of F1B, F1D, F2B or F2D emission is permitted on this frequency for the operation of biomedical telemetry systems except in the following geographic locations:

(i) New York, N.Y.-Northeastern New Jersey; Los Angeles-Long Beach, Calif.; Chicago, Ill.-Northwestern Indiana; Philadelphia, Pa.-N.J.; Detroit, Mich.; San Francisco-Oakland, Calif.; Boston, Mass.; Washington, D.C.-Md.-Va.; Cleveland, Ohio; St. Louis, Mo.-Ill.; Pittsburgh, Pa.; Minneapolis-St. Paul, Minn.; Houston, Tex.; Baltimore, Md.; Dallas, Tex.; Milwaukee, Wis.; Seattle-Everett, Wash.; Miami, Fla.; San Diego, Calif.; Atlanta, Ga.; Cincinnati, Ohio-Ky.; Kansas City, Mo.-Kans.; Buffalo, N.Y.; Denver, Colo.; San Jose, Calif.; New Orleans, La.; Phoenix, Ariz.; Portland, Oreg.-Wash.; Indianapolis, Ind.; Providence-Pawtucket-Warwick, R.I.-Mass.; Columbus, Ohio; San Antonio, Tex.; Louisville, Ky.-Ind.; Dayton, Ohio; Forth Worth, Tex.; Norfolk-Portsmouth, Va.; Memphis, Tenn.-Miss.; Sacramento, Calif.; Fort Lauderdale-Hollywood, Fla.; Rochester, N.Y.; Tampa-St. Petersburg, Fla;

(ii) The continuous carrier mode of operation may be used for telemetry transmissions on this frequency for periods up to two-minutes duration; following which there must be a break in the carrier for at least a one-minute period; and

(iii) Geographical coordinates for the above-listed urbanized areas may be found at Table 1 of §90.635.

(40) This frequency may be designated by common consent as an

intersystem mutual assistance frequency under an area-wide medical communications plan.

(41) This frequency is available nationwide for use in police emergency communications networks operated under statewide law enforcement emergency communications plans.

(42) This frequency may not be assigned within 161 km (100 miles) of New Orleans, La. (coordinates 29°56′53″ N and 90°04′10″ W).

(43) [Reserved]

(44) This frequency will be assigned with an authorized bandwidth not to exceed 6 kHz.

(45) Operations on this frequency are limited to 30 watts transmitter output power.

(46) This frequency is shared with the Industrial/Business Pool in Puerto Rico and the Virgin Islands.

(47) This frequency may be assigned to stations in the Public Safety Pool in accordance with the provisions of § 90.265.

(48) Frequencies in this band will be assigned only for transmitting hydrological or meteorological data or for low power wireless microphones in accordance with the provisions of § 90.265.

(49) This frequency may be assigned only for forest firefighting and conservation activities in accordance with the provisions of § 90.265.

(50)–(51) [Reserved]

(52) In addition to agencies responsible for forest fire prevention, detection, and suppression, this frequency may be assigned to conservation agencies which do not have forest fire responsibilities on a secondary basis to any U.S. Government stations, *Provided*, That such assignment is necessary to permit mobile relay operation by such agencies.

(53) This frequency is subject to the provisions of paragraph (e)(6) of this section.

(54) For FM transmitters, the sum of the highest modulating frequency in hertz and the amount of the frequency deviation or swing in hertz may not exceed 1700 Hz and the maximum deviation may not exceed 1.2 kHz. For AM transmitters, the highest modulating frequency may not exceed 1200 Hz. The carrier frequency must be maintained within .0005 percent of the center of the frequency band, and the authorized bandwidth may not exceed 3 kHz.

(55) Subpart T of this part contains rules for assignment of frequencies in the 220–222 MHz band.

(56) The frequencies available for use at fixed stations in this band and the requirements for assignment are set forth in § 90.261. Operation on these frequencies is secondary to stations in the Industrial/Business Pool where they are assigned for land mobile operations.

(57) This frequency is available for systems first licensed prior to August 18, 1995. No new systems will be authorized after August 18, 1995, but prior authorized systems may be modified, expanded, and renewed.

(58) This frequency is available for systems first licensed prior to March 31, 1980, for radio call box communications related to safety on highways in accordance with the provisions of § 90.241(c). No new systems will be authorized of this nature, but systems authorized prior to March 31, 1980 may be modified, expanded, and renewed.

(59) The continuous carrier mode of operation may be used for telemetry transmission on this frequency.

(60) Paging licensees as of March 20, 1991, may continue to operate on a primary basis until January 14, 1998.

(61) Highway radio call box operations first licensed prior to March 31, 1980 on this frequency may continue to operate in accordance with paragraph (d)(58) of this section.

(62) This frequency is also authorized for use by biomedical telemetry stations. F1B, F1D, F2B, F2D, F3E, G1B, G1D, G2B, G2D, and G3E emissions may be authorized for biomedical transmissions.

(63) Available for medical services mobile operations in the Public Safety Pool in accordance with paragraph (d)(61) of this section.

(64) Use of this frequency is on a secondary basis, limited to 2 watts output power and subject to the provisions of 90.267(h)(1), (h)(2), (h)(3), and (h)(4).

(65) This frequency is primarily authorized for use in the dispatch of medical care vehicles and personnel for the

rendition or delivery of medical services. This frequency may also be assigned for intra-system and inter-system mutual assistance purposes. For uniformity in usage these frequency pairs may be referred to by channel name as follows:

Frequencies base and mobile (megahertz)	Mobile only (MHz)	Channel name
462.950	467.950	MED–9
462.95625	467.95625	MED–91
462.9625	467.9625	MED–92
462.96875	467.96875	MED–93
462.975	467.975	MED–10
462.98125	467.98125	MED–101
462.9875	467.9875	MED–102
462.99375	467.99375	MED–103

(66) For applications for new radio systems, the thirty-two frequency pairs listed in paragraph (d)(66)(i) of this section will be assigned in a block for shared operation under §90.20(a)(1)(iii) or §90.20(a)(2)(xiii) subject to the following:

(i) For uniformity in usage, these frequency pairs may be referred to by channel name as follows:

Frequencies base and mobile (megahertz)	Mobile only (MHz)	Channel name
463.000	468.000	MED–1
463.00625	468.00625	MED–11
463.0125	468.0125	MED–12
463.01875	468.01875	MED–13
463.025	468.025	MED–2
463.03125	468.03125	MED–21
463.0375	468.0375	MED–22
463.04375	468.04375	MED–23
463.050	468.050	MED–3
463.05625	468.05625	MED–31
463.0625	468.0625	MED–32
463.06875	468.06875	MED–33
463.075	463.075	MED–4
463.08125	468.08125	MED–41
463.0875	468.0875	MED–42
463.09375	468.09375	MED–43
463.100	468.100	MED–5
463.10625	468.10625	MED–51
463.1125	468.1125	MED–52
463.11875	468.11875	MED–53
463.125	468.125	MED–6
463.13125	468.13125	MED–61
463.1375	468.1375	MED–62
463.14375	468.14375	MED–63
463.150	468.150	MED–7
463.15625	468.15625	MED–71
463.1625	468.1625	MED–72
463.16875	468.16875	MED–73
463.175	468.175	MED–8
463.18125	468.18125	MED–81
463.1875	468.1875	MED–82
463.19375	468.19375	MED–83

(ii) Except as provided in paragraphs (d)(66)(iv) and (v) of this section, mobile or portable stations licensed prior to July 6, 2000, must employ equipment that is both wired and equipped to transmit/receive, respectively, on each of the following MED frequency pairs with transmitters operated on the 468 MHz frequencies: MED–1, MED–2, MED–3, MED–4, MED–5, MED–6, MED–7, and MED–8.

(iii) Except as provided in paragraphs (d)(66)(v) and (vi) of this section, mobile or portable stations licensed on or after July 6, 2000, must employ equipment that is both wired and equipped to transmit/receive, respectively, on each of the following MED frequency pairs with transmitters operated on the 468 MHz frequencies: MED–1, MED–12, MED–2, MED–22, MED–3, MED–32, MED–4, MED–42, MED–5, MED–52, MED–6 MED–62, MED–7, MED–72, MED–8, and MED–82.

(iv) Except as provided in paragraphs (d)(66)(v) and (vi) of this section, mobile or portable stations licensed on or after January 1, 2006, must employ equipment that is both wired and equipped to transmit/receive, respectively, on each of these MED frequency pairs with transmitters operated on the 468 MHz frequencies.

(v) Portable (hand-held) units operated with a maximum output power of 2.5 watts are exempted from the multi-channel equipment requirements specified in paragraphs (d)(66)(ii), (d)(66)(iii), and (d)(66)(iv) of this section.

(vi) Stations located in areas above line A, as defined in §90.7 will be required to meet multi-channel equipment requirements only for those frequencies up to the number specified in paragraphs (d)(66)(ii), (d)(66)(iii), and (d)(66)(iv) of this section that have been assigned and coordinates with Canada in accordance with the applicable U.S.-Canada agreement.

(67) This frequency is authorized for use only for operations in biomedical telemetry stations. F1B, F1D, F2B, F2D, F3E, G1B, G1D, G2B, G2D and G3E emissions may be authorized. Entities eligible in the Public Safety Pool may use this frequency on a secondary basis for any other permissible communications consistent with §90.20(a)(1)(iii) or §90.20(a)(2)(xiii).

(68) Subpart L of this part contains rules for assignment of frequencies in the 470–512 MHz band.

(69) Subpart S of this part contains rules for assignment of frequencies in the 806–817 MHz and 851–862 MHz bands.

(70) Assignment of frequencies above 928 MHz for operational-fixed stations is governed by part 101 of this chapter.

(71) Frequencies in this band are available only for one-way paging operations in accordance with § 90.494.

(72) This frequency band is available to stations in this service subject to the provisions of § 90.259.

(73) Available only on a shared basis with stations in other services, and subject to no protection from interference due to the operation of industrial, scientific, or medical (ISM) devices. In the band 2483.5–2500 MHz, no applications for new stations or modification to existing stations to increase the number of transmitters will be accepted. Existing licensees as of July 25, 1985, and licensees whose initial applications were filed on or before July 25, 1985, are grandfathered and their operations are on a co-primary basis with the mobile-satellite and radiodetermination-satellite services, and in the segment 2495–2500 MHz, their operations are also on a co-primary basis with part 27 fixed and mobile except aeronautical mobile service operations.

(74) This band is available for Digital Termination Systems and for associated internodal links in the Point-to-Point Microwave Radio Service. No new licenses will be issued under this subpart but current licenses will be renewed.

(75) Appropriate frequencies in the band 2000–3000 kHz which are designated in part 80 of this chapter as available to Public Ship Stations for telephone communications with Public Coast Stations may be assigned on a secondary basis to fixed Stations in the Public Safety Pool for communication with Public Coast Stations only, provided such stations are located in the United States and the following conditions are met:

(i) That such fixed station is established pursuant to the eligibility provisions of (§ 90.47) and that the isolated area involved is an island or other location not more than 480 km (300 statute miles) removed from the desired;

(ii) That evidence is submitted showing that an arrangement has been made with the coast station licensee for the handling of emergency communications permitted by § 80.453 of this chapter and § 90.20(a)(2)(x)(C); and

(iii) That operation of the Public Safety fixed station shall at no time conflict with any provision of part 80 of this chapter and further, that such operation in general shall conform to the practices employed by Public Ship Stations for radiotelephone communication with the same Public Coast Station.

(76) This frequency is authorized only for communications between medical facilities vehicles and personnel related to medical supervision and instruction for the treatment and transport of patients in the rendition or delivery of medical services. F1B, F1D, F2B, F2D, G1B, G1D, G2B, F3E and G3E emissions are authorized. Public Safety entities may use this frequency on a secondary basis for any other permissible communications consistent with § 90.20(a)(1)(iii) or § 90.20(a)(2)(xiii).

(77) Subpart R of this part contains rules for assignment of channels in the 763–775 MHz and 793–805 MHz bands.

(78) Paging operations are not permitted on this frequency.

(79) This frequency will be secondary to marine port operations within 161 km (100 miles) of Los Angeles, Calif. (coordinates 34°03′15″ N and 118°14′28″ W).

(80) After December 7, 2000 this frequency is available primarily for public safety interoperability only communications. Stations licensed prior to December 7, 2000 may continue to use this frequency on a co-primary basis until January 1, 2005. After January 1, 2005, all operations will be secondary to co-channel interoperability communications.

(81) After December 7, 2000 new stations will only be licensed with an authorized bandwidth not to exceed 1125 kHz. Licensees authorized prior to December 7, 2000 may continue to use bandwidths wider that 1125 kHz on a co-primary basis until January 1, 2005. After January 1, 2005, all stations operating with an authorized bandwidth greater than 11.25 kHz will be secondary to adjacent channel interoperability operations.

(82) This frequency is reserved for assignment only in support of, and on a secondary basis to, nationwide interoperability use.

(83) This interoperability frequency is dedicated for the express purpose of nationwide interoperability calling.

(84) Operation on this frequency is subject to the low power provisions of § 90.267. This frequency is assigned to the Public Safety Group in the low power pool.

(85) Subpart Y of this part contains rules for assignment of frequencies in the 4940–4990 MHz band.

(86) Subpart M of this part contains rules for assignment of frequencies in the 5850–5925 MHz band.

(87) The use the frequencies 150.775 MHz and 150.790 MHz are limited to a transmitter output power of 100 watts Effective Radiated Power (ERP) as of May 27, 2005.

(88) Use of this frequency is limited to stations licensed as of May 27, 2005.

(89) As of March 25, 2007, the FCC will cease to issue licenses for new stations in the fixed and mobile services in the following bands: 5900–5950 kHz, 7300–7350 kHz and 9400–9500 kHz. As of March 29, 2009, the FCC will cease to issue licenses for new stations in the fixed and mobile services in the band 7350–7400 kHz and, in the U.S. Pacific insular areas in Region 3, the band 7400–7450 kHz. Stations licensed as of March 25, 2007 in the bands 5900–5950 kHz, 7300–7350 kHz and 9400–9500 kHz and as of March 29, 2009 for the band 7350–7400 kHz in Region 2 and the band 7350–7450 kHz in Region 3 shall:

(1) Be limited to communications only within the United States and its insular areas;

(2) Not cause harmful interference to the broadcasting service;

(3) Be limited to the minimum power needed to achieve communications; and

(4) Take account of the seasonal use of frequencies by the broadcasting service published in accordance with Article 12 of the ITU *Radio Regulations*.

(e) *Additional frequencies available.* In addition to the frequencies shown in the frequency table of this section, the following frequencies are available in this service. (See also § 90.253.)

(1) Substitution of frequencies available below 25 MHz may be made in accordance with the provisions of § 90.263.

(2) Frequencies in the band 73.0–74.6 MHz may be assigned to stations authorized their use on or before December 1, 1961, but no new stations will be authorized in this band, nor will expansion of existing systems be permitted. See also § 90.257.

(3) The frequency bands 31.99–32.00 MHz, 33.00–33.01 MHz, 33.99–34.00 MHz, 37.93–38.00 MHz, 39.99–40.00 MHz, and 42.00–42.01 MHz, are available for assignment for developmental operation subject to the provisions of subpart Q of this part.

(4) Frequencies in the 421–430 MHz band are available in the Detroit, Mich., Cleveland, Ohio and Buffalo, N.Y. areas in accordance with the rules in §§ 90.273 through 90.281.

(5) A Police licensee may use transmitters on the frequencies indicated below in connection with official police activities without specific authorization from the Commission, provided that such use shall be on a secondary basis and shall not cause harmful interference to services of other licensees operating on regularly assigned frequencies, and further provided that all such use complies with the requirements of Federal, State and local laws. The provisions of § 90.429 shall not apply to transmitters authorized under this paragraph. To be eligible for operations in this manner, the transmitter must comply with all of the following requirements.

(i) In accordance with §§ 90.203 and 2.803 of this chapter, the transmitter must be of a type which has been certificated by the Commission.

(ii) The carrier frequency shall be within the bands listed below and must be maintained within 0.005 percent of the frequency of operation. Use on assigned channel center frequencies is not required.

30.85–30.87 MHz	31.21–31.23 MHz
30.89–30.91 MHz	31.25–31.27 MHz
30.93–30.95 MHz	31.29–31.31 MHz
30.97–30.99 MHz	31.33–31.35 MHz
31.01–31.03 MHz	31.37–31.39 MHz
31.05–31.07 MHz	31.41–31.43 MHz
31.09–31.11 MHz	31.45–31.47 MHz
31.13–31.15 MHz	31.49–31.51 MHz
31.17–31.19 MHz	31.53–31.55 MHz

31.57–31.59 MHz	45.93–45.95 MHz
31.61–31.63 MHz	45.97–45.99 MHz
31.65–31.67 MHz	46.01–46.03 MHz
31.69–31.71 MHz	46.05–46.60 MHz
31.73–31.75 MHz	47.00–47.41 MHz
31.77–31.79 MHz	150.995–151.490 MHz
31.81–31.83 MHz	153.740–154.445 MHz
31.85–31.87 MHz	154.635–155.195 MHz
31.89–31.91 MHz	155.415–156.250 MHz
31.93–31.95 MHz	158.715–159.465 MHz
31.97–32.00 MHz	453.0125–453.9875 MHz
33.00–33.03 MHz	458.0125–458.9875 MHz
33.05–33.07 MHz	460.0125–460.5125 MHz
33.41–34.00 MHz	460.5625–460.6375 MHz
37.00–37.43 MHz	462.9375–462.9875 MHz
37.89–38.00 MHz	465.0125–465.5125 MHz
39.00–40.00 MHz	465.5625–465.6375 MHz
42.00–42.91 MHz	467.9375–467.9875 MHz
44.61–45.91 MHz	

(iii) The emitted signal shall be non-voice modulation (type PO emission).

(iv) The maximum occupied bandwidth, containing 99 percent of the radiated power, shall not exceed 2.0 kHz.

(v) The transmitter output power shall not exceed a mean power of 30 mW nor shall any peak exceed 1 watt peak power, as measured into a 50 ohm resistive load. Should the transmitter be supplied with a permanently attached antenna or should the transmitter and antenna combination be contained in a sealed unit, the following standard may be used in lieu of the above: the field strength of the fundamental signal of the transmitter and antenna combination shall not exceed 0.4 V/m mean or 2.3 V/m peak when measured at a distance of 3 meters.

(vi) The transmitter shall contain positive means to limit the transmission time to no more than 10 days. In the event of a malfunction of this positive means, the transmitter signal shall cease. The use of battery life to accomplish the transmission time limitation is permissible.

(6) The frequency 173.075 MHz is available for stolen vehicle recovery systems on a shared basis with Federal stations in the fixed and mobile services.

(i) Stolen vehicle recovery systems are limited to tracking and recovering vehicles, cargo, and hazardous materials that have been reported stolen or missing; missing or wanted persons; and individuals at risk, or individuals of interest to law enforcement, only when established boundaries are violated. Stolen vehicle recovery systems are not authorized for general purpose tracking or monitoring. Mobile units may also transmit automatic collision notifications, vehicle fire notifications, and carjacking alerts.

(ii) Any type of emission may be used within a maximum authorized bandwidth of 12.5 kHz, except that stations that operate as part of a stolen vehicle recovery system that was authorized and in operation prior to May 27, 2005 may operate with a maximum authorized bandwidth of 20 kHz until May 27, 2019. For a complete listing of emission symbols allowable under this part, see § 2.201 of this chapter.

(iii) Mobile transmitters operating on this frequency with emissions authorized in a maximum bandwidth of 12.5 kHz are limited to 5.0 watts power output. Mobile transmitters operating on this frequency with emissions authorized in a maximum bandwidth of 20 kHz are limited to 2.5 watts power output.

(iv) Base station transmitters operating on this frequency with emissions authorized in a maximum bandwidth of 12.5 kHz are limited to 300 watts ERP before February 18, 2009, and 500 watts ERP thereafter. Base station transmitters operating on this frequency with emissions authorized in a maximum bandwidth of 20 kHz are limited to 300 watts ERP.

(v) Transmissions from mobiles shall be limited to 400 milliseconds for every 10 seconds, except when a vehicle is being tracked actively transmissions are limited to 400 milliseconds for every second. Alternatively, transmissions from mobiles shall be limited to 7200 milliseconds for every 300 seconds with a maximum of six such messages in any 30 minute period.

(vi) Transmissions from base stations shall be limited to a total rate of five seconds every minute.

(vii) Any entity eligible to hold authorizations in the Public Safety Pool in accordance with §§ 90.20(a) and 90.111 of this chapter is authorized by this rule to operate mobile transmitters on this frequency. No license will be issued for mobile transmitters.

(viii) Applications for base stations operating on this frequency shall require coordination with the Federal Government. Applicants shall perform

an analysis for each base station that is located within 169 km (105 miles) of a TV Channel 7 transmitter of potential interference to TV Channel 7 viewers. Applicants shall serve a copy of the analysis to the licensee of the affected TV Channel 7 transmitter upon filing the application with the Commission. Such base stations will be authorized if the applicant has limited the interference contour to include fewer than 100 residences or if the applicant:

(A) Shows that the proposed site is the only suitable location (which, at the application stage, requires a showing that the proposed site is especially well-suited to provide the proposed service);

(B) Develops a plan to control any interference caused to TV reception from operations; and

(C) Agrees to make such adjustments in the TV receivers affected as may be necessary to eliminate interference caused by its operations.

(ix) The licensee must eliminate any interference caused by its operation to TV Channel 7 reception within 30 days after notification in writing by the Commission. If this interference is not removed within this 30-day period, operation of the base station must be discontinued. The licensee is expected to help resolve all complaints of interference.

(f) *Limitation on number of frequencies assignable.* Normally only two frequencies or pairs of frequencies in the paired frequency mode of operation will be assigned for mobile service operations by a single applicant in a given area. The assignment of an additional frequency or pair of frequencies will be made only upon a satisfactory showing of need, except that:

(1) Additional frequencies above 25 MHz may be assigned in connection with the operation of mobile repeaters in accordance with §90.247 notwithstanding this limitation;

(2) The frequency 39.06 MHz may be assigned notwithstanding this limitation;

(3) Frequencies in the 25–50 MHz, 150–170 MHz, 450–512 MHz and 902–928 MHz bands may be assigned for the operation of Location and Monitoring Service (LMS) systems in accordance with the provisions of subpart M of this part, notwithstanding this limitation;

(4) A licensee of a radio station in this service may operate radio units for the purpose of determining distance, direction, speed, or position by means of a radiolocation device on any frequency available for radiolocation purposes without additional authorization from the Commission, provided type accepted equipment or equipment authorized pursuant to §90.203(b)(4) and (b)(5) of this part is used, and all other rule provisions are satisfied. A licensee in this service may also operate, subject to all of the foregoing conditions and on a secondary basis, radio units at fixed locations and in emergency vehicles that transmit on the frequency 24.10 GHz, both unmodulated continuous wave radio signals and modulated FM digital signals for the purpose of alerting motorists to hazardous driving conditions or the presence of an emergency vehicle. Unattended and continuous operation of such transmitters will be permitted.

(5) A Police licensee may use, without special authorization from the Commission, any mobile service frequency between 40 and 952 MHz, listed in paragraph (c)(3) of this section, for communications in connection with physical surveillance, stakeouts, raids, and other such activities. Such use shall be on a secondary basis to operations of licensees regularly authorized on the assigned frequencies. The maximum output power that may be used for such communications is 2 watts. Transmitters, operating under this provision of the rules, shall be exempted from the station identification requirements of §90.425. Use of frequencies not designated by a ''PP'' in the coordinator column of the frequency table in paragraph (c)(3) of this section, is conditional on the approval of the coordinator corresponding to each frequency. Spread spectrum transmitters may be operated on Public Safety Pool frequencies between 37 and 952 MHz, providing that they are certificated by the Commission under the provisions of §2.803 of this chapter and §90.203, and meet the following conditions:

(i) Frequency hopping transmitters can be operated, with a maximum output power of 2 watts, on any Public

Safety Pool frequency between 37 and 952 MHz listed in paragraph (c)(3) of this section. At least 20 hopping frequencies shall be used and the average time of occupancy on any frequency shall not be greater than 1/10 second in every 2 seconds;

(ii) Use of spread spectrum transmitters under paragraph (f)(4) of this section is subject to approval by the applicable frequency coordinator of the radio services of the district in which the license and equipment are to be used; and

(iii) The use of direct sequence spread spectrum equipment is also permitted. Equipment must meet the technical standards of § 15.247 of this chapter.

(6) In addition to the frequencies assigned for mobile service operation, one base station frequency above 152 MHz may be assigned as a common frequency to all licensees in a particular area to permit intersystem communication between base stations or mobile stations or both. This frequency use will not be authorized in any area where all available frequencies are required for independent systems.

(7) A licensee may use, without a specific authorization from the Commission, transmitters on the frequencies indicated below in connection with wildlife tracking and/or telemetry and in connection with official forestry-conservation activities, provided that such use shall be on a secondary basis and shall not cause harmful interference to services of other licensees operating on regularly assigned frequencies. The provisions of §§ 90.203, 90.425, and 90.429 shall not apply to transmitters complying with this paragraph. To be eligible for operations in this manner, the transmitter must comply with all of the following requirements.

(i) The carrier frequency shall be within the bands listed below. The carrier frequency must be maintained within 0.005 percent of the frequency of operation.

Use on assigned channel center frequencies is not required.

(MHz)

31.17 to 31.19	31.25 to 31.27
31.21 to 31.23	31.29 to 31.31
31.33 to 31.35	31.93 to 31.95
31.37 to 31.39	31.97 to 31.99
31.41 to 31.43	44.63 to 44.65
31.45 to 31.47	44.67 to 44.69
31.49 to 31.51	44.71 to 44.73
31.53 to 31.55	44.75 to 44.77
31.57 to 31.59	44.79 to 44.81
31.61 to 31.63	44.83 to 44.85
31.65 to 31.67	44.87 to 44.89
31.69 to 31.71	44.91 to 44.93
31.73 to 31.75	44.95 to 44.97
31.77 to 31.79	44.99 to 45.01
31.81 to 31.83	45.03 to 45.05
31.85 to 31.87	151.145 to 151.475
31.89 to 31.91	159.225 to 159.465

(ii) The emitted signal shall be non-voice modulation (A1D, A2D, F1D, or F2D emission).

(iii) The maximum occupied bandwidth, containing 99 percent of the radiated power, shall not exceed 0.25 kHz.

(iv) The transmitter output power shall not exceed a mean power of 5 mW nor shall any peak exceed 100 mW peak power, as measured into a permanently attached antenna; or if the transmitter and antenna combination are contained in a sealed unit, the field strength of the fundamental signal of the transmitter and antenna combination shall not exceed 0.29 V/m mean or 1.28 V/m peak when measured at a distance of 3 meters.

(v) The requirements of § 90.175 regarding frequency coordination apply.

(8) An additional frequency may be assigned for paging operations from those frequencies available under paragraph (d)(13) of this section.

(9) The frequency 155.340 MHz may be assigned as an additional frequency when it is designated as a mutual assistance frequency as provided in paragraph (d)(40) of this section.

(10) Additional frequencies may be assigned for fixed station operations.

(11) The assignment of an additional frequency or frequencies may be authorized notwithstanding this limitation for common, intra-county, intra-fire-district, or intrastate fire coordination operations. The frequency or frequencies requested must be in accordance with a frequency utilization plan, for the area involved, on file with the Commission.

(g) *Former public correspondence working channel in the maritime VHF (156–162 MHz) band allocated for public safety use*

in 33 inland Economic Areas. (1) We define service areas in the marine VHF (156–162 MHz) band by forty-two geographic areas called VHF Public Coast Service Areas (VPCSAs). See § 80.371(c)(1)(ii) of this chapter (Public correspondence frequencies). VPCSAs are based on, and composed of one or more of, the U.S. Department of Commerce's 172 Economic Areas (EAs). See 60 Fed Reg. 13114 (Mar. 10, 1995). You may inspect and copy maps of the EAs and VPCSAs at the FCC Reference Center, Room CY A–257, 445 12th St., SW., Washington, DC 20554. These maps and data are also available on the FCC website at *http://www.fcc.gov/oet/info/maps/areas/.* We number public correspondence channels in the maritime VHF (156–162 MHz) band as channels 24 to 28 and channels 84 to 88. Each channel number represents a channel pair. See § 80.371(c) of this chapter.

(2) In VHF Public Coast Service Areas (VPCSAs) 10–42, the duplex channel pair 157.250 MHz/161.850 MHz (VHF Maritime Channel 25) is allocated for public safety use by entities eligible for licensing under paragraph (a) of this section, and is designated primarily for the purpose of interoperability communications. *See* 47 CFR 80.371(c)(1)(ii) for the definitions of VPCSAs.

(i) The channel pair 157.250 MHz/161.850 MHz was formerly allocated and assigned (under § 80.371(c) (1997) of this chapter) as a public correspondence working channel in the maritime VHF 156–162 MHz band, and was also shared (under former § 90.283 (1997) of this chapter) with private land mobile stations, including grandfathered public safety licensees. Thus, there are grandfathered licensees nationwide (maritime and private land mobile radio stations, including by rule waiver) operating on this channel both inside and outside of VPCSAs 10–42.

(ii) The channel pairs 157.225 MHz/161.825 MHz and 157.275 MHz/161.875 MHz were formerly allocated and assigned under this section as public safety interoperability channels but were reallocated for assignment as VHF public coast station channels under § 80.371(c) of this chapter. Public safety operations licensed on these channels as of March 2, 2009 or licensed pursuant to an application filed prior to September 19, 2008, may remain authorized to operate on the channels on a primary basis until March 4, 2024.

(3) All applicants and licensees under this paragraph must comply with the relevant technical sections under this part unless otherwise stated in this paragraph (g) of this section using the following standards and procedures:

(i) Provide evidence of frequency coordination in accordance with § 90.175. Public safety coordinators except the Special Emergency Coordinator are certified to coordinate applications for the channel pair 157.250 MHz/161.850 MHz (*i.e.* , letter symbol PX under paragraph (c)(2) of this section).

(ii) Station power, as measured at the output terminals of the transmitter, must not exceed 50 Watts for base stations and 20 Watts for mobile stations, except in accordance with the provisions of paragraph (g)(3)(vi) of this section. Antenna height (HAAT) must not exceed 122 meters (400 feet) for base stations and 4.5 meters (15 feet) for mobile stations, except in accordance with paragraph (g)(3)(vi) of this section. Antenna height (HAAT) must not exceed 122 meters (400 feet) for base stations and 4.5 meters (15 feet) for mobile stations, except in accordance with paragraph (g)(3)(vi) of this section. Such base and mobile channels shall not be operated on board aircraft in flight.

(iii) Frequency protection must be provided to other stations in accordance with the following guidelines for each channel and for each area and adjacent area:

(A) Protect coast stations licensed prior to July 6, 1998, by the required separations shown in Table C below.

(B) Protect stations described in paragraph (g)(2)(i) of this section, by frequency coordination in accordance § 90.175 of this part.

(C) Protect public safety stations granted under paragraph (g) of this section by frequency coordination in accordance with § 90.175 of this part.

(D) *Where the Public safety designated channel is not a Public safety designated channel in an adjacent VPCSA:* Applicants shall engineer base stations such that the maximum signal strength at

the boundary of the adjacent VPCSA does not exceed 5dBμV/m.

(iv) The following table, along with the antenna height (HAAT) and power (ERP), must be used to determine the minimum separation required between proposed base stations and co-channel public coast stations licensed prior to July 6, 1998 under part 80 of this chapter. Applicants whose exact ERP or HAAT are not reflected in the table must use the next highest figure shown.

TABLE C—REQUIRED SEPARATION IN KILOMETERS (MILES) OF BASE STATION FROM PUBLIC COAST STATIONS

Base Station Characteristics					
HAAT	ERP (watts)				
Meters (feet)	400	300	200	100	50
15 (50)	138 (86)	135 (84)	129 (80)	129 (80)	116 (72)
30 (100)	154 (96)	151 (94)	145 (90)	137 (85)	130 (81)
61 (200)	166 (103)	167 (104)	161 (100)	153 (95)	145 (90)
122 (400)	187 (116)	177 (110)	183 (114)	169 (105)	159 (99)

(v) In the event of interference, the Commission may require, without a hearing, licensees of base stations authorized under this section that are located within 241 kilometers (150 miles) of a co-channel public coast, I/LT, or grandfathered public safety station licensed prior to July 6, 1998, or an international border, to reduce power, decrease antenna height, and/or install directional antennas.

Mobile stations must be operated only within radio range of their associated base station.

(vi) Applicants seeking to be licensed for stations exceeding the power/antenna height limits of the table in paragraph (g)(3)(iv) of this section must request a waiver of that paragraph and must submit with their application an interference analysis, based upon an appropriate, generally-accepted terrain-based propagation model, that shows that co-channel protected entities, described in paragraph (g)(3)(iii) of this section, would receive the same or greater interference protection than the relevant criteria outlined in paragraph (g)(3)(iii) of this section.

(h) *Spectrum leasing arrangements.* Notwithstanding any other provisions of this section to the contrary, licensees in the Public Safety Radio Services (*see* part 90, subpart B) may enter into spectrum leasing arrangements (*see* part 1, subpart X of this chapter) with entities providing communications in support of public safety operations.

[62 FR 18845, Apr. 17, 1997]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting § 90.20, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

§ 90.22 Paging operations.

Unless specified elsewhere in this part, paging operations may be authorized in the Public Safety Pool on any frequency except those assigned under the provisions of § 90.20(d)(78). Paging operations on frequencies subject to § 90.20(d)(78) authorized before August 17, 1974, may be continued only if they do not cause harmful interference to regular operations on the same frequencies. Such paging operations may be renewed indefinitely on a secondary basis to regular operations, except within 125 km (75 mi) of the following urbanized areas:

Urbanized area	North latitude	West longitude
New York, NY-Northeastern NJ	40-45-06.4	73-59-37.5
Los Angeles-Long Beach, CA	34-03-15.0	118-14-31.3
Chicago, IL	41-52-28.1	87-38-22.2
Philadelphia, PA-NJ	39-56-58.4	75-09-19.6
Detroit, MI	42-19-48.1	83-02-56.7
San Francisco-Oakland, CA	37-46-38.7	122-24-43.9
Boston, MA	42-21-24.4	71-03-23.2
Washington, DC-MD-VA	38-53-51.4	77-00-31.9
Cleveland, OH	41-29-51.2	81-41-49.5
St Louis, MO-IL	38-37-45.2	90-12-22.4
Pittsburgh, PA	40-26-19.2	79-59-59.2
Minneapolis-St Paul, MN	44-58-56.9	93-15-43.8

Urbanized area	North latitude	West longitude
Houston, TX	29-45-26.8	95-21-37.8
Baltimore, MD	39-17-26.4	76-36-43.9
Dallas, TX	32-47-09.5	96-47-38.0
Milwaukee, WI	43-02-19.0	87-54-15.3
Seattle-Everett, WA	47-36-31.4	122-20-16.5
Miami, FL	25-46-38.4	80-11-31.2
San Diego, CA	32-42-53.2	117-09-24.1
Atlanta, GA	33-45-10.4	84-23-36.7
Cincinnati, OH-KY	39-06-7.2	84-30-34.8
Kansas City, MO-KS	39-04-56.0	94-35-20.8
Buffalo, NY	42-52-52.2	78-52-20.1
Denver, CO	39-44-58.0	104-59-23.9

[63 FR 68959, Dec. 14, 1998, as amended at 64 FR 36262, July 6, 1999; 65 FR 60874, Oct. 13, 2000]

Subpart C—Industrial/Business Radio Pool

SOURCE: 62 FR 18874, Apr. 17, 1997, unless otherwise noted.

§ 90.31 Scope.

The Industrial/Business Radio Pool covers the licensing of the radio communications of entities engaged in commercial activities, engaged in clergy activities, operating educational, philanthropic, or ecclesiastical institutions, or operating hospitals, clinics, or medical associations. Rules as to eligibility for licensing, frequencies available, permissible communications and classes and number of stations, and any special requirements are set forth in the following sections.

§ 90.33 General eligibility.

(a) In addition to the eligibility shown in the Industrial/Business Pool, eligibility is also provided for any corporation proposing to furnish nonprofit radiocommunication service to its parent corporation, to another subsidiary of the same parent, or to its own subsidiary. This corporate eligibility is not subject to the cooperative use provision of § 90.179.

(b) Eligibility is also provided for a nonprofit corporation or association that is organized for the purpose of furnishing a radiocommunications service to persons who meet the eligibility requirements of the Industrial/Business Pool. Such use is subject to the cooperative use provisions of § 90.179.

§ 90.35 Industrial/Business Pool.

(a) *Eligibility.* Persons primarily engaged in any of the following activities are eligible to hold authorizations in the Industrial/Business Pool to provide commercial mobile radio service as defined in part 20 of this chapter or to operate stations for transmission of communications necessary to such activities of the licensee:

(1) The operation of a commercial activity;

(2) The operation of educational, philanthropic, or ecclesiastical institutions;

(3) Clergy activities; or

(4) The operation of hospitals, clinics, or medical associations.

(b) *Industrial/Business Pool frequencies.* (1) The following table indicates frequencies available for assignment to Industrial/Business Pool stations, together with the class of station(s) to which they are normally assigned, the specific assignment limitations which are explained in paragraph (b) of this section, and the certified frequency coordinator for each frequency:

(2) Unless otherwise specified, coordination of frequencies in the Industrial/Business pool must be done in accordance with the following:

(i) Unless specified elsewhere in this part, frequencies without any coordinator specified in the Coordinator column of paragraph (b)(3) of this section may be coordinated by any frequency coordinator certified in the Industrial/Business Pool.

(ii) A letter symbol in the Coordinator column of the frequency table in paragraph (b)(3) of this section designates the mandatory certified frequency coordinator for the associated frequency in the table. However, any coordinator certified in the Industrial/Business Pool may coordinate applications on such frequencies provided the prior written consent of the designated coordinator is obtained. Frequencies for which two coordinators are listed may be coordinated by either of the listed coordinators.

(iii) For frequencies above 150 MHz, applications for new or modified facilities on frequencies shared prior to radio service consolidation by the former Manufacturers Radio Service, the Forest Products Radio Service, the

Power Radio Service, the Petroleum Radio Service, the Motor Carrier Radio Service, the Railroad Radio Service, the Telephone Maintenance Radio Service and the Automobile Emergency Radio Service may be coordinated by any certified Industrial/Business Pool coordinator. However, in the event that the interference contour of a proposed station would overlap the service contour of an existing station licensed on one of these previously shared frequencies, the written concurrence of the coordinator associated with the industry for which the existing station license was issued, or the written concurrence of the licensee of the existing station, shall be obtained. For the purposes of this §90.35, the service contour for UHF stations is the 39 dBu contour; and the interference contour for UHF stations is the 21 dBu contour; the service contour for VHF stations is the 37 dBu contour; and the interference contour for VHF stations is the 19 dBu contour.

(iv) The letter symbols listed in the Coordinator column of the frequency table in paragraph (b)(3) of this section refer to specific frequency coordinators as follows:

IP—Petroleum Coordinator
IW—Power Coordinator
LR—Railroad Coordinator
LA—Automobile Emergency Coordinator

(3) *Frequencies.*

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE

Frequency or band	Class of station(s)	Limitations	Coordinator
Kilohertz			
2000 to 25,000	Fixed, base or mobile.	1, 90	
2292	Base or mobile	4, 5, 7.	
2398	do	5, 7.	
4637.5	do	5, 7.	
Megahertz			
25.02	do	3, 4	IP
25.04	do	8	IP
25.06	do	3, 4	IP
25.08	do	8, 9	IP
25.10	do	3, 4, 9	IP
25.12	do	9	IP
25.14	do	3, 4, 9	IP
25.16	do	9	IP
25.18	do	3, 4, 9	IP
25.20	do	9	IP
25.22	do	4, 7	IP
25.24	do		IP
25.26	do	4, 7	IP
25.28	do		IP
25.30	do	4, 7	IP
25.32	do		IP
27.43	do.		
27.45	do.		
27.47	do.		
27.49	do	10.	
27.51	Mobile	11.	
27.53	do	11.	
27.555	Base or mobile	89	
27.615	do	89	
27.635	do	89	
27.655	do	89	
27.765	do	89	
27.86	do	82	
29.71	do		
29.73	do.		
29.75	do.		
29.77	do.		
29.79	do.		
30.58	do.		
30.60	do.		
30.62	do.		
30.64	do.		
30.66	do	4, 7.	
30.68	do.		
30.70	do	4, 7	IP
30.72	do.		
30.74	do	4, 7.	
30.76	do.		
30.78	do	4, 7	IP
30.80	do.		
30.82	do	4, 7.	
30.84	Mobile	11, 12.	
30.86	Base or mobile	13	
30.88	do.		
30.90	do	13.	
30.92	do.		
30.94	do	13.	
30.96	do.		
30.98	do	13.	
31.00	do.		
31.02	do	13.	
31.04	do.		
31.06	do	13.	
31.08	do.		
31.10	do	13.	
31.12	do.		
31.14	do	13.	
31.16	do.		
31.20	do.		
31.24	do.		
31.28	do.		
31.32	do.		
31.36	do.		
31.40	do.		
31.44	do.		
31.48	do.		
31.52	do.		
31.56	do.		
31.60	do.		
31.64	do.		
31.68	do.		
31.72	do.		
31.76	do.		
31.80	do.		
31.84	do.		
31.88	do.		
31.92	do.		
31.96	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
33.12	Mobile	11	
33.14	Mobile	11, 12.	
33.16	Base or mobile		
33.18	do		IP
33.20	do		IP
33.22	do		IP
33.24	do		IP
33.26	do		IP
33.28	do		IP
33.30	do		IP
33.32	do		IP
33.34	do		IP
33.36	do		IP
33.38	do		IP
33.40	Mobile	12, 14.	
35.02	do	11, 12, 13.	
35.04	Base or Mobile	10.	
35.06	do.		
35.08	do.		
35.10	do.		
35.12	do.		
35.14	do.		
35.16	do.		
35.18	do.		
35.28	do.		
35.32	do.		
35.36	do.		
35.40	do.		
35.44	do		
35.48	do		
35.52	do		
35.70	do.		
35.72	do.		
35.74	do.		
35.76	do.		
35.78	do.		
35.80	do.		
35.82	do.		
35.84	do.		
35.86	do.		
35.88	do.		
35.90	do.		
35.92	do.		
35.94	do.		
35.96	do.		
35.98	do.		
36.25	do	15	IP
37.44	do.		
37.46	do		IW
37.48	do		IW
37.50	do		IW
37.52	do		IW
37.54	do		IW
37.56	do		IW
37.58	do		IW
37.60	Base, mobile, or operational fixed.	16	IW
37.62	Base or mobile		IW
37.64	do		IW
37.66	do		IW
37.68	do		IW
37.70	do		IW
37.72	do		IW
37.74	do		IW
37.76	do		IW
37.78	do		IW
37.80	do		IW
37.82	do		IW

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
37.84	Base, mobile, or operational fixed.	16	IW
37.86	Base or mobile		IW
37.88	do.		
41.71	do	15	IP
42.96	do.		
42.98	Mobile	11, 12.	
43.00	Base or mobile		
43.02	do.		
43.04	do	17.	
43.06	do.		
43.08	do.		
43.10	do.		
43.12	do.		
43.14	do.		
43.16	Mobile.		
43.18	Base or mobile.		
43.28	do.		
43.32	do.		
43.36	do.		
43.40	do.		
43.44	do.		
43.48	do.		
43.52	do.		
43.70	do.		
43.72	do	18.	
43.74	do	18.	
43.76	do.		
43.78	do.		
43.80	do.		
43.82	do	18.	
43.84	do	18.	
43.86	do	19.	
43.88	do	19.	
43.90	do	19.	
43.92	do	18, 19.	
43.94	do	19.	
43.96	do	18.	
43.98	do.		
44.00	do.		
44.02	do.		
44.04	do.		
44.06	do.		
44.08	do.		
44.10	do	20.	
44.12	do	18.	
44.14	do.		
44.16	do	18.	
44.18	do	18.	
44.20	do	18, 21.	
44.22	do.		
44.24	do.		
44.26	do.		
44.28	do.		
44.30	do.		
44.32	do	18.	
44.34	do.		
44.36	do	18, 19.	
44.38	do	19.	
44.40	do	18, 19.	
44.42	do	19.	
44.44	do	19.	
44.46	do	18.	
44.48	do	18.	
44.50	do.		
44.52	do.		
44.54	do.		
44.56	do.		
44.58	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
44.60	do.		
47.44	do.		
47.48	do.		
47.52	do.		
47.56	do.		
47.60	do.		
47.64	do.		
47.68	do.		
47.70	do		IW
47.72	do		IW
47.74	do		IW
47.76	do		IW
47.78	do		IW
47.80	do		IW
47.82	do		IW
47.84	do		IW
47.86	do		IW
47.88	do		IW
47.90	do		IW
47.92	do		IW
47.94	do		IW
47.96	do		IW
47.98	do		IW
48.00	do		IW
48.02	do		IW
48.04	do		IW
48.06	do		IW
48.08	do		IW
48.10	do		IW
48.12	do		IW
48.14	do		IW
48.16	do		IW
48.18	do		IW
48.20	do		IW
48.22	do		IW
48.24	do		IW
48.26	do		IW
48.28	do		IW
48.30	do		IW
48.32	do		IW
48.34	do		IW
48.36	do		IW
48.38	do		IW
48.40	do		IW
48.42	do		IW
48.44	do		IW
48.46	do		IW
48.48	do		IW
48.50	do		IW
48.52	do		IW
48.54	do		IW
48.56	do.		
48.58	do.		
48.60	do.		
48.62	do.		
48.64	do.		
48.66	do.		
48.68	do.		
48.70	do.		
48.72	do.		
48.74	do.		
48.76	do	18.	
48.78	do.		
48.80	do.		
48.82	do.		
48.84	do	18.	
48.86	do	18.	
48.88	do.		
48.90	do.		
48.92	do	18.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
48.94	do.		
48.96	do.		
48.98	do.		
49.00	do.		
49.02	do	18.	
49.04	do.		
49.06	do.		
49.08	do	18.	
49.10	do	18.	
49.12	do.		
49.14	do.		
49.16	do	18.	
49.18	do.		
49.20	do	18.	
49.22	do.		
49.24	do	18.	
49.26	do	18.	
49.28	do	18.	
49.30	do.		
49.32	do.		
49.34	do.		
49.36	do	18.	
49.38	do.		
49.40	do	18.	
49.42	do.		
49.44	do.		
49.46	do	18.	
49.48	do.		
49.50	do	18.	
49.52	do.		
49.54	do.		
49.56	do.		
49.58	do.		
72 to 76	Operational fixed.	22.	
72.02	Mobile	23, 24.	
72.04	do	23, 24.	
72.06	do	23, 24.	
72.08	do	23, 24, 25.	
72.10	do	23, 24.	
72.12	do	23, 24.	
72.14	do	23, 24.	
72.16	do	23, 24, 25.	
72.18	do	23, 24.	
72.20	do	23, 24.	
72.22	do	23, 24.	
72.24	do	23, 24, 25.	
72.26	do	23, 24.	
72.28	do	23, 24.	
72.30	do	23, 24.	
72.32	do	23, 24, 25.	
72.34	do	23, 24.	
72.36	do	23, 24.	
72.38	do	23, 24.	
72.40	do	23, 24, 25.	
72.44	do	13, 24, 77.	
72.48	do	13, 24, 77.	
72.52	do	13, 24, 77.	
72.56	do	13, 24, 77.	
72.60	do	13, 24, 77.	
74.61	do	26, 77.	
74.63	do	26, 77.	
74.65	do	26, 77.	
74.67	do	26, 77.	
74.69	do	26, 77.	
74.71	do	26, 77.	
74.73	do	26, 77.	
74.75	do	26, 77.	
74.77	do	26, 77.	
74.79	do	26, 77.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
75.21	do	26, 77.	
75.23	do	26, 77.	
75.25	do	26, 77.	
75.27	do	26, 77.	
75.29	do	26, 77.	
75.31	do	26, 77.	
75.33	do	26, 77.	
75.35	do	26, 77.	
75.37	do	26, 77.	
75.39	do	26, 77.	
75.44	do	13, 24, 77.	
75.48	do	13, 24, 77.	
75.52	do	13, 24, 77.	
75.56	do	13, 24, 77.	
75.60	do	13, 24, 77.	
150 to 170	Base or mobile	27.	
150.815	do		LA
150.830	do	28, 29	LA
150.845	do		LA
150.8525	do	30	LA
150.860	do		LA
150.8675	do	30	LA
150.875	do		LA
150.8825	do	30	LA
150.890	do		LA
150.8975	do	30	LA
150.905	do		LA
150.920	do	28, 29	LA
150.935	do		LA
150.9425	do	30	LA
150.950	do		LA
150.9575	do	30	LA
150.965	do		LA
150.9725	do	30	LA
150.980	do	8	IP
150.9875	do	8, 30	IP
150.995	do	31.	
151.0025	do	30, 31	
151.010	do	31.	
151.0175	do	30, 31	
151.025	do	31.	
151.0325	do	30, 31	
151.040	do	31.	
151.0475	do	3031	
151.055	do	31.	
151.070	Base	28, 29, 31.	
151.085	Base or mobile	31.	
151.0925	do	30, 31	
151.100	do	31.	
151.1075	do	30, 31	
151.115	do	31.	
151.1225	do	30, 31	
151.130	do	31.	
151.1375	do	30, 31	
151.145	do	31.	
151.1525	do	30, 31	
151.160	do	31.	
151.1675	do	30, 31	
151.175	do	31.	
151.190	Base	28, 29, 31.	
151.205	Base or mobile	31.	
151.2125	do	30, 31	
151.220	do	31.	
151.2275	do	30, 31	
151.235	do	31.	
151.2425	do	30, 31	
151.250	do	31.	
151.2575	do	30, 31	
151.265	do	31.	
151.2725	do	30, 31	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
151.280	do	31.	
151.2875	do	30, 31	
151.295	do	31.	
151.310	Base	28, 29, 31.	
151.325	Base or mobile	31.	
151.3325	do	30, 31	
151.340	do	31.	
151.3475	do	30, 31	
151.355	do	31.	
151.3625	do	30, 31	
151.370	do	31.	
151.3775	do	30, 31	
151.385	do	31.	
151.3925	do	30, 31	
151.400	do	31.	
151.4075	do	30, 31	
151.415	do	31.	
151.4225	do	30, 31	
151.430	do	31.	
151.4375	do	30, 31	
151.445	do	31.	
151.4525	do	30, 31	
151.460	do	31.	
151.4675	do	30, 31	
151.475	do	31.	
151.4825	do	30, 31	
151.490	do	13, 32.	
151.4975	do	30, 32	
151.505	do	17.	
151.5125	do	30, 17	
151.520	do.		
151.5275	do	30	
151.535	do.		
151.5425	do	30	
151.550	do.		
151.5575	do	30	
151.565	do.		
151.5725	do	30	
151.580	do.		
151.5875	do	30	
151.595	do.		
151.6025	do	30	
151.625	do	10.	
151.640	do	10, 33.	
151.6475	do	30	
151.655	do.		
151.6625	do	30	
151.670	do	30	
151.6775	do	30	
151.685	do.		
151.700	do	10, 30, 34.	
151.715	do.		
151.7225	do	30	
151.730	do	30	
151.7375	do	30	
151.745	do.		
151.760	do	10, 30, 34.	
151.775	do.		
151.7825	do	30	
151.790	do	30	
151.7975	do	30	
151.805	do.		
151.835	Base or mobile.		
151.8425	do	30	
151.850	do	30	
151.8575	do	30	
151.865	do.		
151.895	do		
151.9025	do	30	
151.910	do	30	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
151.9175	do	30	
151.925	do.		
151.955	do		
151.9625	do	30	
151.970	do	30	
151.9775	do	30	
151.985	do.		
152.2625	do	33.	
152.270	do	6.	
152.2775	do	6, 30	
152.285	do	6.	
152.2925	do	6, 30	
152.300	do	6.	
152.3075	do	6, 30	
152.315	do	6.	
152.3225	do	6, 30	
152.330	do	6.	
152.3375	do	6, 30	
152.345	do	6.	
152.3525	do	6, 30	
152.360	do	6.	
152.3675	do	6, 30	
152.375	do	6.	
152.3825	do	6, 30	
152.390	do	6.	
152.3975	do	6, 30	
152.405	do	6.	
152.4125	do	6, 30	
152.420	do	6.	
152.4275	do	6, 30	
152.435	do	6.	
152.4425	do	6, 30	
152.450	do	6.	
152.4575	do	6, 30	
152.465	do	79.	
152.480	do	29, 36, 37, 38.	
152.8625	do	33.	
152.870	do		
152.8775	do	30	
152.885	do.		
152.8925	do	30	
152.900	do.		
152.9075	do	30	
152.915	do.		
152.9225	do	30	
152.930	do.		
152.9375	do	30	
152.945	do.		
152.9525	do	30	
152.960	do.		
152.9675	do	30	
152.975	do.		
152.9825	do	30	
152.990	do.		
152.9975	do	30	
153.005	do.		
153.0125	do	30	
153.020	do.		
153.0275	do	30	
153.035	do		IP
153.0425	do	30.	
153.050	do	4, 7	IP
153.0575	do	4, 7, 30.	
153.065	do		IP
153.0725	do	30.	
153.080	do	4, 7	IP
153.0875	do	4, 7, 30.	
153.095	do		IP
153.1025	do	30, 80.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
153.110	do	4, 7	IP
153.1175	do	4, 7, 30.	
153.125	do		IP
153.1325	do	30.	
153.140	do	4, 7	IP
153.1475	do	4, 7, 30.	
153.155	do		IP
153.1625	do	30.	
153.170	do	4, 7	IP
153.1775	do	4, 7, 30.	
153.185	do		IP
153.1925	do	30.	
153.200	do	4, 7	IP
153.2075	do	4, 7, 30.	
153.215	do		IP
153.2225	do	30.	
153.230	do	4, 7	IP
153.2375	do	4, 7, 30.	
153.245	do		IP
153.2525	do	30.	
153.260	do	4, 7	IP
153.2675	do	4, 7, 30.	
153.275	do		IP
153.2825	do	30.	
153.290	do	4, 7	IP
153.2975	do	4, 7, 30.	
153.305	do		IP
153.3125	do	30.	
153.320	do	4, 7	IP
153.3275	do	4, 7, 30.	
153.335	do		IP
153.3425	do	30.	
153.350	do	4, 7	IP
153.3575	do	4, 7, 30.	
153.365	do		IP
153.3725	do	30.	
153.380	do		IP
153.3875	do	30.	
153.395	do		IP
153.4025	do	30.	
153.410	do		IW
153.4175	do	30	IW
153.425	do	80	IP, IW
153.4325	do	30, 80	IP, IW
153.440	do	80	IP, IW
153.4475	do	30, 80	IP, IW
153.455	do	80	IP, IW
153.4625	do	30, 80	IP, IW
153.470	do		IW
153.4775	do	30	IW
153.485	do	80	IP, IW
153.4925	do	30, 80	IP, IW
153.500	do	80	IP, IW
153.5075	do	30, 80	IP, IW
153.515	do	80	IP, IW
153.5225	do	30, 80	IP, IW
153.530	do		IW
153.5375	do	30	IW
153.545	do	80	IP, IW
153.5525	do	30, 80	IP, IW
153.560		30, 80	IP, IW
153.5675	do	30, 80	IP, IW
153.575	do	80	IP, IW
153.5825	do	30, 80	IP, IW
153.590	do		IW
153.5975	do	30	IW
153.605	do	80	IP, IW
153.6125	do	30, 80	IP, IW
153.620	do	80	IP, IW
153.6275	do	30, 80	IP, IW

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
153.635	do	80	IP, IW
153.6425	do	30, 80	IP, IW
153.650	do		IW
153.6575	do	30	IW
153.665	do	80	IP, IW
153.6725	do	30, 80	IP, IW
153.680	do	80	IP, IW
153.6875	do	30, 80	IP, IW
153.695	do		IW
153.7025	do	30	IW
153.710	do		IW
153.7175	do	30	IW
153.725	do		IW
153.7325	do	30	IW
154.45625	Fixed or mobile	39, 40, 41, 42.	
154.46375	do	39, 40, 43.	
154.47125	do	39, 40, 41, 44.	
154.47875	do	39, 40, 41, 42.	
154.4825	Base or mobile	30	
154.490	do.		
154.4975	do	30	
154.505	do	30	
154.515	do.		
154.5275	Mobile	10, 30, 34	
154.540	Base or mobile.		
154.5475	do	30	
154.555	do	33.	
154.585	Mobile	8, 46	IP
154.610	Base or mobile	33.	
154.625	do	36, 37, 48.	
154.640	Base	36, 37, 48.	
157.470	Base or mobile	12	LA
157.4775	do	12, 30	LA
157.485	do	12	LA
157.4925	do	12, 30	LA
157.500	do	12	LA
157.5075	do	12, 30	LA
157.515	do	12	LA
157.5225	do	12, 30	LA
157.530	Mobile	6.	
157.5375	do	6, 30	
157.545	do	6.	
157.5525	do	6, 30	
157.560	Base or mobile	6.	
157.5675	do	6, 30	
157.575	Mobile	6.	
157.5825	do	6, 30	
157.590	do	6.	
157.5975	do	6, 30	
157.605	do	6.	
157.6125	do	6, 30	
157.620	Base or mobile	6.	
157.6275	do	6, 30	
157.635	Mobile	6.	
157.6425	do	6, 30	
157.650	do	6.	
157.6575	do	6, 30	
157.665	do	6.	
157.6725	do	6, 30	
157.680	do	6.	
157.6875	do	6, 30	
157.695	do	6.	
157.7025	do	6, 30	
157.710	do	6.	
157.7175	do	6, 30	
157.725	Base or mobile	79.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
157.740	do	29, 36, 37, 38.	
158.1225	do	33	IW
158.130	do		IW
158.1375	do	6, 30	IW
158.145	do		IP, IW
158.1525	do	6, 30	IP, IW
158.160	do		IP, IW
158.1675	do	6, 30	IP, IW
158.175	do	81	IP, IW
158.1825	do	30, 81	IP, IW
158.190	do		IW
158.1975	do	30	IW
158.205	do	81	IP, IW
158.2125	do	30, 81	IP, IW
158.220	do	81	IP, IW
158.2275	do	30, 81	IP, IW
158.235	do	81	IP, IW
158.2425	do	30, 81	IP, IW
158.250	do		IW
158.2575	do	30	IW
158.265	do	81	IP, IW
158.2725	do	30, 81	IP, IW
158.280	do		IP
158.2875	do	30	IP
158.295	do		IP
158.3025	do	30	IP
158.310	do	4, 7	IP
158.3175	do	4, 7, 30	IP
158.325	do		IP
158.3325	do	30	IP
158.340	Mobile.		
158.3475	do	30	
158.355	Base or mobile		IP
158.3625	do	30	IP
158.370	do	4, 7	IP
158.3775	do	4, 7, 30	IP
158.385	do.		
158.3925	do	30	
158.400	do	17.	
158.4075	do	17, 30	
158.415	do		IP
158.4225	do	30	IP
158.430	do	4, 7	IP
158.4375	do	4, 7, 30	IP
158.445	Mobile	8, 49	IP
158.460	Base or mobile	29, 36, 37, 38, 48.	
159.480	do	8, 82	IP
159.4875	do	8, 30	IP
159.495	do.		
159.5025	do	30	
159.510	do.		
159.5175	do	30	
159.525	do.		
159.5325	do	30	
159.540	do.		
159.5475	do	30	
159.555	do.		
159.5625	do	30	
159.570	do.		
159.5775	do	30	
159.585	do.		
159.5925	do	30	
159.600	do.		
159.6075	do	30	
159.615	do.		
159.6225	do	30	
159.630	do.		
159.6375	do	30	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
159.645	do.		
159.6525	do	30	
159.660	do.		
159.6675	do	30	
159.675	do.		
159.6825	do	30	
159.690	do.		
159.6975	do	30	
159.705	do.		
159.7125	do	30	
159.720	do.		
159.7275	do	30	
159.735	do.		
159.7425	do	30	
159.750	do.		
159.7575	do	30	
159.765	do.		
159.7725	do	30	
159.780	do.		
159.7875	do	30	
159.795	do.		
159.8025	do	30	
159.810	do.		
159.8175	do	30	
159.825	do.		
159.8325	do	30	
159.840	do.		
159.8475	do	30	
159.855	do.		
159.8625	do	30	
159.870	do.		
159.8775	do	30	
159.885	do.		
159.8925	do	30	
159.900	do.		
159.9075	do	30	
159.915	do.		
159.9225	do	30	
159.930	do.		
159.9375	do	30	
159.945	do.		
159.9525	do	30	
159.960	do.		
159.9675	do	30	
159.975	do.		
159.9825	do	30	
159.990	do.		
159.9975	do	30	
160.005	do.		
160.0125	do	30	
160.020	do.		
160.0275	do	30	
160.035	do.		
160.0425	do	30	
160.050	do.		
160.0575	do	30	
160.065	do.		
160.0725	do	30	
160.080	do.		
160.0875	do	30	
160.095	do.		
160.1025	do	30	
160.110	do.		
160.1175	do	30	
160.125	do.		
160.1325	do	30	
160.140	do.		
160.1475	do	30	
160.155	do.		
160.1625	do	30	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
160.170	do.		
160.1775	do	30	
160.185	do.		
160.1925	do	30	
160.200	do.		
160.2075	do	30	
160.215	do	50	LR
160.2225	do	30, 50	LR
160.230	do	50	LR
160.2375	do	30, 50	LR
160.245	do	50	LR
160.2525	do	30, 50	LR
160.260	do	50	LR
160.2675	do	30, 50	LR
160.275	do	50	LR
160.2825	do	30, 50	LR
160.290	do	50	LR
160.2975	do	30, 50	LR
160.305	do	50	LR
160.3125	do	30, 50	LR
160.320	do	50	LR
160.3275	do	30, 50	LR
160.335	do	50	LR
160.3425	do	30, 50	LR
160.350	do	50	LR
160.3575	do	30, 50	LR
160.365	do	50	LR
160.3725	do	30, 50	LR
160.380	do	50	LR
160.3875	do	30, 50	LR
160.395	do	50	LR
160.4025	do	30, 50	LR
160.410	do	50, 52	LR
160.4175	do	30, 50, 52	LR
160.425	do	50, 52	LR
160.4325	do	30, 50, 52	LR
160.440	do	50, 52	LR
160.4475	do	30, 50, 52	LR
160.455	do	50, 52	LR
160.4625	do	30, 50, 52	LR
160.470	do	50, 52	LR
160.4775	do	30, 50, 52	LR
160.485	do	50, 52	LR
160.4925	do	30, 50, 52	LR
160.500	do	50, 52	LR
160.5075	do	30, 50, 52	LR
160.515	do	50, 52	LR
160.5225	do	30, 50, 52	LR
160.530	do	50, 52	LR
160.5375	do	30, 50, 52	LR
160.545	do	50, 52	LR
160.5525	do	30, 50, 52	LR
160.560	do	50, 52	LR
160.5675	do	30, 50, 52	LR
160.575	do	50, 52	LR
160.5825	do	30, 50, 52	LR
160.590	do	50, 52	LR
160.5975	do	30, 50, 52	LR
160.605	do	50, 52	LR
160.6125	do	30, 50, 52	LR
160.620	do	50	LR
160.6275	do	30, 50	LR
160.635	do	50	LR
160.6425	do	30, 50	LR
160.650	do	50	LR
160.6575	do	30, 50	LR
160.665	do	50	LR
160.6725	do	30, 50	LR
160.680	do	50	LR
160.6875	do	30, 50	LR

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
160.695	do	50	LR
160.7025	do	30, 50	LR
160.710	do	50	LR
160.7175	do	30, 50	LR
160.725	do	50	LR
160.7325	do	30, 50	LR
160.740	do	50	LR
160.7475	do	30, 50	LR
160.755	do	50	LR
160.7625	do	30, 50	LR
160.770	do	50	LR
160.7775	do	30, 50	LR
160.785	do	50	LR
160.7925	do	30, 50	LR
160.800	do	50	LR
160.8075	do	30, 50	LR
160.815	do	50	LR
160.8225	do	30, 50	LR
160.830	do	50	LR
160.8375	do	30, 50	LR
160.845	do	50	LR
160.8525	do	30, 50	LR
160.860	do	50, 51	LR
160.8675	do	30, 50, 51	LR
160.875	do	50, 51	LR
160.8825	do	30, 50, 51	LR
160.890	do	50, 51	LR
160.8975	do	30, 50, 51	LR
160.905	do	50, 51	LR
160.9125	do	30, 50, 51	LR
160.920	do	50, 51	LR
160.9275	do	30, 50, 51	LR
160.935	do	50, 51	LR
160.9425	do	30, 50, 51	LR
160.950	do	50, 51	LR
160.9575	do	30, 50, 51	LR
160.965	do	50, 51	LR
160.9725	do	30, 50, 51	LR
160.980	do	50, 51	LR
160.9875	do	30, 50, 51	LR
160.995	do	50, 51	LR
161.0025	do	30, 50, 51	LR
161.010	do	50, 51	LR
161.0175	do	30, 50, 51	LR
161.025	do	50, 51	LR
161.0325	do	30, 50, 51	LR
161.040	do	50, 51	LR
161.0475	do	30, 50, 51	LR
161.055	do	50, 51	LR
161.0625	do	30, 50, 51	LR
161.070	do	50, 51	LR
161.0775	do	30, 50, 51	LR
161.085	do	50, 51	LR
161.0925	do	30, 50, 51	LR
161.100	do	50, 51	LR
161.1075	do	30, 50, 51	LR
161.115	do	50, 51	LR
161.1225	do	30, 50, 51	LR
161.130	do	50, 51	LR
161.1375	do	30, 50, 51	LR
161.145	do	50, 51	LR
161.1525	do	30, 50, 51	LR
161.160	do	50, 51	LR
161.1675	do	30, 50, 51	LR
161.175	do	50, 51	LR
161.1825	do	30, 50, 51	LR
161.190	do	50, 51	LR
161.1975	do	30, 50, 51	LR
161.205	do	50, 51	LR
161.2125	do	30, 50, 51	LR

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
161.220	do	50, 51	LR
161.2275	do	30, 50, 51	LR
161.235	do	50, 51	LR
161.2425	do	30, 50, 51	LR
161.250	do	50, 51	LR
161.2575	do	30, 50, 51	LR
161.265	do	50, 51	LR
161.2725	do	30, 50, 51	LR
161.280	do	50, 51	LR
161.2875	do	30, 50, 51	LR
161.295	do	50, 51	LR
161.3025	do	30, 50, 51	LR
161.310	do	50, 51	LR
161.3175	do	30, 50, 51	LR
161.325	do	50, 51	LR
161.3325	do	30, 50, 51	LR
161.340	do	50, 51	LR
161.3475	do	30, 50, 51	LR
161.355	do	50, 51	LR
161.3625	do	30, 50, 51	LR
161.370	do	50, 51	LR
161.3775	do	30, 50, 51	LR
161.385	do	50, 52	LR
161.3925	do	30, 50, 52	LR
161.400	do	50, 52	LR
161.4075	do	30, 50, 52	LR
161.415	do	50, 52	LR
161.4225	do	30, 50, 52	LR
161.430	do	50, 52	LR
161.4375	do	30, 50, 52	LR
161.445	do	50, 52	LR
161.4525	do	30, 50, 52	LR
161.460	do	50, 52	LR
161.4675	do	30, 50, 52	LR
161.475	do	50, 52	LR
161.4825	do	30, 50, 52	LR
161.490	do	50, 52	LR
161.4975	do	30, 50, 52	LR
161.505	do	50, 52	LR
161.5125	do	30, 50, 52	LR
161.520	do	50, 52	LR
161.5275	do	30, 50, 52	LR
161.535	do	50, 52	LR
161.5425	do	30, 50, 52	LR
161.550	do	50, 52	LR
161.5575	do	30, 50, 52	LR
161.565	do	50, 52	LR
161.610	do	78	LR
169 to 172	Mobile, operational fixed.	53.	
173.20375	Fixed or mobile	39, 40, 41, 44.	
173.210	do	40, 41, 44, 54.	
173.225	Base or mobile.		
173.2375	Fixed or mobile	39, 40, 41, 42.	
173.250	Base or mobile		IP, IW
173.2625	Fixed or mobile	39, 40, 41, 42.	
173.275	Base or mobile.		
173.2875	Fixed or mobile	39, 40, 41, 42.	
173.300	Base or mobile		IP, IW
173.3125	Fixed or mobile	39, 40, 41, 42.	
173.325	Base or mobile.		
173.3375	Fixed or mobile	39, 40, 41, 42.	
173.350	Base or mobile		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
173.3625	Fixed or mobile	39, 40, 41, 42.	
173.375	Base or mobile.		
173.390	Fixed or mobile	40, 41, 44, 54.	
173.39625	do	39, 40, 41, 44.	
216 to 217	Base or mobile	55	
217 to 220	Base, mobile, or operational fixed.	55	
220 to 222	Base or mobile		
406 to 416	Operational fixed.	53.	
450 to 470	Fixed, base, or mobile.	27, 57.	
451.01875	Base or mobile	33	IW
451.025	do		IW
451.03125	do	33	IW
451.0375	do	30	IW
451.04375	do	33	IW
451.050	do		IW
451.05625	do	33	IW
451.0625	do	30	IW
451.06875	do	33	IW
451.075	do		IW
451.08125	do	33	IW
451.0875	do	30	IW
451.09375	do	33	IW
451.100	do		IW
451.10625	do	33	IW
451.1125	do	30	IW
451.11875	do	33	IW
451.125	do		IW
451.13125	do	33	IW
451.1375	do	30	IW
451.14375	do	33	IW
451.150	do		IW
451.15625	do	33	IW
451.1625	do	30	IW
451.16875	do	33	IW
451.175	do		IP, IW
451.18125	do	33, 84.	
451.1875	do	30, 84.	
451.19375	do	33, 84.	
451.200	do		IW
451.20625	do	33	IW
451.2125	do	30	IW
451.21875	do	33	IW
451.225	do		IP, IW
451.23125	do	33, 84.	
451.2375	do	30, 84.	
451.24375	do	33, 84.	
451.250	do		IW
451.25625	do	33	IW
451.2625	do	30	IW
451.26875	do	33	IW
451.275	do		IP, IW
451.28125	do	33, 84.	
451.2875	do	30, 84.	
451.29375	do	33, 84.	
451.300	do.		
451.30625	do	33, 84.	
451.3125	do	30, 84.	
451.31875	do	33, 84.	
451.325	do.		
451.33125	do	33, 84.	
451.3375	do	30, 84.	
451.34375	do	33, 84.	
451.350	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
451.35625	do	33, 84.	
451.3625	do	30, 84.	
451.36875	do	33, 84.	
451.375	do		IP, IW
451.38125	do	33, 84.	
451.3875	do	30, 84.	
451.39375	do	33, 84.	
451.400	do.		
451.40625	do	33, 84.	
451.4125	do	30, 84.	
451.41875	do	33, 84.	
451.425	do		IP, IW
451.43125	do	33, 84.	
451.4375	do	30, 84.	
451.44375	do	33, 84.	
451.450	do.		
451.45625	do	33, 84.	
451.4625	do	30, 84.	
451.46875	do	33, 84.	
451.475	do		IP, IW
451.48125	do	33, 84.	
451.4875	do	30, 84.	
451.49375	do	33, 84.	
451.500	do.		
451.50625	do	33, 84.	
451.5125	do	30, 84.	
451.51875	do	33, 84.	
451.525	do		IP, IW
451.53125	do	33, 84.	
451.5375	do	30, 84.	
451.54375	do	33, 84.	
451.550	do	4, 7	IP
451.55625	do	4, 7, 33, 84.	
451.5625	do	4, 7, 30, 84.	
451.56875	do	4, 7, 33, 84.	
451.575	do		IP, IW
451.58125	do	33, 84.	
451.5875	do	30, 84.	
451.59375	do	33, 84.	
451.600	do	4, 7	IP
451.60625	do	4, 7, 33, 84.	
451.6125	do	4, 7, 30, 84.	
451.61875	do	4, 7, 33, 84.	
451.625	do		IP, IW
451.63125	do	33, 84.	
451.6375	do	30, 84.	
451.64375	do	33, 84.	
451.650	do	4, 7	IP
451.65625	do	4, 7, 33, 84.	
451.6625	do	4, 7, 30, 84.	
451.66875	do	4, 7, 33, 84.	
451.675	do		IP, IW
451.68125	do	33, 84.	
451.6875	do	30, 84.	
451.69375	do	33, 84.	
451.700	do	4, 7	IP
451.70625	do	4, 7, 33, 84.	
451.7125	do	4, 7, 30, 84.	
451.71875	do	4, 7, 33, 84.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
451.725	do.		
451.73125	do	33, 84.	
451.7375	do	30, 84.	
451.74375	do	33, 84.	
451.750	do	4, 7	IP
451.75625	do	4, 7, 33, 84.	
451.7625	do	4, 7, 30, 84.	
451.76875	do	4, 7, 33, 84.	
451.775	do.		
451.78125	do	33.	
451.7875	do	30.	
451.79375	do	33.	
451.800	Base, mobile, or operational fixed.	17, 58.	
451.80625	do	17, 33, 58.	
451.8125	do	17, 30, 58.	
451.81875	do	17, 33, 58.	
451.825	Base or mobile.		
451.83125	do	33.	
451.8375	do	30.	
451.84375	do	33.	
451.850	do.		
451.85625	do	33.	
451.8625	do	30.	
451.86875	do	33.	
451.875	do.		
451.88125	do	33.	
451.8875	do	30.	
451.89375	do	33.	
451.900	do.		
451.90625	do	33.	
451.9125	do	30.	
451.91875	do	33.	
451.925	do.		
451.93125	do	33.	
451.9375	do	30.	
451.94375	do	33.	
451.950	do.		
451.95625	do	33.	
451.9625	do	30.	
451.96875	do	33.	
451.975	do.		
451.98125	do	33.	
451.9875	do	30.	
451.99375	do	33.	
452.000	do.		
452.00625	do	33.	
452.0125	do	30.	
452.01875	do	33.	
452.025	do.		
452.03125	do	33, 84.	
452.0375	do	30, 84.	
452.04375	do	33, 84.	
452.050	do.		
452.05625	do	33, 84.	
452.0625	do	30, 84.	
452.06875	do	33, 84.	
452.075	do.		
452.08125	do	33, 84.	
452.0875	do	30, 84.	
452.09375	do	33, 84.	
452.100	do.		
452.10625	do	33, 84.	
452.1125	do	30, 84.	
452.11875	do	33, 84.	
452.125	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
452.13125	do	33, 84.	
452.1375	do	30, 84.	
452.14375	do	33, 84.	
452.150	do.		
452.15625	do	33, 84.	
452.1625	do	30, 84.	
452.16875	do	33, 84.	
452.175	do.		
452.18125	do	33, 84.	
452.1875	do	30, 84.	
452.19375	do	33, 84.	
452.200	do.		
452.20625	do	33.	
452.2125	do	30.	
452.21875	do	33.	
452.225	do		
452.23125	do	33.	
452.2375	do	30.	
452.24375	do	33.	
452.250	do.		
452.25625	do	33.	
452.2625	do	30.	
452.26875	do	33.	
452.275	do.		
452.28125	do	33, 84.	
452.2875	do	30, 84.	
452.29375	do	33, 84.	
452.300	do.		
452.30625	do	33, 84.	
452.3125	do	30, 84.	
452.31875	do	33, 84.	
452.325	do		LR
452.33125	do	33.	
452.3375	do	30.	
452.34375	do	33.	
452.350	do.		
452.35625	do	33.	
452.3625	do	30.	
452.36875	do	33.	
452.375	do		LR
452.38125	do	33.	
452.3875	do	30.	
452.39375	do	33.	
452.400	do.		
452.40625	do	33, 84.	
452.4125	do	30, 84.	
452.41875	do	33, 84.	
452.425	do		LR
452.43125	do	33.	
452.4375	do	30.	
452.44375	do	33.	
452.450	do.		
452.45625	do	33.	
452.4625	do	30.	
452.46875	do	33.	
452.475	do		LR
452.48125	do	33, 84.	
452.4875	do	30, 84.	
452.49375	do	33, 84.	
452.500	do.		
452.50625	do	33, 84.	
452.5125	do	30, 84.	
452.51875	do	33, 84.	
452.525	do		LA
452.53125	do	33, 84	LA
452.5375	do	30, 84	LA
452.54375	do	33, 84	LA
452.550	do		LA
452.55625	do	33	LA
452.5625	do	30	LA

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
452.56875	do	33	LA
452.575	do		LA
452.58125	do	33	LA
452.5875	do	30	LA
452.59375	do	33	LA
452.600	do		LA
452.60625	do	33	LA
452.6125	do	30	LA
452.61875	do	33	LA
452.625	do.		
452.63125	do	33, 84.	
452.6375	do	30, 84.	
452.64375	do	33, 84.	
452.650	do.		
452.65625	do	33, 84.	
452.6625	do	30, 84.	
452.66875	do	33, 84.	
452.675	do.		
452.68125	do	33, 84.	
452.6875	do	30, 84.	
452.69375	do	33, 84.	
452.700	do.		
452.70625	do	33, 84.	
452.7125	do	30, 84.	
452.71875	do	33, 84.	
452.725	do.		
452.73125	do	33.	
452.7375	do	30.	
452.74375	do	33.	
452.750	do.		
452.75625	do	33, 84.	
452.7625	do	30, 84.	
452.76875	do	33, 84.	
452.775	do		LR
452.78125	do	33, 84.	
452.7875	do	30, 84.	
452.79375	do	33, 84.	
452.800	do.		
452.80625	do	33, 84.	
452.8125	do	30, 84.	
452.81875	do	33, 84.	
452.825	do		LR
452.83125	do	33, 84.	
452.8375	do	30, 84.	
452.84375	do	33, 84.	
452.850	do.		
452.85625	do	33, 84.	
452.8625	do	30, 84.	
452.86875	do	33, 84.	
452.875	do		LR
452.88125	do	33, 84.	
452.8875	do	30, 84.	
452.89375	do	33, 84.	
452.900	do		LR
452.90625	do	33	LR
452.9125	do	30	LR
452.91875	do	33	LR
452.925	do	59	LR
452.93125	do	33, 59	LR
452.9375	do	30, 59	LR
452.94375	do	33, 59	LR
452.950	do	59	LR
452.95625	do	33, 59	LR
452.9625	do	30, 59	LR
452.96875	do	33, 59	LR
452.975	do.		
452.98125	do	33, 84.	
452.9875	do	30, 84.	
452.99375	do	33, 84.	
453.000	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
453.00625	do	33.	
453.0125	do	30.	
453.01875	do	33.	
454.000	do	8	IP
456.01875	do	33	IW
456.025	Mobile		IW
456.03125	do	33	IW
456.0375	do	30	IW
456.04375	do	33	IW
456.050	do		IW
456.05625	do	33	IW
456.0625	do	30	IW
456.06875	do	33	IW
456.075	do		IW
456.08125	do	33	IW
456.0875	do	30	IW
456.09375	do	33	IW
456.100	do		IW
456.10625	do	33	IW
456.1125	do	30	IW
456.11875	do	33	IW
456.125	do		IW
456.13125	do	33	IW
456.1375	do	30	IW
456.14375	do	33	IW
456.150	do		IW
456.15625	do	33	IW
456.1625	do	30	IW
456.16875	do	33	IW
456.175	do		IP, IW
456.18125	do	33, 84.	
456.1875	do	30, 84.	
456.19375	do	33, 84.	
456.200	do		IW
456.20625	do	33	IW
456.2125	do	30	IW
456.21875	do	33	IW
456.225	do		IP, IW
456.23125	do	33, 84.	
456.2375	do	30, 84.	
456.24375	do	33, 84.	
456.250	do		IW
456.25625	do	33	IW
456.2625	do	30	IW
456.26875	do	33	IW
456.275	do		IP, IW
456.28125	do	33, 84.	
456.2875	do	30, 84.	
456.29375	do	33, 84.	
456.300	do.		
456.30625	do	33, 84.	
456.3125	do	30, 84.	
456.31875	do	33, 84.	
456.325	do.		
456.33125	do	33, 84.	
456.3375	do	30, 84.	
456.34375	do	33, 84.	
456.350	do.		
456.35625	do	33, 84.	
456.3625	do	30, 84.	
456.36875	do	33, 84.	
456.375	do		IP, IW
456.38125	do	33, 84.	
456.3875	do	30, 84.	
456.39375	do	33, 84.	
456.400	do.		
456.40625	do	33, 84.	
456.4125	do	30, 84.	
456.41875	do	33, 84.	
456.425	do		IP, IW

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
456.43125	.....do	33, 84.	
456.4375	.....do	30, 84.	
456.44375	.....do	33, 84.	
456.450	.....do.		
456.45625	.....do	33, 84.	
456.4625	.....do	30, 84.	
456.46875	.....do	33, 84.	
456.475	.....do		IP, IW
456.48125	.....do	33, 84.	
456.4875	.....do	30, 84.	
456.49375	.....do	33, 84.	
456.500	.....do.		
456.50625	.....do	33, 84.	
456.5125	.....do	30, 84.	
456.51875	.....do	33, 84.	
456.525	.....do		IP, IW
456.53125	.....do	33, 84.	
456.5375	.....do	30, 84.	
456.54375	.....do	33, 84.	
456.550	.....do		IP
456.55625	.....do	33, 84.	
456.5625	.....do	30, 84.	
456.56875	.....do	33, 84.	
456.575	.....do		IP, IW
456.58125	.....do	33, 84.	
456.5875	.....do	30, 84.	
456.59375	.....do	33, 84.	
456.600	.....do		IP
456.60625	.....do	33, 84.	
456.6125	.....do	30, 84.	
456.61875	.....do	33, 84.	
456.625	.....do		IP, IW
456.63125	.....do	33, 84.	
456.6375	.....do	30, 84.	
456.64375	.....do	33, 84.	
456.650	.....do		IP
456.65625	.....do	33, 84.	
456.6625	.....do	30, 84.	
456.66875	.....do	33, 84.	
456.675	.....do		IP, IW
456.68125	.....do	33, 84.	
456.6875	.....do	30, 84.	
456.69375	.....do	33, 84.	
456.700	.....do		IP
456.70625	.....do	33, 84.	
456.7125	.....do	30, 84.	
456.71875	.....do	33, 84.	
456.725	.....do.		
456.73125	.....do	33, 84.	
456.7375	.....do	30, 84.	
456.74375	.....do	33, 84.	
456.750	.....do		IP
456.75625	.....do	33, 84.	
456.7625	.....do	30, 84.	
456.76875	.....do	33, 84.	
456.775	.....do.		
456.78125	.....do	33.	
456.7875	.....do	30.	
456.79375	.....do	33.	
456.800	Base, mobile, or operational fixed.	17, 58.	
456.80625	.....do	17, 33, 58.	
456.8125	.....do	17, 30, 58.	
456.81875	.....do	17, 33, 58.	
456.825	Mobile.		
456.83125	.....do	33.	
456.8375	.....do	30.	
456.84375	.....do	33.	
456.850	.....do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
456.85625	.....do	33.	
456.8625	.....do	30.	
456.86875	.....do	33.	
456.875	.....do.		
456.88125	.....do	33.	
456.8875	.....do	30.	
456.89375	.....do	33.	
456.900	.....do.		
456.90625	.....do	33.	
456.9125	.....do	30.	
456.91875	.....do	33.	
456.925	.....do.		
456.93125	.....do	33.	
456.9375	.....do	30.	
456.94375	.....do	33.	
456.950	.....do.		
456.95625	.....do	33.	
456.9625	.....do	30.	
456.96875	.....do	33.	
456.975	.....do.		
456.98125	.....do	33.	
456.9875	.....do	30.	
456.99375	.....do	33.	
457.000	.....do.		
457.00625	.....do	33.	
457.0125	.....do	30.	
457.01875	.....do	33.	
457.025	.....do.		
457.03125	.....do	33, 84.	
457.0375	.....do	30, 84.	
457.04375	.....do	33, 84.	
457.050	.....do.		
457.05625	.....do	33, 84.	
457.0625	.....do	30, 84.	
457.06875	.....do	33, 84.	
457.075	.....do.		
457.08125	.....do	33, 84.	
457.0875	.....do	30, 84.	
457.09375	.....do	33, 84.	
457.100	.....do.		
457.10625	.....do	33, 84.	
457.1125	.....do	30, 84.	
457.11875	.....do	33, 84.	
457.125	.....do.		
457.13125	.....do	33, 84.	
457.1375	.....do	30, 84.	
457.14375	.....do	33, 84.	
457.150	.....do.		
457.15625	.....do	33, 84.	
457.1625	.....do	30, 84.	
457.16875	.....do	33, 84.	
457.175	.....do.		
457.18125	.....do	33, 84.	
457.1875	.....do	30, 84.	
457.19375	.....do	33, 84.	
457.200	.....do.		
457.20625	.....do	33.	
457.2125	.....do	30.	
457.21875	.....do	33.	
457.225	.....do.		
457.23125	.....do	33.	
457.2375	.....do	30.	
457.24375	.....do	33.	
457.250	.....do.		
457.25625	.....do	33.	
457.2625	.....do	30.	
457.26875	.....do	33.	
457.275	.....do.		
457.28125	.....do	33, 84.	
457.2875	.....do	30, 84.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
457.29375	do	33, 84.	
457.300	do.		
457.30625	do	33, 84.	
457.3125	do	30, 84.	
457.31875	do	33, 84.	
457.325	do		LR
457.33125	do	33.	
457.3375	do	30.	
457.34375	do	33.	
457.350	do.		
457.35625	do	33.	
457.3625	do	30.	
457.36875	do	33.	
457.375	do		LR
457.38125	do	33.	
457.3875	do	30.	
457.39375	do	33.	
457.400	do.		
457.40625	do	33, 84.	
457.4125	do	30, 84.	
457.41875	do	33, 84.	
457.425	do		LR
457.43125	do	33.	
457.4375	do	30.	
457.44375	do	33.	
457.450	do.		
457.45625	do	33.	
457.4625	do	30.	
457.46875	do	33.	
457.475	do		LR
457.48125	do	33, 84.	
457.4875	do	30, 84.	
457.49375	do	33, 84.	
457.500	do.		
457.50625	do	33, 84.	
457.5125	do	30, 84.	
457.51875	do	33, 84.	
457.525	do	12, 47, 60.	
457.53125	do	11, 12, 33, 47, 60.	
457.5375	do	11, 12, 30, 47, 60.	
457.54375	do	11, 12, 33, 47, 60.	
457.550	do	12, 47, 60.	
457.55625	do	11, 12, 33, 47, 60.	
457.5625	do	12, 30, 47, 60.	
457.56875	do	11, 12, 33, 47, 60.	
457.575	do	12, 47, 60.	
457.58125	do	11, 12, 33, 47, 60.	
457.5875	do	12, 30, 47, 60.	
457.59375	do	11, 12, 33, 47, 60.	
457.600	do	12, 47, 60.	
457.60625	do	11, 12, 33, 47, 60.	
457.6125	do	12, 30, 47, 60.	
457.61875	do	11, 12, 33, 47, 60.	
457.625	do.		
457.63125	do	33, 84.	
457.6375	do	30, 84.	
457.64375	do	33, 84.	
457.650	do.		

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
457.65625	do	33, 84.	
457.6625	do	30, 84.	
457.66875	do	33, 84.	
457.675	do.		
457.68125	do	33, 84.	
457.6875	do	30, 84.	
457.69375	do	33, 84.	
457.700	do.		
457.70625	do	33, 84.	
457.7125	do	30, 84.	
457.71875	do	33, 84.	
457.725	do.		
457.73125	do	33.	
457.7375	do	30.	
457.74375	do	33.	
457.750	do.		
457.75625	do	33.	
457.7625	do	30.	
457.76875	do	33.	
457.775	do		LR
457.78125	do	33, 84.	
457.7875	do	30, 84.	
457.79375	do	33, 84.	
457.800	do.		
457.80625	do	33, 84.	
457.8125	do	30, 84.	
457.81875	do	33, 84.	
457.825	do		LR
457.83125	do	33, 84.	
457.8375	do	30, 84.	
457.84375	do	33, 84.	
457.850	do.		
457.85625	do	33, 84.	
457.8625	do	30, 84.	
457.86875	do	33, 84.	
457.875	do		LR
457.88125	do	33, 84.	
457.8875	do	30, 84.	
457.89375	do	33, 84.	
457.900	do		LR
457.90625	do	33	LR
457.9125	do	30	LR
457.91875	do	33	LR
457.925	do	59	LR
457.93125	do	33, 59	LR
457.9375	do	30, 59	LR
457.94375	do	33, 59	LR
457.950	do	59	LR
457.95625	do	33, 59	LR
457.9625	do	30, 59	LR
457.96875	do	33, 59	LR
457.975	do.		
457.98125	do	33, 84.	
457.9875	do	30, 84.	
457.99375	do	33, 84.	
458.000	do.		
458.00625	do	33.	
458.0125	do	30.	
458.01875	do	33.	
459.000	Base or mobile	8	IP
460.650	do	61, 62.	
460.65625	do	33, 61, 62.	
460.6625	do	30, 61, 62, 69.	
460.66875	do	33, 61, 62.	
460.675	do	61, 62.	
460.68125	do	33, 61, 62.	
460.6875	do	30, 61, 62, 69.	
460.69375	do	33, 61, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
460.700	do	61, 62.	
460.70625	do	33, 61, 62.	
460.7125	do	30, 61, 62, 69.	
460.71875	do	33, 61, 62.	
460.725	do	61, 62.	
460.73125	do	33, 61, 62.	
460.7375	do	30, 61, 62, 69.	
460.74375	do	33, 61, 62.	
460.750	do	61, 62.	
460.75625	do	33, 61, 62.	
460.7625	do	30, 61, 62, 69.	
460.76875	do	33, 61, 62.	
460.775	do	61, 62.	
460.78125	do	33, 61, 62.	
460.7875	do	30, 61, 62, 69.	
460.79375	do	33, 61, 62.	
460.800	do	61, 62.	
460.80625	do	33, 61, 62.	
460.8125	do	30, 61, 62, 69.	
460.81875	do	33, 61, 62.	
460.825	do	61, 62.	
460.83125	do	33, 61, 62.	
460.8375	do	30, 61, 62, 69.	
460.84375	do	33, 61, 62.	
460.850	do	61, 62.	
460.85625	do	33, 61, 62.	
460.8625	do	30, 61, 62, 69.	
460.86875	do	33, 61, 62.	
460.875	do	61, 62.	
460.88125	do	33, 61, 62.	
460.8875	do	30, 61, 62, 69.	
460.89375	do	33, 61, 62.	
460.900	do	63, 64, 65.	
460.90625	do	33, 63, 65, 87.	
460.9125	do	63, 65, 83 87.	
460.91875	do	33, 63, 65, 87.	
460.925	do	63, 64, 65.	
460.93125	do	33, 63, 65, 87.	
460.9375	do	63, 65, 83, 87.	
460.94375	do	33, 63, 65, 87.	
460.950	do	63, 64, 65.	
460.95625	do	33, 63, 65, 87.	
460.9625	do	63, 65, 83, 87.	
460.96875	do	33, 63, 65, 87.	
460.975	do	64, 65, 66	
460.98125	do	33, 65, 66, 87.	
460.9875	do	65, 66, 83, 87.	
460.99375	do	33, 65, 66, 87.	
461.000	do	64, 65, 66.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
461.00625	do	33, 65, 66, 87.	
461.0125	do	65, 66, 83, 87.	
461.01875	do	33, 65, 66, 87.	
461.025	do	62.	
461.03125	do	33, 86.	
461.0375	do	83, 86.	
461.04375	do	33, 86.	
461.050	do	62.	
461.05625	do	33, 86.	
461.0625	do	83, 86.	
461.06875	do	33, 86.	
461.075	do	62.	
461.08125	do	33, 86.	
461.0875	do	83, 86.	
461.09375	do	33, 86.	
461.100	do	62.	
461.10625	do	33, 86.	
461.1125	do	83, 86.	
461.11875	do	33, 86.	
461.125	do	62.	
461.13125	do	33, 86.	
461.1375	do	83, 86.	
461.14375	do	33, 86.	
461.150	do	62.	
461.15625	do	33, .	
461.1625	do	83, 86.	
461.16875	do	33, 86.	
461.175	do	62.	
461.18125	do	33, 86.	
461.1875	do	83, 86.	
461.19375	do	33, 86.	
461.200	do	62.	
461.20625	do	33, 86.	
461.2125	do	83, 86.	
461.21875	do	33, 86.	
461.225	do	62.	
461.23125	do	33, 86.	
461.2375	do	83, 86.	
461.24375	do	33, 86.	
461.250	do	62.	
461.25625	do	33, 86.	
461.2625	do	83, 86.	
461.26875	do	33, 86.	
461.275	do	62.	
461.28125	do	33, 86.	
461.2875	do	83, 86.	
461.29375	do	33, 86.	
461.300	do	62.	
461.30625	do	33, 86.	
461.3125	do	83, 86.	
461.31875	do	33, 86.	
461.325	do	62.	
461.33125	do	33, 86.	
461.3375	do	83, 86.	
461.34375	do	33, 86.	
461.350	do	62.	
461.35625	do	33, 86.	
461.3625	do	83, 86.	
461.36875	do	33, 86.	
461.375	do	62.	
461.38125	do	33, 62.	
461.3875	do	30, 62.	
461.39375	do	33, 62.	
461.400	do	62.	
461.40625	do	33, 62.	
461.4125	do	30, 62.	
461.41875	do	33, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
461.425	do	62.	
461.43125	do	33, 62.	
461.4375	do	30, 62.	
461.44375	do	33, 62.	
461.450	do	62.	
461.45625	do	33, 62.	
461.4625	do	30, 62.	
461.46875	do	33, 62.	
461.475	do	62.	
461.48125	do	33, 62.	
461.4875	do	30, 62.	
461.49375	do	33, 62.	
461.500	do	62.	
461.50625	do	33, 62.	
461.5125	do	30, 62.	
461.51875	do	33, 62.	
461.525	do	62.	
461.53125	do	33, 62.	
461.5375	do	30, 62.	
461.54375	do	33, 62.	
461.550	do	62.	
461.55625	do	33, 62.	
461.5625	do	30, 62.	
461.56875	do	33, 62.	
461.575	do	62.	
461.58125	do	33, 62.	
461.5875	do	30, 62.	
461.59375	do	33, 62.	
461.600	do	62.	
461.60625	do	33, 62.	
461.6125	do	30, 62.	
461.61875	do	33, 62.	
461.625	do	62.	
461.63125	do	33, 62.	
461.6375	do	30, 62.	
461.64375	do	33, 62.	
461.650	do	62.	
461.65625	do	33, 62.	
461.6625	do	30, 62.	
461.66875	do	33, 62.	
461.675	do	62.	
461.68125	do	33, 62.	
461.6875	do	30, 62.	
461.69375	do	33, 62.	
461.700	do	62.	
461.70625	do	33, 62.	
461.7125	do	30, 62.	
461.71875	do	33, 62.	
461.725	do	62.	
461.73125	do	33, 62.	
461.7375	do	30, 62.	
461.74375	do	33, 62.	
461.750	do	62.	
461.75625	do	33, 62.	
461.7625	do	30, 62.	
461.76875	do	33, 62.	
461.775	do	62.	
461.78125	do	33, 62.	
461.7875	do	30, 62.	
461.79375	do	33, 62.	
461.800	do	62.	
461.80625	do	33, 62.	
461.8125	do	30, 62.	
461.81875	do	33, 62.	
461.825	do	62.	
461.83125	do	33, 62.	
461.8375	do	30, 62.	
461.84375	do	33, 62.	
461.850	do	62.	
461.85625	do	33, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
461.8625	do	30, 62.	
461.86875	do	33, 62.	
461.875	do	62.	
461.88125	do	33, 62.	
461.8875	do	30, 62.	
461.89375	do	33, 62.	
461.900	do	62.	
461.90625	do	33, 62.	
461.9125	do	30, 62.	
461.91875	do	33, 62.	
461.925	do	62.	
461.93125	do	33, 62.	
461.9375	do	30, 62.	
461.94375	do	33, 62.	
461.950	do	62.	
461.95625	do	33, 62.	
461.9625	do	30, 62.	
461.96875	do	33, 62.	
461.975	do	62.	
461.98125	do	33, 62.	
461.9875	do	30, 62.	
461.99375	do	33, 62.	
462.000	do	62.	
462.00625	do	33, 62.	
462.0125	do	30, 62.	
462.01875	do	33, 62.	
462.025	do	62.	
462.03125	do	33, 62.	
462.0375	do	30, 62.	
462.04375	do	33, 62.	
462.050	do	62.	
462.05625	do	33, 62.	
462.0625	do	30, 62.	
462.06875	do	33, 62.	
462.075	do	62.	
462.08125	do	33, 62.	
462.0875	do	30, 62.	
462.09375	do	33, 62.	
462.100	do	62.	
462.10625	do	33, 62.	
462.1125	do	30, 62.	
462.11875	do	33, 62.	
462.125	do	62.	
462.13125	do	33, 62.	
462.1375	do	30, 62.	
462.14375	do	33, 62.	
462.150	do	62.	
462.15625	do	33, 62.	
462.1625	do	30, 62.	
462.16875	do	33, 62.	
462.175	do	62.	
462.18125	do	33, 84.	
462.1875	do	83, 84.	
462.19375	do	33, 84.	
462.200	do.		
462.20625	do	33, 85.	
462.2125	do	83, 85.	
462.21875	do	33, 85.	
462.225	do.		
462.23125	do	33, 85.	
462.2375	do	83, 85.	
462.24375	do	33, 85.	
462.250	do.		
462.25625	do	33, 85.	
462.2625	do	83, 85.	
462.26875	do	33, 85.	
462.275	do.		
462.28125	do	33, 85.	
462.2875	do	83, 85.	
462.29375	do	33, 85.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
462.300	do.		
462.30625	do	33, 85.	
462.3125	do	83, 85.	
462.31875	do	33, 85.	
462.325	do.		
462.33125	do	33, 85.	
462.3375	do	83, 85.	
462.34375	do	33, 85.	
462.350	do.		
462.35625	do	33, 85.	
462.3625	do	83, 85.	
462.36875	do	33, 85.	
462.375	do.		
462.38125	do	33, 85.	
462.3875	do	83, 85.	
462.39375	do	33, 85.	
462.400	do.		
462.40625	do	33, 85.	
462.4125	do	83, 85.	
462.41875	do	33, 85.	
462.425	do.		
462.43125	do	33, 85.	
462.4375	do	83, 85.	
462.44375	do	33, 85.	
462.450	do.		
462.45625	do	33, 84.	
462.4625	do	83, 84.	
462.46875	do	33, 84.	
462.475	do		IP, IW
462.48125	do	33, 84.	
462.4875	do	83, 84.	
462.49375	do	84.	
462.500	do.		
462.50625	do	33, 84.	
462.5125	do	83, 84.	
462.51875	do	33, 84.	
462.525	do		IP, IW
462.53125	do	33.	
462.750	Base	29, 36.	
462.7625	Mobile	67, 86.	
462.775	Base	29, 36.	
462.7875	Mobile	67, 86.	
462.800	Base	29, 36.	
462.8125	Mobile	67, 86.	
462.825	Base	29, 36.	
462.8375	Mobile	67, 86.	
462.850	Base	29, 36.	
462.8625	Mobile	67, 86.	
462.875	Base	29, 36.	
462.8875	Mobile	67, 86.	
462.900	Base	29, 36.	
462.9125	Mobile	67, 86.	
462.925	Base	29, 36.	
462.9375	Mobile	88	
462.94375	Base or mobile	33.	
463.200	do	62.	
463.20625	do	33, 62.	
463.2125	do	30, 62.	
463.21875	do	33, 62.	
463.225	do	62.	
463.23125	do	33, 62.	
463.2375	do	30, 62.	
463.24375	do	33, 62.	
463.250	do	62.	
463.25625	do	33, 62.	
463.2625	do	30, 62.	
463.26875	do	33, 62.	
463.275	do	62.	
463.28125	do	33, 62.	
463.2875	do	30, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
463.29375	do	33, 62.	
463.300	do	62.	
463.30625	do	33, 62.	
463.3125	do	30, 62.	
463.31875	do	33, 62.	
463.325	do	62.	
463.33125	do	33, 62.	
463.3375	do	30, 62.	
463.34375	do	33, 62.	
463.350	do	62.	
463.35625	do	33, 62.	
463.3625	do	30, 62.	
463.36875	do	33, 62.	
463.375	do	62.	
463.38125	do	33, 62.	
463.3875	do	30, 62.	
463.39375	do	33, 62.	
463.400	do	62.	
463.40625	do	33, 62.	
463.4125	do	30, 62.	
463.41875	do	33, 62.	
463.425	do	62.	
463.43125	do	33, 62.	
463.4375	do	30, 62.	
463.44375	do	33, 62.	
463.450	do	62.	
463.45625	do	33, 62.	
463.4625	do	30, 62.	
463.46875	do	33, 62.	
463.475	do	62.	
463.48125	do	33, 62.	
463.4875	do	30, 62.	
463.49375	do	33, 62.	
463.500	do	62.	
463.50625	do	33, 62.	
463.5125	do	30, 62.	
463.51875	do	33, 62.	
463.525	do	62.	
463.53125	do	33, 62.	
463.5375	do	30, 62.	
463.54375	do	33, 62.	
463.550	do	62.	
463.55625	do	33, 62.	
463.5625	do	30, 62.	
463.56875	do	33, 62.	
463.575	do	62.	
463.58125	do	33, 62.	
463.5875	do	30, 62.	
463.59375	do	33, 62.	
463.600	do	62.	
463.60625	do	33, 62.	
463.6125	do	30, 62.	
463.61875	do	33, 62.	
463.625	do	62.	
463.63125	do	33, 62.	
463.6375	do	30, 62.	
463.64375	do	33, 62.	
463.650	do	62.	
463.65625	do	33, 62.	
463.6625	do	30, 62.	
463.66875	do	33, 62.	
463.675	do	62.	
463.68125	do	33, 62.	
463.6875	do	30, 62.	
463.69375	do	33, 62.	
463.700	do	62.	
463.70625	do	33, 62.	
463.7125	do	30, 62.	
463.71875	do	33, 62.	
463.725	do	62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
463.73125	do	33, 62.	
463.7375	do	30, 62.	
463.74375	do	33, 62.	
463.750	do	62.	
463.75625	do	33, 62.	
463.7625	do	30, 62.	
463.76875	do	33, 62.	
463.775	do	62.	
463.78125	do	33, 62.	
463.7875	do	30, 62.	
463.79375	do	33, 62.	
463.800	do	62.	
463.80625	do	33, 62.	
463.8125	do	30, 62.	
463.81875	do	33, 62.	
463.825	do	62.	
463.83125	do	33, 62.	
463.8375	do	30, 62.	
463.84375	do	33, 62.	
463.850	do	62.	
463.85625	do	33, 62.	
463.8625	do	30, 62.	
463.86875	do	33, 62.	
463.875	do	62.	
463.88125	do	33, 62.	
463.8875	do	30, 62.	
463.89375	do	33, 62.	
463.900	do	62.	
463.90625	do	33, 62.	
463.9125	do	30, 62.	
463.91875	do	33, 62.	
463.925	do	62.	
463.93125	do	33, 62.	
463.9375	do	30, 62.	
463.94375	do	33, 62.	
463.950	do	62.	
463.95625	do	33, 62.	
463.9625	do	30, 62.	
463.96875	do	33, 62.	
463.975	do	62.	
463.98125	do	33, 62.	
463.9875	do	30, 62.	
463.99375	do	33, 62.	
464.000	do	62.	
464.00625	do	33, 62.	
464.0125	do	30, 62.	
464.01875	do	33, 62.	
464.025	do	62.	
464.03125	do	33, 62.	
464.0375	do	30, 62.	
464.04375	do	33, 62.	
464.050	do	62.	
464.05625	do	33, 62.	
464.0625	do	30, 62.	
464.06875	do	33, 62.	
464.075	do	62.	
464.08125	do	33, 62.	
464.0875	do	30, 62.	
464.09375	do	33, 62.	
464.100	do	62.	
464.10625	do	33, 62.	
464.1125	do	30, 62.	
464.11875	do	33, 62.	
464.125	do	62.	
464.13125	do	33, 62.	
464.1375	do	30, 62.	
464.14375	do	33, 62.	
464.150	do	62.	
464.15625	do	33, 62.	
464.1625	do	30, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
464.16875	do	33, 62.	
464.175	do	62.	
464.18125	do	33, 62.	
464.1875	do	30, 62.	
464.19375	do	33, 62.	
464.200	do	62.	
464.20625	do	33, 62.	
464.2125	do	30, 62.	
464.21875	do	33, 62.	
464.225	do	62.	
464.23125	do	33, 62.	
464.2375	do	30, 62.	
464.24375	do	33, 62.	
464.250	do	62.	
464.25625	do	33, 62.	
464.2625	do	30, 62.	
464.26875	do	33, 62.	
464.275	do	62.	
464.28125	do	33, 62.	
464.2875	do	30, 62.	
464.29375	do	33, 62.	
464.300	do	62.	
464.30625	do	33, 62.	
464.3125	do	30, 62.	
464.31875	do	33, 62.	
464.325	do	62.	
464.33125	do	33, 62.	
464.3375	do	30, 62.	
464.34375	do	33, 62.	
464.350	do	62.	
464.35625	do	33, 62.	
464.3625	do	30, 62.	
464.36875	do	33, 62.	
464.375	do	62.	
464.38125	do	33, 62.	
464.3875	do	30, 62.	
464.39375	do	33, 62.	
464.400	do	62.	
464.40625	do	33, 62.	
464.4125	do	30, 62.	
464.41875	do	33, 62.	
464.425	do	62.	
464.43125	do	33, 62.	
464.4375	do	30, 62.	
464.44375	do	33, 62.	
464.450	do	62.	
464.45625	do	33, 62.	
464.4625	do	30, 62.	
464.46875	do	33, 62.	
464.475	do	62.	
464.48125	do	33, 86.	
464.4875	do	83, 86.	
464.500	do	10, 34.	
464.5125	do	83, 86.	
464.51875	do	33, 86.	
464.525	do	62.	
464.53125	do	33, 86.	
464.5375	do	83, 86.	
464.550	do	10, 34.	
464.5625	do	83, 86.	
464.56875	do	33, .	
464.575	do	62.	
464.58125	do	33, 62.	
464.5875	do	30, 62.	
464.59375	do	33, 62.	
464.600	do	62.	
464.60625	do	33, 62.	
464.6125	do	30, 62.	
464.61875	do	33, 62.	
464.625	do	62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
464.63125	.....do	33, 62.	
464.6375	.....do	30, 62.	
464.64375	.....do	33, 62.	
464.650	.....do	62.	
464.65625	.....do	33, 62.	
464.6625	.....do	30, 62.	
464.66875	.....do	33, 62.	
464.675	.....do	62.	
464.68125	.....do	33, 62.	
464.6875	.....do	30, 62.	
464.69375	.....do	33, 62.	
464.700	.....do	62.	
464.70625	.....do	33, 62.	
464.7125	.....do	30, 62.	
464.71875	.....do	33, 62.	
464.725	.....do	62.	
464.73125	.....do	33, 62.	
464.7375	.....do	30, 62.	
464.74375	.....do	33, 62.	
464.750	.....do	62.	
464.75625	.....do	33, 62.	
464.7625	.....do	30, 62.	
464.76875	.....do	33, 62.	
464.775	.....do	62.	
464.78125	.....do	33, 62.	
464.7875	.....do	30, 62.	
464.79375	.....do	33, 62.	
464.800	.....do	62.	
464.80625	.....do	33, 62.	
464.8125	.....do	30, 62.	
464.81875	.....do	33, 62.	
464.825	.....do	62.	
464.83125	.....do	33, 62.	
464.8375	.....do	30, 62.	
464.84375	.....do	33, 62.	
464.850	.....do	62.	
464.85625	.....do	33, 62.	
464.8625	.....do	30, 62.	
464.86875	.....do	33, 62.	
464.875	.....do	62.	
464.88125	.....do	33, 62.	
464.8875	.....do	30, 62.	
464.89375	.....do	33, 62.	
464.900	.....do	62.	
464.90625	.....do	33, 62.	
464.9125	.....do	30, 62.	
464.91875	.....do	33, 62.	
464.925	.....do	62.	
464.93125	.....do	33, 62.	
464.9375	.....do	30, 62.	
464.94375	.....do	33, 62.	
464.950	.....do	62.	
464.95625	.....do	33, 62.	
464.9625	.....do	30, 62.	
464.96875	.....do	33, 62.	
464.975	.....do	62.	
464.98125	.....do	33, 62.	
464.9875	Mobile	67.	
465.000	Base	29, 34, 36.	
465.0125	Mobile	88.	
465.01875	.....do	33, 34.	
465.650	.....do	62, 68.	
465.65625	.....do	33, 62, 68.	
465.6625	.....do	30, 62, 68, 69.	
465.66875	.....do	33, 62, 68.	
465.675	.....do	62, 68.	
465.68125	.....do	33, 62, 68.	
465.6875	.....do	30, 62, 68, 69.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
465.69375	.....do	33, 62, 68.	
465.700	.....do	62, 68.	
465.70625	.....do	33, 62, 68.	
465.7125	.....do	30, 62, 68, 69.	
465.71875	.....do	33, 62, 68.	
465.725	.....do	62, 68.	
465.73125	.....do	33, 62, 68.	
465.7375	.....do	30, 62, 68, 69.	
465.74375	.....do	33, 62, 68.	
465.750	.....do	62, 68.	
465.75625	.....do	33, 62, 68.	
465.7625	.....do	30, 62, 68, 69.	
465.76875	.....do	33, 62, 68.	
465.775	.....do	62, 68.	
465.78125	.....do	33, 62, 68.	
465.7875	.....do	30, 62, 68, 69.	
465.79375	.....do	33, 62, 68.	
465.800	.....do	62, 68.	
465.80625	.....do	33, 62, 68.	
465.8125	.....do	30, 62, 68, 69.	
465.81875	.....do	33, 62, 68.	
465.825	.....do	62, 68.	
465.83125	.....do	33, 62, 68.	
465.8375	.....do	30, 62, 68, 69.	
465.84375	.....do	33, 62, 68.	
465.850	.....do	62, 68.	
465.85625	.....do	33, 62, 68.	
465.8625	.....do	30, 62, 68, 69.	
465.86875	.....do	33, 62, 68.	
465.875	.....do	62, 68.	
465.88125	.....do	33, 62, 68.	
465.8875	.....do	30, 62, 68, 69.	
465.89375	.....do	33, 62, 68.	
465.900	.....do	63, 64.	
465.90625	.....do	33, 63, 87.	
465.9125	.....do	63, 83, 87.	
465.91875	.....do	33, 63, 87.	
465.925	.....do	63, 64.	
465.93125	.....do	33, 63, 87.	
465.9375	.....do	63, 83, 87.	
465.94375	.....do	33, 63, 87.	
465.950	.....do	63, 64.	
465.95625	.....do	33, 63, 87.	
465.9625	.....do	63, 83, 87.	
465.96875	.....do	33, 63, 64.	
465.975	.....do	64, 66.	
465.98125	.....do	33, 66, 87.	
465.9875	.....do	66, 83, 87.	
465.99375	.....do	33, 66, 87.	
466.000	.....do	64, 66.	
466.00625	.....do	33, 66, 87.	
466.0125	.....do	66, 69, 83, 87.	
466.01875	.....do	33, 66, 87.	
466.025	.....do	62.	
466.03125	.....do	33, 86.	
466.0375	.....do	83, 86.	
466.04375	.....do	33, 86.	
466.050	.....do	62.	
466.05625	.....do	33, 86.	
466.0625	.....do	83, 86.	
466.06875	.....do	33, 86.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
466.075	do	62.	
466.08125	do	33, 86.	
466.0875	do	83, 86.	
466.09375	do	33, 86.	
466.100	do	62.	
466.10625	do	33, 86.	
466.1125	do	83, 86.	
466.11875	do	33, 86.	
466.125	do	62.	
466.13125	do	33, 86.	
466.1375	do	83, 86.	
466.14375	do	33, 86.	
466.150	do	62.	
466.15625	do	33, 86.	
466.1625	do	83, 86.	
466.16875	do	33, 86.	
466.175	do	62.	
466.18125	do	33, 84.	
466.1875	do	83, 84.	
466.19375	do	33, 84.	
466.200	do	62.	
466.20625	do	33, 85.	
466.2125	do	83, 85.	
466.21875	do	33, 85.	
466.225	do	62.	
466.23125	do	33, 85.	
466.2375	do	83, 85.	
466.24375	do	33, 85.	
466.250	do	62.	
466.25625	do	33, 85.	
466.2625	do	83, 85.	
466.26875	do	33, 85.	
466.275	do	62.	
466.28125	do	33, 85.	
466.2875	do	83, 85.	
466.29375	do	33, 85.	
466.300	do	62.	
466.30625	do	33, 85.	
466.3125	do	83, 85.	
466.31875	do	33, 85.	
466.325	do	62.	
466.33125	do	33, 85.	
466.3375	do	83, 85.	
466.34375	do	33, 85.	
466.350	do	62.	
466.35625	do	33, 85.	
466.3625	do	83, 85.	
466.36875	do	33, 85.	
466.375	do	62.	
466.38125	do	33, 85.	
466.3875	do	83, 85.	
466.39375	do	33, 85.	
466.400	do	62.	
466.40625	do	33, 85.	
466.4125	do	83, 85.	
466.41875	do	33, 85.	
466.425	do	62.	
466.43125	do	33, 85.	
466.4375	do	83, 85.	
466.44375	do	33, 85.	
466.450	do	62.	
466.45625	do	33, 84.	
466.4625	do	83, 84.	
466.46875	do	33, 84.	
466.475	do	62.	
466.48125	do	33, 84.	
466.4875	do	83, 84.	
466.49375	do	33, 84.	
466.500	do	62.	
466.50625	do	33, 84.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
466.5125	do	83, 84.	
466.51875	do	33, 84.	
466.525	do	62.	
466.53125	do	33, 62.	
466.5375	do	30, 62.	
466.54375	do	33, 62.	
466.550	do	62.	
466.55625	do	33, 62.	
466.5625	do	30, 62.	
466.56875	do	33, 62.	
466.575	do	62.	
466.58125	do	33, 62.	
466.5875	do	30, 62.	
466.59375	do	33, 62.	
466.600	do	62.	
466.60625	do	33, 62.	
466.6125	do	30, 62.	
466.61875	do	33, 62.	
466.625	do	62.	
466.63125	do	33, 62.	
466.6375	do	30, 62.	
466.64375	do	33, 62.	
466.650	do	62.	
466.65625	do	33, 62.	
466.6625	do	30, 62.	
466.66875	do	33, 62.	
466.675	do	62.	
466.68125	do	33, 62.	
466.6875	do	30, 62.	
466.69375	do	33, 62.	
466.700	do	62.	
466.70625	do	33, 62.	
466.7125	do	30, 62.	
466.71875	do	33, 62.	
466.725	do	62.	
466.73125	do	33, 62.	
466.7375	do	30, 62.	
466.74375	do	33, 62.	
466.750	do	62.	
466.75625	do	33, 62.	
466.7625	do	30, 62.	
466.76875	do	33, 62.	
466.775	do	62.	
466.78125	do	33, 62.	
466.7875	do	30, 62.	
466.79375	do	33, 62.	
466.800	do	62.	
466.80625	do	33, 62.	
466.8125	do	30, 62.	
466.81875	do	33, 62.	
466.825	do	62.	
466.83125	do	33, 62.	
466.8375	do	30, 62.	
466.84375	do	33, 62.	
466.850	do	62.	
466.85625	do	33, 62.	
466.8625	do	67, 86.	
466.86875	do	33, 62.	
466.875	do	62.	
466.88125	do	33, 62.	
466.8875	do	67, 86.	
466.89375	do	33, 62.	
466.900	do	62.	
466.90625	do	33, 62.	
466.9125	do	67, 86.	
466.91875	do	33, 62.	
466.925	do	62.	
466.93125	do	33, 62.	
466.9375	do	88.	
466.94375	do	33, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
466.950	do	62.	
466.95625	do	33, 62.	
466.9625	do	30, 62.	
466.96875	do	33, 62.	
466.975	do	62.	
466.98125	do	33, 62.	
466.9875	do	30, 62.	
466.99375	do	33, 62.	
467.000	do	62.	
467.00625	do	33, 62.	
467.0125	do	30, 62.	
467.01875	do	33, 62.	
467.025	do	62.	
467.03125	do	33, 62.	
467.0375	do	30, 62.	
467.04375	do	33, 62.	
467.050	do	62.	
467.05625	do	33, 62.	
467.0625	do	30, 62.	
467.06875	do	33, 62.	
467.075	do	62.	
467.08125	do	33, 62.	
467.0875	do	30, 62.	
467.09375	do	33, 62.	
467.100	do	62.	
467.10625	do	33, 62.	
467.1125	do	30, 62.	
467.11875	do	33, 62.	
467.125	do	62.	
467.13125	do	33, 62.	
467.1375	do	30, 62.	
467.14375	do	33, 62.	
467.150	do	62.	
467.15625	do	33, 62.	
467.1625	do	30, 62.	
467.16875	do	33, 62.	
467.175	do	62.	
467.18125	do	33, 62.	
467.1875	do	30, 62.	
467.19375	do	33, 62.	
467.200	do.		
467.20625	do	33.	
467.2125	do	30.	
467.21875	do	33.	
467.225	do.		
467.23125	do	33.	
467.2375	do	30.	
467.24375	do	33.	
467.250	do.		
467.25625	do	33.	
467.2625	do	30.	
467.26875	do	33.	
467.275	do.		
467.28125	do	33.	
467.2875	do	30.	
467.29375	do	33.	
467.300	do.		
467.30625	do	33.	
467.3125	do	30.	
467.31875	do	33.	
467.325	do.		
467.33125	do	33.	
467.3375	do	30.	
467.34375	do	33.	
467.350	do.		
467.35625	do	33.	
467.3625	do	30.	
467.36875	do	33.	
467.375	do.		
467.38125	do	33.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
467.3875	do	30.	
467.39375	do	33.	
467.400	do.		
467.40625	do	33.	
467.4125	do	30.	
467.41875	do	33.	
467.425	do.		
467.43125	do	33.	
467.4375	do	30.	
467.44375	do	33.	
467.450	do.		
467.45625	do	33.	
467.4625	do	30.	
467.46875	do	33.	
467.475	do		IP, IW
467.48125	do	33.	
467.4875	do	30.	
467.49375	do	33.	
467.500	do.		
467.50625	do	33.	
467.5125	do	30.	
467.51875	do	33.	
467.525	do		IP, IW
467.53125	do	33.	
467.74375	do	33, 62.	
467.750	do	11, 12, 35, 60.	
467.75625	do	11, 12, 33, 35, 60.	
467.7625	do	11, 12, 30, 35, 60.	
467.76875	do	11, 12, 33, 35, 60.	
467.775	do	11, 12, 35, 60.	
467.78125	do	11, 12, 33, 35, 60.	
467.7875	do	11, 12, 30, 35, 60.	
467.79375	do	11, 12, 33, 35, 60.	
467.800	do	11, 12, 35, 60.	
467.80625	do	11, 12, 33, 35, 60.	
467.8125	do	11, 12, 30, 35, 60.	
467.81875	do	11, 12, 33, 35, 60.	
467.825	do	11, 12, 35, 60.	
467.83125	do	11, 12, 33, 35, 60.	
467.8375	do	11, 12, 30, 35, 60.	
467.850	do	11, 12, 35.	
467.8625	do	67.	
467.875	do	11, 12, 35.	
467.8875	do	67.	
467.900	do	11, 12, 35.	
467.9125	do	67.	
467.925	do	11, 12, 35.	
467.93125	do	33.	
467.9375	do	30, 67.	
467.94375	do	33.	
468.200	do	62.	
468.20625	do	33, 62.	
468.2125	do	30, 62.	
468.21875	do	33, 62.	
468.225	do	62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
468.23125	do	33, 62.	
468.2375	do	30, 62.	
468.24375	do	33, 62.	
468.250	do	62.	
468.25625	do	33, 62.	
468.2625	do	30, 62.	
468.26875	do	33, 62.	
468.275	do	62.	
468.28125	do	33, 62.	
468.2875	do	30, 62.	
468.29375	do	33, 62.	
468.300	do	62.	
468.30625	do	33, 62.	
468.3125	do	30, 62.	
468.31875	do	33, 62.	
468.325	do	62.	
468.33125	do	33, 62.	
468.3375	do	30, 62.	
468.34375	do	33, 62.	
468.350	do	62.	
468.35625	do	33, 62.	
468.3625	do	30, 62.	
468.36875	do	33, 62.	
468.375	do	62.	
468.38125	do	33, 62.	
468.3875	do	30, 62.	
468.39375	do	33, 62.	
468.400	do	62.	
468.40625	do	33, 62.	
468.4125	do	30, 62.	
468.41875	do	33, 62.	
468.425	do	62.	
468.43125	do	33, 62.	
468.4375	do	30, 62.	
468.44375	do	33, 62.	
468.450	do	62.	
468.45625	do	33, 62.	
468.4625	do	30, 62.	
468.46875	do	33, 62.	
468.475	do	62.	
468.48125	do	33, 62.	
468.4875	do	30, 62.	
468.49375	do	33, 62.	
468.500	do	62.	
468.50625	do	33, 62.	
468.5125	do	30, 62.	
468.51875	do	33, 62.	
468.525	do	62.	
468.53125	do	33, 62.	
468.5375	do	30, 62.	
468.54375	do	33, 62.	
468.550	do	62.	
468.55625	do	33, 62.	
468.5625	do	30, 62.	
468.56875	do	33, 62.	
468.575	do	62.	
468.58125	do	33, 62.	
468.5875	do	30, 62.	
468.59375	do	33, 62.	
468.600	do	62.	
468.60625	do	33, 62.	
468.6125	do	30, 62.	
468.61875	do	33, 62.	
468.625	do	62.	
468.63125	do	33, 62.	
468.6375	do	30, 62.	
468.64375	do	33, 62.	
468.650	do	62.	
468.65625	do	33, 62.	
468.6625	do	30, 62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
468.66875	do	33, 62.	
468.675	do	62.	
468.68125	do	33, 62.	
468.6875	do	30, 62.	
468.69375	do	33, 62.	
468.700	do	62.	
468.70625	do	33, 62.	
468.7125	do	30, 62.	
468.71875	do	33, 62.	
468.725	do	62.	
468.73125	do	33, 62.	
468.7375	do	30, 62.	
468.74375	do	33, 62.	
468.750	do	62.	
468.75625	do	33, 62.	
468.7625	do	30, 62.	
468.76875	do	33, 62.	
468.775	do	62.	
468.78125	do	33, 62.	
468.7875	do	30, 62.	
468.79375	do	33, 62.	
468.800	do	62.	
468.80625	do	33, 62.	
468.8125	do	30, 62.	
468.81875	do	33, 62.	
468.825	do	62.	
468.83125	do	33, 62.	
468.8375	do	30, 62.	
468.84375	do	33, 62.	
468.850	do	62.	
468.85625	do	33, 62.	
468.8625	do	30, 62.	
468.86875	do	33, 62.	
468.875	do	62.	
468.88125	do	33, 62.	
468.8875	do	30, 62.	
468.89375	do	33, 62.	
468.900	do	62.	
468.90625	do	33, 62.	
468.9125	do	30, 62.	
468.91875	do	33, 62.	
468.925	do	62.	
468.93125	do	33, 62.	
468.9375	do	30, 62.	
468.94375	do	33, 62.	
468.950	do	62.	
468.95625	do	33, 62.	
468.9625	do	30, 62.	
468.96875	do	33, 62.	
468.975	do	62.	
468.98125	do	33, 62.	
468.9875	do	30, 62.	
468.99375	do	33, 62.	
469.000	do	62.	
469.00625	do	33, 62.	
469.0125	do	30, 62.	
469.01875	do	33, 62.	
469.025	do	62.	
469.03125	do	33, 62.	
469.0375	do	30, 62.	
469.04375	do	33, 62.	
469.050	do	62.	
469.05625	do	33, 62.	
469.0625	do	30, 62.	
469.06875	do	33, 62.	
469.075	do	62.	
469.08125	do	33, 62.	
469.0875	do	30, 62.	
469.09375	do	33, 62.	
469.100	do	62.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
469.10625	do	33, 62.	
469.1125	do	30, 62.	
469.11875	do	33, 62.	
469.125	do	62.	
469.13125	do	33, 62.	
469.1375	do	30, 62.	
469.14375	do	33, 62.	
469.150	do	62.	
469.15625	do	33, 62.	
469.1625	do	30, 62.	
469.16875	do	33, 62.	
469.175	do	62.	
469.18125	do	33, 62.	
469.1875	do	30, 62.	
469.19375	do	33, 62.	
469.200	do	62.	
469.20625	do	33, 62.	
469.2125	do	30, 62.	
469.21875	do	33, 62.	
469.225	do	62.	
469.23125	do	33, 62.	
469.2375	do	30, 62.	
469.24375	do	33, 62.	
469.250	do	62.	
469.25625	do	33, 62.	
469.2625	do	30, 62.	
469.26875	do	33, 62.	
469.275	do	62.	
469.28125	do	33, 62.	
469.2875	do	30, 62.	
469.29375	do	33, 62.	
469.300	do	62.	
469.30625	do	33, 62.	
469.3125	do	30, 62.	
469.31875	do	33, 62.	
469.325	do	62.	
469.33125	do	33, 62.	
469.3375	do	30, 62.	
469.34375	do	33, 62.	
469.350	do	62.	
469.35625	do	33, 62.	
469.3625	do	30, 62.	
469.36875	do	33, 62.	
469.375	do	62.	
469.38125	do	33, 62.	
469.3875	do	30, 62.	
469.39375	do	33, 62.	
469.400	do	62.	
469.40625	do	33, 62.	
469.4125	do	30, 62.	
469.41875	do	33, 62.	
469.425	do	62.	
469.43125	do	33, 62.	
469.4375	do	30, 62.	
469.44375	do	33, 62.	
469.450	do	62.	
469.45625	do	33, 62.	
469.4625	do	30, 62.	
469.46875	do	33, 62.	
469.475	do	62.	
469.48125	do	33, 86.	
469.4875	do	83, 86.	
469.500	do	10, 34.	
469.5125	do	83, 86.	
469.51875	do	33, 86.	
469.525	do	62.	
469.53125	do	33, 86.	
469.5375	do	83, 86.	
469.550	do	10, 34.	
469.5625	do	83, 86.	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
469.56875	do	33, 86.	
469.575	do	62.	
469.58125	do	33, 62.	
469.5875	do	30, 62.	
469.59375	do	33, 62.	
469.600	do	62.	
469.60625	do	33, 62.	
469.6125	do	30, 62.	
469.61875	do	33, 62.	
469.625	do	62.	
469.63125	do	33, 62.	
469.6375	do	30, 62.	
469.64375	do	33, 62.	
469.650	do	62.	
469.65625	do	33, 62.	
469.6625	do	30, 62.	
469.66875	do	33, 62.	
469.675	do	62.	
469.68125	do	33, 62.	
469.6875	do	30, 62.	
469.69375	do	33, 62.	
469.700	do	62.	
469.70625	do	33, 62.	
469.7125	do	30, 62.	
469.71875	do	33, 62.	
469.725	do	62.	
469.73125	do	33, 62.	
469.7375	do	30, 62.	
469.74375	do	33, 62.	
469.750	do	62.	
469.75625	do	33, 62.	
469.7625	do	30, 62.	
469.76875	do	33, 62.	
469.775	do	62.	
469.78125	do	33, 62.	
469.7875	do	30, 62.	
469.79375	do	33, 62.	
469.800	do	62.	
469.80625	do	33, 62.	
469.8125	do	30, 62.	
469.81875	do	33, 62.	
469.825	do	62.	
469.83125	do	33, 62.	
469.8375	do	30, 62.	
469.84375	do	33, 62.	
469.850	do	62.	
469.85625	do	33, 62.	
469.8625	do	30, 62.	
469.86875	do	33, 62.	
469.875	do	62.	
469.88125	do	33, 62.	
469.8875	do	30, 62.	
469.89375	do	33, 62.	
469.900	do	62.	
469.90625	do	33, 62.	
469.9125	do	30, 62.	
469.91875	do	33, 62.	
469.925	do	62.	
469.93125	do	33, 62.	
469.9375	do	30, 62.	
469.94375	do	33, 62.	
469.950	do	62.	
469.95625	do	33, 62.	
469.9625	do	30, 62.	
469.96875	do	33, 62.	
469.975	do	62.	
469.98125	do	33, 62.	
470 to 512	Base or mobile	70.	
809 to 824	Mobile	71	
854 to 869	Base or mobile	71	

INDUSTRIAL/BUSINESS POOL FREQUENCY TABLE—Continued

Frequency or band	Class of station(s)	Limitations	Coordinator
896 to 901	Mobile	71.	
928 and above	Operational fixed.	72.	
929 to 930	Base only	73.	
935 to 940	Base or mobile	71.	
1427 to 1432	Base, mobile or operational fixed..	55	
2,450 to 2,500	Base or mobile	74.	
8,400 to 8,500	.....do	75.	
5850-5925	.....do	90	Not applicable.
10,550 to 10,680.	.....do	76.	

(c) Explanation of assignment limitations appearing in the frequency table of paragraph (b)(3) of this section:

(1) Use of this frequency is permitted as follows:

(i) Only entities engaged in the following activities are eligible to use this spectrum, and then only in accordance with § 90.266:

(A) Prospecting for petroleum, natural gas or petroleum products;

(B) Distribution of electric power or the distribution by pipeline of fuels or water;

(C) Exploration, its support services, and the repair of pipelines; or

(D) The repair of telecommunications circuits.

(ii) Except as provided in this part, licensees may not use these frequencies in the place of other operational circuits permitted by the Commission's rules. Circuits operating on these frequencies may be used only for the following purposes:

(A) Providing standby backup communications for circuits which have been disrupted and which directly affect the safety of life, property, or the national interest or are used for coordinating inter-utility, intra-utility, and power pool distribution of electric power;

(B) Providing operational circuits during exploration;

(C) Coordinating the repair of inter-utility, intra-utility, and power pool electric power distribution networks, or the repair of pipelines;

(D) Exploratory efforts in mining for solid fuels, minerals, and metals important to the national interest;

(E) Repair of pipelines used for the transmission of fuel or water;

(F) Services supporting the exploration for energy or mineral resources important to the national interest, without which such exploration cannot be conducted; or

(G) Coordinating the repair of wireline or point-to-point microwave circuits.

(2) [Reserved]

(3) This frequency is available for assignment only to stations utilized for geophysical purposes.

(4) Geophysical operations may use tone or impulse signaling for purposes other than indicating failure of equipment or abnormal conditions on this frequency. All such tone or impulse signaling shall be on a secondary basis and subject to the following limitations:

(i) Maximum duration of a single non-voice transmission may not exceed 3 minutes;

(ii) The bandwidth utilized for secondary tone or impulse signaling shall not exceed that authorized to the licensee for voice emission on the frequency concerned;

(iii) Frequency loading resulting from the use of secondary tone or impulse signaling will not be considered in whole or in part, as a justification for authorizing additional frequencies in the licensee's mobile service system; and

(iv) The maximum transmitter output power for tone or impulse transmissions shall not exceed 50 watts.

(5) Frequencies below 25 MHz will be assigned to base or mobile stations only upon a satisfactory showing that, from a safety of life standpoint, frequencies above 25 MHz will not meet the operational requirements of the applicant.

(6) Frequencies may be assigned in pairs with the separation between base and mobile transmit frequencies being 5.26 MHz. A mobile station may be assigned the frequency which would normally be assigned to a base station for single frequency operation. However, this single-frequency operation may be subject to interference that would not occur to a two-frequency system. Base or mobile stations operating wholly within Standard Metropolitan Areas

having 50,000 or more population (1950 Census) must be operated in the half-duplex mode.

(7) This frequency is available for assignment to geophysical stations on a secondary basis to other licensees. Geophysical stations must cease operations on this frequency immediately upon receiving notice that interference is being caused to mobile service stations.

(8) This frequency is primarily available for oil spill containment and cleanup operations and for training and drills essential in the preparations for the containment and cleanup of oil spills. It is secondarily available for general base-mobile operations on a noninterference basis. Secondary users of this frequency are required to forego its use should oil spill containment and cleanup activities be present in their area of operation or upon notice by the Commission or a primary user that harmful interference is being caused to oil spill containment or cleanup activities in other areas.

(9) Operation on this frequency is secondary to stations in the maritime mobile service operating in accordance with the International table of frequency allocations.

(10) This frequency will be assigned only to stations used in itinerant operations, except within 56 km (35 miles) of Detroit, Mich., where it may be assigned for either itinerant or permanent area operations (*i.e.*, general use).

(11) Operation on this frequency is limited to a maximum output power of 2 watts; and each station authorized will be classified and licensed as a mobile station. Any units of such a station, however, may provide the operational functions of a base or fixed station on a secondary basis to mobile service operations, Provided, that the separation between the control point and the center of the radiating portion of the antenna of any units so used does not exceed 8 m (25 ft.).

(12) This frequency may not be used aboard aircraft in flight.

(13) This frequency is shared with the Public Safety Pool.

(14) Operation on this frequency is limited to a maximum output power of 1 watt and each station authorized will be classified and licensed as a mobile station. Any units of such a station, however, may provide the operational functions of a base or fixed station on a secondary basis to mobile service operations, provided that the separation between the control point and the center of the radiating portion of the antenna of any units so used does not exceed 8m (25 ft.).

(15) This Government frequency is available for shared Government/non-Government use by stations engaged in oil spill containment and cleanup operations and for training and drills essential in the preparation for containment and cleanup of oil spills. Such use will be confined to inland and coastal waterways.

(16) This frequency may be assigned only to stations operating in an interconnected or coordinated utility system in accordance with an operational communications plan which sets forth all points of communications. Authorizations at variance with an established operational communications plan will be made only on a secondary basis.

(17) This frequency will be assigned only to stations used in itinerant operations.

(18) This frequency is also used on a secondary basis for cordless telephones under part 15 of this chapter.

(19) In addition to single frequency operation, this frequency is available to base and mobile stations for the paired frequency mode of operation. For two frequency systems, the separation between base and mobile transmit frequencies is 500 kHz with the base stations transmitting on the higher of the two frequencies.

(20) In the State of Alaska only, the frequency 44.10 MHz is available for assignment on a primary basis to stations in the Common Carrier Rural Radio Service utilizing meteor burst communications. The frequency may be used by private radio stations for meteor burst communications on a secondary, non-interference basis. Usage shall be in accordance with parts 22 and 90 of this chapter. Stations utilizing meteor burst communications shall not cause harmful interference to stations of other radio services operating in accordance with the allocation table.

(21) In the State of Alaska only, the frequency 44.20 MHz is available for assignment on a primary basis to private land mobile radio stations utilizing meteor burst communications. The frequency may be used by common carrier stations for meteor burst communications on a secondary, non-interference basis. Usage shall be in accordance with parts 22 and 90 of this chapter. Stations utilizing meteor burst communications shall not cause harmful interference to stations of other radio services operating in accordance with the allocation table.

(22) The frequencies available for use at operational fixed stations in the band 72-76 MHz are listed in § 90.257(a)(1). These frequencies are shared with other services and are available only in accordance with the provisions of § 90.257. Seismic telemetry transmitters certificated with 1 watt or less power and a frequency tolerance not exceeding ±0.005% may be used as temporary operational fixed stations.

(23) This frequency is shared with fixed stations in other services and is subject to no protection from interference.

(24) All operations on this frequency are subject to the provisions of § 90.257(b).

(25) This frequency is shared with the Radio Control (R/C) Service, of the part 95 Personal Radio Services, where it is used solely for the radio control of models.

(26) Pulsed modulations will not be authorized on this frequency.

(27) Assignment of frequencies in this band are subject to the provisions of § 90.173. In the 150–170 MHz band, licensees as of August 18, 1995 who operate systems that are 2.5 kHz removed from regularly assignable frequencies may continue to operate on a secondary, non-interference basis after August 1, 2003.

(28) In Puerto Rico and the Virgin Islands this frequency is subject to the following:

(i) This frequency is assigned only for one-way paging communications to mobile receivers. Only A1D, A2D, A3E, F1D, F2D, F3E, or G3E emissions may be authorized. Licensees may provide one-way paging communications on this frequency to individuals, persons eligible for licensing under subparts B or C of this part, to representatives of Federal Government agencies, and foreign governments and their representatives; and

(ii) This frequency will not be assigned to stations for use at temporary locations.

(29) This frequency will be authorized a channel bandwidth of 25 kHz. Except when limited elsewhere, one-way paging transmitters on this frequency may operate with an output power of 350 watts.

(30) This frequency will be assigned with an authorized bandwidth not to exceed 11.25 kHz. In the 450–470 MHz band, secondary telemetry operations pursuant to § 90.238(e) will be authorized on this frequency.

(31) Use of this frequency is limited to stations located in Puerto Rico and the Virgin Islands.

(32) This frequency is not available to stations located in Puerto Rico and the Virgin Islands.

(33) This frequency will be assigned with an authorized bandwidth not to exceed 6 kHz.

(34) Operation on this frequency is limited to a maximum output power of 35 watts.

(35) This frequency may be used for mobile operation for radio remote control and telemetering functions. A1D, A2D, F1D, or F2D emission may be authorized and mobile stations used to control remote objects or devices may be operated on the continuous carrier transmit mode.

(36) This frequency is assigned only for one-way paging communications to mobile receivers. Only A1D, A2D, A3E, F1D, F2D, F3E, or G3E emissions may be authorized. Licensees may provide one-way paging communications on this frequency to individuals, persons eligible for licensing under subparts B or C of this part, to representatives of Federal Government agencies, and foreign governments and their representatives.

(37) This frequency is available on a secondary basis to one-way paging communications.

(38) This frequency will not be assigned to stations for use at temporary locations.

(39) For FM transmitters the sum of the highest modulating frequency and the amount of frequency deviation may not exceed 2.8 kHz and the maximum frequency deviation may not exceed 2.5 kHz. For AM transmitters the highest modulating frequency may not exceed 2.0 kHz. The carrier frequency must be maintained within 0.0005 percent, and the authorized bandwidth may not exceed 6 kHz.

(40) This frequency is shared with the Public Safety Pool for remote control and telemetry operations.

(41) Operational fixed stations must employ directional antennas having a front-to-back ratio of at least 20 dB. Omnidirectional antennas having unity gain may be employed for stations communicating with at least three receiving locations separated by 160 deg. of azimuth.

(42) The maximum effective radiated power (ERP) may not exceed 20 watts for fixed stations and 2 watts for mobile stations. The height of the antenna system may not exceed 15.24 meters (50 ft.) above the ground. All such operation is on a secondary basis to adjacent channel land mobile operations.

(43) This frequency is available for the following:

(i) Assignment to multiple address fixed stations employing omnidirectional antennas used for power utility peak load shaving and shedding and to mobile stations used for the remote control of objects and devices. The maximum power that may be authorized to fixed stations is 300 watts output, and the maximum power that may be authorized for mobile stations is 1 watt output. This frequency may also be assigned to operational fixed stations employing directional antenna systems (front-to-back ratio of 20 dB) when such stations are located at least 120 km. (75 mi.) from the boundaries of any urbanized area of 200,000 or more population. (U.S. Census of Population, 1960). The maximum power output of the transmitter for such fixed stations may not exceed 50 watts. A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emission may be authorized; or

(ii) On a secondary basis for remote control and telemetry operations, subject to paragraphs (c)(41), (42), (43), (46), and (47) of this section.

(44) The maximum output power of the transmitter may not exceed 50 watts for fixed stations and 1 watt for mobile stations. A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emission may be authorized, and mobile stations used to control remote objects and devices may be operated in the continuous transmit mode.

(45) [Reserved]

(46) This frequency is limited to a maximum power of 20 watts.

(47) This frequency may be used for mobile operation for remote control and telemetering functions. A1D, A2D, F1D, or F2D emission may be authorized. The use of the continuous carrier transmit mode for these purposes is permitted only for stations authorized and continuously licensed since before May 21, 1971.

(48) Operation on this frequency is limited to a maximum output power of 20 watts.

(49) Operation on this frequency is limited to a maximum output power of 75 watts.

(50) This frequency may also be used for the transmission of tone or voice communications, including such communications when prerecorded, for purposes of automatically indicating abnormal conditions of trackage and railroad rolling stock when in motion, on a secondary basis to other stations on this frequency. All such operations shall be subject to the following:

(i) The output power shall not exceed 30 watts;

(ii) The bandwidth used shall not exceed that authorized to the licensee for voice transmissions on the frequency concerned;

(iii) The station shall be so designed and installed that it can normally be activated only by its associated automatic control equipment and, in addition, it shall be equipped with a time delay or clock device which will deactivate the station within three (3) minutes following activation by the last car in the train; and

(iv) Stations authorized pursuant to the provisions of this paragraph are exempt from the station identification requirements of § 90.425.

(51) In Puerto Rico and the Virgin Islands only, this frequency is available on a shared basis with remote pickup broadcast stations.

(52) In Puerto Rico and the Virgin Islands only, this frequency is available to all stations operating in the Industrial/Business Pool and may be coordinated by any frequency coordinator certified in the Industrial/Business Pool.

(53) Frequencies in this band will be assigned only for transmitting hydrological or meteorological data or for low power wireless microphones in accordance with the provisions of § 90.265.

(54) For FM transmitters the sum of the highest modulating frequency and the amount of frequency deviation may not exceed 1.7 kHz and the maximum deviation may not exceed 1.2 kHz. For AM transmitters the highest modulating frequency may not exceed 1.2 kHz. The carrier frequency must be maintained within 0.0005 percent and the authorized bandwidth may not exceed 3 kHz.

(55) This band is available to stations operating in this service subject to the provisions of § 90.259.

(56) Subpart T of this part contains rules for assignment of frequencies in the 220–222 MHz band.

(57) The requirements for secondary fixed use of frequencies in this band are set forth in § 90.261.

(58) Operational fixed assignments on this frequency will only be made to an itinerant fixed control or relay station on a secondary basis to land-mobile stations in the Industrial/Business Pool, provided that the fixed relay or control station is to be associated with base and mobile facilities authorized to use other frequencies available for itinerant operation in the Industrial/Business Pool. All such use of these frequencies for fixed systems is limited to locations 161 or more km. (100 mi.) from the center of any urbanized area of 200,000 or more population, except that the distance may be 120 km. (75 mi.) if the output power does not exceed 20 watts. All such fixed systems are limited to a maximum of two frequencies and must employ directional antennas with a front-to-back ratio of at least 15 dB. The centers of urbanized areas of 200,000 or more population are determined from the appendix, page 226, of the U.S. Commerce publication, ''Air Line Distance Between Cities in the United States.'' Urbanized areas of 200,000 or more population are defined in the U.S. Census of Population, 1960, volume 1, table 23, page 1–50.

(59) This frequency may be assigned primarily for stations used for the purpose of controlling slave locomotives that are placed within a train to assist the lead locomotive by providing, among other functions, auxiliary starting, pulling, and braking actions. Additionally, on a secondary basis this frequency may be assigned for remote control of all types of locomotives and, within a railroad yard or terminal area, for remote control of cab indicator devices placed with a locomotive to give visual signals to the operator of the locomotive. (A1, A2, F1 or F2 emissions may be authorized.)

(60)(i) This frequency is available for voice or non-voice communications concerned with cargo handling from a dock or cargo handling facility, a vessel alongside the dock, or cargo handling facility. The effective radiated power (ERP) shall not exceed 2 watts. Mobile relay stations may be temporarily installed on vessels located at or in the vicinity of a dock or cargo handling facility. The center of the radiating system of the mobile relay shall be located no more than 3 meters (10 feet) above the vessel's highest working dock.

(ii) This frequency is also available for low power non-cargo handling operations, both voice and non-voice, on a secondary basis to cargo handling communications. Such operations are not subject to the power limitations in paragraph (c)(60)(i) of this section on the following frequencies: 457.525 MHz, 457.550 MHz, 457.5625 MHz, 457.575 MHz, 457.5875 MHz, 457.600 MHz, and 457.6125 MHz. This frequency will not be assigned for non-cargo handling operations at temporary locations.

(iii) For mobile relay operations under paragraph (c)(60)(i) of this section, frequency pairing is as follows:

Mobile relay (MHz) [1]	Mobile (MHz)
457.525	467.750
457.53125	467.75625

Mobile relay (MHz) [1]	Mobile (MHz)
457.5375	467.7625
457.54375	467.76875
457.550	467.775
457.55625	467.78125
457.5625	467.7875
457.56875	467.79375
457.575	467.800
457.58125	467.80625
457.5875	467.8125
457.59375	467.81875
457.600	467.825
457.60625	467.83125
457.6125	.....
457.61875	.....

[1] The mobile relay frequencies may also be used for single frequency simplex.

(61) This frequency is available for assignment as follows:

(i) To persons furnishing commercial air transportation service or, pursuant to § 90.179, to an entity furnishing radio communications service to persons so engaged, for stations located on or near the airports listed in paragraph (c)(61)(iv) of this section. Stations will be authorized on a primary basis and may be used only in connection with servicing and supplying of aircraft. Operation on this frequency is limited to a maximum effective radiated power (ERP) of 100 watts at locations within 16 km (10 miles) of the coordinates of the listed airports.

(ii) To stations in the Industrial/Business Pool for secondary use at locations 80 km (approximately 50 miles) or more from the coordinates of the listed airports. Operation will be limited to a maximum ERP of 300 watts.

(iii) To stations in the Industrial/Business Pool for secondary use at locations greater than 16 km (approximately 10 miles) but less than 80 km (approximately 50 miles) from the coordinates of the listed airports. Operation will be limited to a maximum ERP of 10 watts. Use of this frequency is restricted to the confines of an industrial complex or manufacturing yard area. Stations licensed prior to April 25, 2005, may continue to operate with facilities authorized as of that date.

(iv) The airports and their respective reference coordinates are (coordinates are referenced to North American Datum 1983 (NAD83)):

City and airport	Reference coordinates	
	N. Latitude	W. Longitude
Aberdeen, SD: Aberdeen Regional (ABR)	45°26′56.6″	98°25′18.6″
Agana, GU: Guam International (GUM)	13°29′00.4″	144°47′45.5″ E
Akron, OH: Akron-Canton Regional (CAK)	40°54′58.7″	81°26′32.9″
Alamosa, CO: San Luis Valley Regional/Bergman Field (ALS)	37°26′05.7″	105°51′59.6″
Albany, NY: Albany Int'l (ALB)	42°44′53.2″	73°48′10.7″
Albuquerque, NM: Albuquerque International Sunport (ABQ)	35°02′24.8″	106°36′33.1″
Allentown-Bethlehem, PA: Lehigh Valley Int'l (ABE)	40°39′08.5″	75°26′25.5″
Amarillo, TX: Amarillo International (AMA)	35°13′09.7″	101°42′21.3″
Anchorage, AK: Ted Stevens Anchorage International (ANC)	61°10′27.6″	149°59′46.3″
Appleton, WI: Outagamie County Regional (ATW)	44°15′26.7″	88°31′10.1″
Aspen, CO: Aspen-Pitkin County/Sardy Field (ASE)	39°13′23.4″	106°52′07.9″
Atlanta, GA:		
Atlanta International (ATL)	33°38′25.6″	84°25′37.0″
Dekalb-Peachtree (PDK)	33°52′32.2″	84°18′07.1″
Fulton County (FTY)	33°46′44.9″	84°31′16.9″
Austin, TX: Austin Bergstrom International (AUS)	30°11′40.3″	97°40′11.5″
Bakersfield, CA: Meadows Field (BFL)	35°26′00.9″	119°03′24.4″
Baltimore, MD: Baltimore-Washington Int'l (BWI)	39°10′31.5″	76°40′05.5″
Baton Rouge, LA: Baton Rouge Metropolitan (BTR)	30°31′59.4″	91°08′58.7″
Billings, MT: Billings Logan International (BIL)	45°48′27.6″	108°32′34.3″
Birmingham, AL: Birmingham Int'l (BHM)	33°33′46.6″	86°45′12.8″
Bismarck, ND: Bismarck Municipal (BIS)	46°46′21.8″	100°44′44.7″
Boise, ID: Boise Air Terminal (BOI)	43°33′52.0″	116°13′22.0″
Boston, MA: Logan International (BOS)	42°21′51.7″	71°00′18.7″
Bozeman, MT: Gallatin Field (BZN)	45°46′36.8″	111°09′10.8″
Bridgeport, CT: Sikorsky Memorial (BDR)	41°09′48.5″	73°07′34.2″
Buffalo, NY: Buffalo Niagara Int'l (BUF)	42°56′25.9″	78°43′55.8″
Burlington, VT: Burlington Int'l (BTV)	44°28′18.7″	73°09′11.8″
Cedar Rapids, IA: The Eastern Iowa (CID)	41°53′04.5″	91°42′39.1″
Charleston, SC: Charleston AFB/International (CHS)	32°53′55.1″	80°02′25.8″
Charlotte, NC: Charlotte-Douglas Int'l (CLT)	35°12′50.4″	80°56′35.3″
Chattanooga, TN: Lovell (CHA)	35°02′06.9″	85°12′13.6″
Chicago, IL-Northwest, IN:		
Chicago-Wheeling-Palwaukee (PWK)	42°06′51.1″	87°54′05.3″
Meigs (CGX)	41°51′31.8″	87°36′28.5″

City and airport	Reference coordinates	
	N. Latitude	W. Longitude
South Bend Regional (SBN)	41°42′32.2″	86°19′06.5″
Midway (MDW)	41°47′09.5″	87°45′08.7″
O'Hare International (ORD)	41°58′46.5″	87°54′16.1″
West Chicago-Dupage (DPE)	41°54′24.8″	88°14′54.3″
Cincinnati, OH:		
Cincinnati-Blue Ash (ISZ)	39°14′48.1″	84°23′20.3″
Lunken (LUK)	39°06′12.0″	84°25′07.0″
Cleveland, OH:		
Burke Lakefront (BKL)	41°31′03.0″	81°41′00.0″
Cuyahoga County (CGF)	41°33′54.5″	81°29′10.9″
Hopkins International (CLE)	41°24′39.2″	81°50′57.8″
Columbia, SC: Columbia Metropolitan (CAE)	33°56′19.8″	81°07′10.3″
Columbus, GA: Columbus Metropolitan (CSG)	32°30′58.8″	84°56′19.9″
Columbus, OH:		
Port Columbus Int'l (CMH)	39°59′52.8″	82°53′30.8″
Rickenbacker International (LCK)	39°48′49.5″	82°55′40.3″
Corpus Christi, TX: Corpus Christi International (CRP)	27°46′13.3″	97°30′04.4″
Covington/Cincinnati, KY: Cincinnati/Northern Kentucky Int'l (CVG)	39°02′46.1″	84°39′43.8″
Crescent City, CA: Jack McNamara Field (CEC)	41°46′48.6″	124°14′11.5″
Dallas, TX:		
Addison (ADS)	32°58′06.8″	96°50′11.2″
Dallas-Ft. Worth Int'l (DFW)	32°53′45.4″	97°02′13.9″
Dallas-Love Field (DAL)	32°50′49.6″	96°51′06.4″
Red Bird (RBD)	32°40′51.1″	96°52′05.5″
Davenport, IA (Rock Island, Moline, IL):		
Davenport Municipal (DVN)	41°36′37.0″	90°35′18.0″
Quad City (MLI)	41°26′54.7″	90°30′27.1″
Dayton, OH: Dayton International (DAY)	39°54′08.6″	84°13′09.8″
Denver, CO:		
Centennial (APA)	39°34′12.5″	104°50′57.5″
Colorado Springs Municipal (COS)	38°48′20.9″	104°42′00.9″
Jeffco (BJC)	39°54′31.6″	105°07′01.9″
Denver International (DEN)	39°51′30.3″	104°40′01.2″
Des Moines, IA: Des Moines Int'l (DSM)	41°32′05.8″	93°39′38.5″
Detroit, MI:		
Detroit City (DET)	42°24′33.1″	83°00′35.5″
Detroit Metro-Wayne County (DTW)	42°12′43.4″	83°20′55.8″
Oakland-Pontiac (PTK)	42°39′54.7″	83°25′07.4″
Willow Run (YIP)	42°14′16.5″	83°31′49.5″
Duluth, MN: Duluth International (DLH)	46°50′31.5″	92°11′37.1″
Durango, CO: Durango-La Plata County (DRO)	37°09′05.5″	107°45′13.6″
Eagle, CO: Eagle County Regional (EGE)	39°38′33.2″	106°55′03.7″
El Paso, TX: El Paso International (ELP)	31°48′24.0″	106°22′40.1″
Eugene, OR: Mahlon Sweet Field (EUG)	44°07′23.7″	123°13′07.3″
Eureka, CA: Eureka Municipal (033)	40°46′51.4″	124°12′44.2″
Fargo, ND: Hector International (FAR)	46°55′09.7″	96°48′53.9″
Flint, MI: Bishop (FNT)	42°57′55.8″	83°44′36.4″
Ft. Lauderdale-Hollywood, FL:		
Ft. Lauderdale Executive (FXE)	26°11′50.2″	80°10′14.6″
Ft. Lauderdale-Hollywd Int'l (FLL)	26°04′21.3″	80°09′09.9″
Ft. Meyers, FL: Page Field (FMY)	26°35′11.8″	81°51′47.7″
Ft. Meyers, FL: Southwest Florida International (RSW)	26°32′10.2″	81°45′18.6″
Ft. Wayne, IN: Fort Wayne International (FWA)	40°58′42.5″	85°11′42.5″
Ft. Worth, TX:		
Fort Worth Alliance (AFW)	32°59′12.5″	97°19′07.7″
Meacham (FTW)	32°49′11.2″	97°21′44.8″
Fresno, CA:		
Fresno-Chandler Downtown (FCH)	36°43′56.5″	119°49′11.6″
Fresno Yosemite Int'l (FAT)	36°46′34.3″	119°43′05.3″
Gainesville, FL: Gainesville Regional (GNV)	29°41′24.2″	82°16′18.4″
Grand Forks, ND: Grand Forks International (GFK)	47°56′57.3″	97°10′34.0″
Grand Rapids, MI: Gerald R. Ford Int'l (GRR)	42°52′51.0″	85°31′22.1″
Great Falls, MT: Great Falls International (GTF)	47°28′55.2″	111°22′14.5″
Green Bay, WI: Austin Straubel Int'l (GRB)	44°29′06.3″	88°07′46.5″
Greensboro, NC: Piedmont Tirad International (GSO)	36°05′51.9″	79°56′14.3″
Greer, SC: Greenville-Spartanburg Int'l (GSP)	34°53′44.4″	82°13′07.9″
Gunnison, CO: Gunnison County (GUC)	38°32′02.2″	106°55′58.9″
Hana, HI: Hana (HNM)	20°47′44.3″	156°00′52.0″
Harlingen, TX: Valley International (HRL)	26°13′42.6″	97°39′15.8″
Harrisburg, PA:		
Capital City (CXY)	40°13′01.7″	76°51′05.3″
Harrisburg Int'l (MDT)	40°11′36.6″	76°45′48.3″

City and airport	Reference coordinates	
	N. Latitude	W. Longitude
Hartford, CT (Windsor Locks):		
Bradley Int'l (BDL)	41°56′20.0″	72°40′59.6″
Hartford-Brainard (HFD)	41°44′10.6″	72°39′00.8″
Hayden, CO: Yampa Valley (HDN)	40°28′52.2″	107°13′03.6″
Hilo, HI: Hilo Int'l (ITO)	19°43′12.9″	155°02′54.5″
Honolulu, HI: Honolulu International (HNL)	21°19′07.3″	157°55′20.7″
Houston, TX:		
W.P. Hobby (HOU)	29°38′43.5″	95°16′44.0″
D.W. Hooks Memorial (DWH)	30°03′42.7″	95°33′10.0″
George Bush Intercontinental (IAH)	29°58′49.7″	95°20′23.0″
Indianapolis, IN: Indianapolis Int'l (IND)	39°43′02.4″	86°17′39.8″
Jackson Hole, WY: Jackson Hole (JAC)	43°36′26.4″	110°44′15.9″
Jacksonville, FL:		
Craig Municipal (CRG)	30°20′10.8″	81°30′52.0″
Jacksonville Int'l (JAX)	30° 29′38.6″	81°41′16.3″
Kalamazoo, MI: Kalamazoo/Battle Creek International (AZO)	42°14′05.5″	85°33′07.4″
Kalispell, MT: Glacier Park International (FCA)	48°18′41.1″	114°15′18.2″
Kansas City, MO-KS:		
Kansas City Int'l (MCI)	39°17′51.4″	94°42′50.1″
Kansas City Municipal Dntn (MKC)	39°07′23.7″	94°35′33.9″
Kauna Kakai, HI: Molokai (MKK)	21°09′10.4″	157°05′46.5″
Knoxville, TN: McGhee Tyson (TYS)	35°48′44.9″	83°59′34.3″
Lacrosse, WI: Lacrosse Municipal (LSE)	43°52′46.5″	91°15′24.6″
Lansing, MI: Capital City (LAN)	42°46′43.3″	84°35′14.5″
Las Vegas, NV: McCarran Int'l (LAS)	36°04′49.3″	115°09′08.4″
Lihue, HI: Lihue (LIH)	21°58′33.5″	159°20′20.3″
Lincoln, NE: Lincoln Municipal (LNK)	40°51′03.5″	96°45′33.3″
Little Rock, AR: Adams Field (LIT)	34°43′48.8″	92°13′27.3″
Los Angeles,CA:		
Burbank-Glendale-Pasadena (BUR)	34°12′02.2″	118°21′30.6″
Catalina (AVX)	33°24′17.8″	118°24′57.1″
Long Beach-Daugherty Field (LGB)	33°49′03.8″	118°09′05.8″
Los Angeles Int'l (LAX)	33°56′33.1″	118°24′29.1″
Ontario Int'l (ONT)	34°03′21.6″	117°36′04.3″
Santa Ana-John Wayne-Orange City (SNA)	33°40′32.4,″	117°52′05.6″
Louisville, KY: Louisville Int'l-Standiford Field (SDF)	38°10′27.8″	85°44′09.6″
Lubbock, TX: Lubbock International (LBB)	33°39′49.1″	101°49′22.0″
Lynchburg, VA: Lynchburg Regional-Preston Glen Field (LYH)	37°19′36.1″	79°12′01.6″
Madison, WI: Dane County Regional-Truax Field (MSN)	43°08′23.5″	89°20′15.1″
Manchester, NH: Manchester (MHT)	42°56′04.3″	71°26′13.4″
Memphis, TN: Memphis Int'l (MEM)	35°02′32.7″	89°58′36.0″
Miami, FLA:		
Miami Int'l (MIA)	25°47′35.7″	80°17′26.0″
Opa Locka (OPF)	25°54′25.2″	80°16′42.2″
Kendall-Tamiami Executive (TMB)	25°38′52.4″	80°25′58.0″
Milwaukee, WI: General Mitchell Int'l (MKE)	42°56′50.0″	87°53′47.7″
Minneapolis-St. Paul, MN: Minneapolis-St. Paul Int'l (MSP)	44°52′49.9″	93°13′00.9″
Minot, ND: Minot International (MOT)	48°15′33.8″	101°16′49.2″
Missoula, MT: Missoula International (MSO)	46°54′58.7″	114°05′26.0″
Mobile, AL: Mobile Regional (MOB)	30°41′29.1″	88°14′34.2″
Modesto, CA: Modesto City-County (MOD)	37°37′32.9″	120°57′15.9″
Monterey, CA: Monterey Peninsula (MRY)	36°35′13.1″	121°50′34.6″
Montrose, CO: Montrose Regional (MTJ)	38°30′31.9″	107°53′37.8″
Nashville, TN: Nashville Int'l (BNA)	36°07′28.1″	86°40′41.5″
New Haven, CT: Tweed-New Haven Municipal (HVN)	41°15′50.0″	72°53′13.6″
New Orleans, LA:		
Lakefront (NEW)	30°02′32.7″	90°01′41.7″
New Orleans Int'l (MYS)	29°59′36.2″	90°15′28.9″
Newburgh, NY: Stewart International (SWF)	41°30′14.7″	74°06′17.4″
Newport News-Hampton,VA: Newport News/Williamsburg (PHF)	37°07′54.8″	76°29′34.8″
New York-Northeast, NJ:		
Republic (FRG)	40°43′43.6″	73°24′48.3″
JFK International (JFK)	40°38′23.1″	73°46′44.1″
LaGuardia (LGA)	40°46′38.1″	73°52′21.4″
Long Island-McArthur (ISP)	40°47′42.8″	73°06′00.8″
Morristown Municipal (NJ) (MMU)	40°47′57.7″	74°24′53.5″
Newark Int'l (FWR)	40°41′32.9″	74°10′07.2″
Teterboro (NJ) (TEB)	40°51′00.4″	74°03′39.0″
Norfolk, VA: Norfolk Int'l (ORF)	36°53′40.6″	76°12′04.4″
Oklahoma City, OK:		
Wiley Post (PWA)	35°32′04.4″	97°38′49.9″
Will Rogers World (OKC)	35°23′35.1″	97°36′02.6″

City and airport	Reference coordinates	
	N. Latitude	W. Longitude
Omaha, NE: Eppley Airfield (OMA)	41°18′09.1″	95° 53′39.0″
Orlando, FL:		
Orlando Executive (ORL)	28°32′43.7″	81°19′58.6″
Orlando Int'l (MCO)	28°25′44.0″	81°18′57.7″
Palm Springs, CA: Palm Springs International (PSP)	33°49′46.8″	116°30′24.1″
Peoria, IL: Greater Peoria Regional (PIA)	40°39′51.3″	89°41′35.9″
Philadelphia, PA-NJ:		
Northeast Philadelphia (PNE)	40°04′55.0″	75°00′38.1″
Philadelphia Int'l (PHL)	39°52′19.0″	75°14′28.1″
Phoenix, AZ:		
Phoenix-Sky Habor Int'l (PHX)	33°26′03.0″	112°00′29.0″
Scottsdale (SDL)	33°37′22.3″	111°54′37.9″
Pittsburgh, PA:		
Allegheny County (AGC)	40°21′15.9″	79°55′48.9″
Pittsburgh Int'l (PIT)	40°29′29.3″	80°13′58.3″
Portland, ME: Portland International Jetport (PWM)	43°38′46.2″	70°18′31.5″
Portland, OR:		
Portland-Hillsboro (HIO)	45°32′25.4″	122°56′59.4″
Portland International (PDX)	45°35′19.4″	122°35′51.0″
Portland-Troutdale (TTD)	45°32′57.7″	122°24′04.5″
Providence-Pawtucket, RI-MA:		
North Central State (SFZ)	41°55′14.7″	71°29′29.0″
T.F. Green State (PVD)	41°43′26.4″	71°25′41.6″
Pueblo, CO: Pueblo Memorial (PUB)	38°17′20.7″	104°29′47.7″
Raleigh/Durham, NC: Raleigh-Durham International (RDU)	35°52′39.5″	78°47′14.9″
Rapid City, SD: Rapid City Regional (RAP)	44°02′43.2″	103°03′26.5″
Reno, NV: Reno/Tahoe International (RNO)	39°29′54.8″	119°46′05.0″
Richmond, VA: Richmond International (RIC)	37°30′18.6″	77°19′10.8″
Roanoke, VA: Roanoke Regional/Woodrum Field (ROA)	37°19′31.7″	79°58′31.5″
Rochester, MN: Rochester International (RST)	43°54′26.0″	92°29′56.4″
Rochester, NY: Greater Rochester Int'l (ROC)	43°07′07.9″	77°40′20.6″
Sacramento, CA:		
Sacramento Executive (SAC)	38°30′45.1″	121°29′36.5″
Sacramento Int'l (SMF)	38°41′43.5″	121°35′26.8″
Saginaw, MI: MBS International (MBS)	43°31′58.5″	84°04′46.7″
Saipan Isl., CQ: Saipan International (GSN)	15°07′08.4″	145°43′45.7″ E
St. Louis, MO-IL:		
Spirit of St. Louis (SUS)	38°39′42.7″	90°39′04.4″
St. Louis-Lambert Int'l (STC)	38°44′51.7″	90°21′35.9″
St. Petersburg, FL:		
Albert Whitted Municipal (SPG)	27°45′54.4″	82°37′37.1″
St. Petersburg Clearwater Int'l (PIE)	27°54′38.8″	82°41′14.9″
Salt Lake City, UT: Salt Lake City Int'l (SLC)	40°47′18.2″	111°58′39.9″
San Antonio, TX: San Antonio Int'l (SAT)	29°32′01.3″	98°28′11.2″
San Diego, CA: San Diego Lindbergh Int'l (SAN)	32°44′00.8″	117°11′22.8″
San Francisco-Oakland, CA:		
Metropolitan Oakland Int'l (OAK)	37°43′16.7″	122°13′14.6″
San Francisco Int'l (SFO)	37°37′08.4″	122°22′29.4″
San Jose, CA: San Jose Int'l (SJC)	37°21′42.7″	121°55′44.4″
San Juan, PR: Luis Munoz (SJU)	18°26′21.9″	66°00′06.6″
Santa Barbara, CA: Santa Barbara Municipal (SBA)	34°25′34.4″	119°50′25.3″
Santa Fe, NM: Santa Fe Municipal (SAF)	35°37′00.4″	106°05′17.3″
Sarasota, FL: Sarasota/Bradenton International (SRQ)	27°23′43.2″	82°33′14.8″
Savannah, GA: Savannah International (SAV)	32°07′39.3″	81°12′07.7″
Seattle, WA:		
Boeing/King County Int'l (BFI)	47°26′47.9″	122°18′33.5″
Seattle-Tacoma Int'l (SEA)	47°26′56.3″	122°18′33.5″
Shreveport, LA:		
Shreveport Downtown (DTN)	32°32′24.8″	93°44′42.1″
Shreveport Regional (SHV)	32°26′47.9″	93°49′32.2″
Sioux City, IA: Sioux Gateway (SUX)	42°24′09.4″	96°23′03.7″
Sioux Falls, SD: Joe Foss Field (FSD)	43°34′52.9″	96°44′30.1″
South Bend, IN: South Bend Regional (SBN)	41°42′32.2″	86°19′06.5″
Spokane, WA:		
Grant County Int'l (MWH)	47°12′27.5″	119°19′12.7″
Spokane Int'l (GEG)	47°37′11.5″	117°32′01.8″
Springfield, MA:		
Barnes Municipal (BAF)	42°09′27.8″	72°42′56.2″
Westover ARB/Metropolitan (CEF)	42°11′53.8″	72°32′03.3″
Springfield, MO: Springfield-Branson Regional (SGF)	37°14′39.6″	93°23′12.7″
Syracuse, NY: Syracuse-Hancock Int'l (SYR)	43°06′40.3″	76°06′22.7″
Tacoma, WA: Tacoma Narrows (TIW)	47°16′04.6″	122°34′41.2″

City and airport	Reference coordinates	
	N. Latitude	W. Longitude
Tallahassee, FL: Tallahassee Regional (TLH)	30°23′47.5″	84°21′01.2″
Tampa, FL: Tampa Int'l (TPA)	27°58′31.7″	82°31′59.7″
Telluride, CO: Telluride Regional (TEX)	37°57′13.5″	107°54′30.5″
Toledo, OH: Toledo Express (TOL)	41°35′12.5″	83°48′28.2″
Trenton, NJ-PA: Trenton Mercer (TTN)	40°16′36.1″	74°48′48.5″
Tucson, AZ: Tucson Int'l (TUS)	32°06′57.9″	110°56′27.7″
Tulsa, OK:		
R.L. Jones, Jr. (RVS)	36°02′22.7″	95°59′04.7″
Tulsa Int'l (TUL)	36°11′54.1″	95°53′17.7″
Washington, DC:		
Dulles International (IAD)	38°56′40.3″	77°27′20.9″
Ronald Reagan National (DCA)	38°51′07.5″	77°02′15.8″
Waterloo, IA: Waterloo Municipal (ALO)	42°33′25.5″	92°24′01.2″
West Palm Beach, FL: Palm Beach International (PBI)	26°40′59.4″	80°05′44.1″
White Plains, NY: Westchester County (HPN)	41°04′01.1″	73°42′27.3″
Wichita, KS: Mid-Continent (ICT)	37°38′59.9″	97°25′58.9″
Scranton, PA: Wilkes-Barre/Scranton Int'l (AVP)	41°20′17.3″	75°43′27.4″
Wilmington, DE: New Castle County (ILG)	39°40′43.4″	75°36′23.5″
Worcester, MA: Worcester Regional (ORH)	42°16′02.4″	71°52′32.6″
Youngstown-Warren, OH-PA: Youngstown-Warren Regional (YNG)	41°15′38.7″	80°40′44.8″

[1] Coordinates followed by an "E" are east longitude.

(v) Stations operating on the frequencies subject to the provisions of §90.35(b)(69) will be limited to a maximum output power of 2 watts until January 30, 2006, which is thirty days after the December 31, 2005 lifting of the freeze on the filing of high powered applications for 12.5 kHz offset channels in the 460–470 MHz band.

(62) This frequency may be assigned to fixed stations in the Industrial/Business Pool in accordance with the provisions of §90.261.

(63) Within the boundaries of urbanized areas of 200,000 or more population, defined in the United States Census of Population, 1960, vol. 1, table 23, page 1–50, this frequency may be used only by persons rendering a central station commercial protection service within the service area of the radio station utilizing the frequency and may be used only for communications pertaining to safety of life and property, and for maintenance or testing of the protection facilities. Central Station commercial protection service is defined as an electrical protection and supervisory service rendered to the public from and by a central station accepted and certified by one or more of the recognized rating agencies, or the Underwriters Laboratories' (UL), or Factory Mutual System. Other stations in the Industrial/Business Pool may be licensed on this frequency only when all base, mobile relay and control stations are located at least 120 km (75 miles) from the city center or centers of the specified urbanized areas of 200,000 or more population. With respect to combination urbanized areas containing more than one city, 120 km (75 mile) separation shall be maintained from each city center which is included in the urbanized area. The locations of centers of cities are determined from appendix, page 226, of the U.S. Commerce publication ''Air Line Distance Between Cities in the United States.''

(64) Persons who render a central station commercial protection service are authorized to operate fixed stations on this frequency for the transmission of tone or impulse signals on a secondary, noninterference base-to-base/mobile operations subject to the following conditions and limitations:

(i) Secondary fixed operations may be used only for the following purposes:

(A) Indication of equipment malfunction;

(B) Actuation of a device to indicate the presence of an intruder, fire, or other hazardous condition on the property under the protection of the licensee;

(C) Indication of an abnormal condition in facilities under the protection of the licensee that, if not promptly reported, would result in danger to human life;

(D) Transmission, as may be necessary, to verify status of equipment; adjust operating conditions; or correct any abnormal condition; or

(E) Confirmation of status, or that an operation or correction has been accomplished.

(ii) The maximum duration of any one non-voice signal may not exceed 2 seconds and shall not be transmitted more than three times.

(iii) Systems employing automatic interrogation shall be limited to non-voice techniques and shall not be activated for this purpose more than 10 seconds out of any 60-second period. This 10-second frame includes both transmit and response times.

(iv) The bandwidth shall not exceed that authorized to the licensee for the primary operation on the frequency concerned.

(v) Frequency loading resulting from the use of secondary signaling will not be considered in whole or in part as a justification for authorizing additional frequencies in the licensee's mobile system.

(vi) A mobile service frequency may not be used exclusively for secondary signaling.

(vii) The output power shall not exceed 30 watts (at the remote site).

(viii) A1D, A2D, F1D, or F2D emission may be authorized.

(ix) The transmitter shall be designed to deactivate automatically after 3 minutes of continuous carrier radiation.

(x) Operational fixed stations authorized under this paragraph are exempt from the requirements of §§ 90.137(b), 90.429(d), 90.425 and 90.433.

(xi) On these frequencies, base, mobile relay or mobile stations may transmit secondary tone or impulse signals to receivers, as provided in this section.

(65) Licensees providing a central station commercial protection service may communicate with police or fire stations, or vehicles, on this frequency, and may install licensed transmitting units which operate on this frequency at police or fire stations, or in police or fire vehicles, if the frequency's primary use is in a base/mobile system for a central station commercial protection service.

(66) This frequency may be assigned only to persons rendering a central station commercial protection service, which is defined in paragraph (c)(63) of this section, within the service area of the radio station utilizing the frequency.

(67) Medical telemetry operations are authorized on this frequency on a secondary basis. Medical telemetry operations are subject to the provisions of § 90.267(h)(2). Itinerant operations on this frequency will be prohibited until the end of the freeze on the filing of high power applications for 12.5 kHz offset channels in the 460–470 MHz band.

(68) Each station authorized on this frequency will be classified and licensed as a mobile station. Any units of such a station, however, may provide the operational functions of a base station on a secondary basis to mobile service operations provided that the vertical separation between control point or ground level and the center of the radiating portion of the antenna of any units so used does not exceed 8 meters (approximately 25 feet). This frequency is available for assignment as follows:

(i) To persons furnishing commercial air transportation service or, pursuant to § 90.179, to an entity furnishing radio communications service to persons so engaged, for stations located on or near the airports listed in paragraph (c)(61)(iv) of this section. Stations will be authorized on a primary basis and may be used only in connection with servicing and supplying of aircraft. Operation on this frequency is limited to a maximum effective radiated power (ERP) of 40 watts at locations within 16 km (approximately 10 miles) of the coordinates of the listed airports.

(ii) To stations in the Industrial/Business Pool for secondary use at locations 80 km (approximately 50 miles) or more from the coordinates of the listed airports. Operation will be limited to a maximum ERP of 120 watts. Wide area operation will not be permitted. The area of normal, day-to-day operations will be described in the application.

(iii) To stations in the Industrial/Business Pool for secondary use at locations greater than 16 km (approximately 10 miles) but less than 80 km (approximately 50 miles) from the coordinates of the listed airports. Operation will be limited to a maximum ERP of 6 watts. Use of this frequency is restricted to the confines of an industrial complex or manufacturing yard area. Stations licensed prior to April 25, 2005, may continue to operate with facilities authorized as of that date.

(iv) Stations operating on the frequencies subject to the provisions of § 90.35(b)(69) will be limited to a maximum output power of 2 watts until January 30, 2006, which is thirty days after the December 31, 2005 lifting of the freeze on the filing of high powered applications for 12.5 kHz offset channels in the 460–470 MHz band.

(69) This frequency may be used on a secondary, non-interference basis by a hospital or health care institution holding a license to operate a radio station under this part to operate a medical radio telemetry device with an output power not to exceed 20 milliwatts without specific authorization from the Commission.

(70) Subpart L of this part contains rules for assignment of frequencies in the 470–512 MHz band.

(71) Subpart S of this part contains rules for assignment of frequencies in the 806–821/851–866 and 896–901/935–940 MHz bands.

(72) Assignment of frequencies above 928 MHz for operational-fixed stations is governed by part 101 of this chapter.

(73) Frequencies in this band are available only for one-way paging operations in accordance with § 90.494.

(74) Available only on a shared basis with stations in other services, and subject to no protection from interference due to the operation of industrial, scientific, or medical (ISM) devices. In the band 2483.5–2500 MHz, no applications for new stations or modification to existing stations to increase the number of transmitters will be accepted. Existing licensees as of July 25, 1985, and licensees whose initial applications were filed on or before July 25, 1985, are grandfathered and their operations are on a co-primary basis with the mobile-satellite and radiodetermination-satellite services, and in the segment 2495–2500 MHz, their operations are also on a co-primary basis with part 27 fixed and mobile except aeronautical mobile service operations.

(75) Use of frequencies in this band is limited to developmental operation and is subject to the provisions of subpart Q of this part.

(76) The frequencies in the band 10.55–10.68 GHz are available for Digital Termination Systems and for associated intermodal links in the Point-to-Point Microwave Service. No new licenses will be issued under this subpart but current licenses will be renewed.

(77) All communications on this frequency must be conducted within the boundaries or confines of the licensee's business premises.

(78) Base and mobile stations authorized as of April 1, 1968, may continue to be authorized for such operation on a secondary basis to the Maritime Mobile Service. The licensees of such stations may renew, modify, reinstate, or assign their licenses in those cases where such assignment accompanies a change of ownership of the licensee's business to the assignee, and may expand existing systems when using that frequency; however, they will not be authorized to establish any new systems.

(79) Frequencies may be assigned in pairs with the separation between base and mobile transmit frequencies being 5.26 MHz. A mobile station may be assigned the frequency which would normally be assigned to a base station for single frequency operation. However, this single-frequency operation may be subject to interference that would not occur to a two-frequency system. Base or mobile stations located 80.5 km (50 miles) or less from the center or any urbanized area of 600,000 or more population (U.S. Census of Population, 1970) must be operated in the half-duplex mode.

(80) Concurrence from the Petroleum Coordinator is required only for applications for this frequency that request authorization for transmitters in Arkansas, Louisiana, Oklahoma, or Texas.

(81) Concurrence from the Petroleum Coordinator is required only for applications for this frequency that request

authorization for transmitters in Arkansas, Louisiana, Oklahoma, Oregon, Texas, or Washington.

(82) After December 7, 2000 new stations will only be licensed with an authorized bandwidth not to exceed 11.25 kHz. Licensees authorized prior to December 7, 2000 may continue to use bandwidths wider than 11.25 kHz on a co-primary basis until January 1, 2005. After January 1, 2005, all stations operating with an authorized bandwidth greater than 11.25 kHz will be secondary to adjacent channel public safety interoperability operations. (*See* § 90.20(c)(3)).

(83) Telemetry operations on this frequency will be authorized pursuant to § 90.267.

(84) Operation on this frequency is subject to the low power provisions of § 90.267. This frequency is assigned to Group A in the low power pool.

(85) Operation on this frequency is subject to the low power provisions of § 90.267. This frequency is assigned to Group B in the low power pool.

(86) Operation on this frequency is subject to the low power provisions of § 90.267. This frequency is assigned to Group C in the low power pool.

(87) Operation on this frequency is subject to the low power provisions of § 90.267. This frequency is assigned to Group D in the low power pool.

(88) Use of this frequency is on a secondary basis limited to 2 watts output power and subject to the provisions of § 90.267(h)(1), (h)(2), (h)(3) and (h)(4).

(89) The frequency may be assigned only to entities meeting the definition of a forest product licensee (*see* § 90.7). Operations are on a secondary basis to Federal Government operations including experimental stations, will not exceed 150 watts output power, and are limited to the states of Washington, Oregon, Maine, North Carolina, South Carolina, Tennessee, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (eastern portion).

(90) As of March 25, 2007, the FCC will cease to issue licenses for new stations in the fixed and mobile services in the following bands: 5900–5950 kHz, 7300–7350 kHz, 9400–9500 kHz, 11600–11650 kHz, 12050–12100 kHz, 13800–13870 kHz, and 15600–15800 kHz. As of March 29, 2009, the FCC will cease to issue licenses for new stations in the fixed and mobile services in the band 7350–7400 kHz and, in the U.S. Pacific insular areas in Region 3, the band 7400–7450 kHz. Stations licensed as of March 25, 2007 in the bands 5900–5950 kHz, 7300–7350 kHz, 9400–9500 kHz, 11600–11650 kHz, 12050–12100 kHz, 13800–13870 kHz, and 15600–15800 kHz and as of March 29, 2009 for the band 7350–7400 kHz in Region 2 and the band 7350–7450 kHz in Region 3 shall:

(1) Be limited to communications only within the United States and its insular areas;

(2) Not cause harmful interference to the broadcasting service;

(3) Be limited to the minimum power needed to achieve communications; and

(4) Take account of the seasonal use of frequencies by the broadcasting service published in accordance with Article 12 of the ITU Radio Regulations.

(d) *Additional frequencies available.* In addition to the frequencies shown in the frequency table of this section, the following frequencies are available in this service. (See also § 90.253.)

(1) Frequencies may be substituted for those available below 25 MHz in accordance with the provisions of § 90.263.

(2) Frequencies in the band 73.0–74.6 MHz may be assigned to stations authorized on or before December 1, 1961, but no new stations will be authorized in this band, nor will expansion of existing systems be permitted. (See also § 90.257).

(3) Frequencies in the 421–430 MHz band are available in the Detroit, Cleveland, and Buffalo areas in accordance with the rules in §§ 90.273 through 90.281.

(4) The following frequencies are available only in Puerto Rico and the Virgin Islands. These ''Base and Mobile'' and ''Mobile only'' frequencies are available on a shared basis with the Public Safety Pool. These ''Mobile only'' frequencies may be assigned to a control station associated with a mobile relay system if it is also assigned to the associated mobile station.

Base and mobile	Mobile only
159.240	160.410
159.2475	160.4175
159.255	160.425

Base and mobile	Mobile only
159.2625	160.4325
159.270	160.440
159.2775	160.4475
159.285	160.455
159.2925	160.4625
159.300	160.470
159.3075	160.4775
159.315	160.485
159.3225	160.4925
159.330	160.500
159.3375	160.5075
159.345	160.515
159.3525	160.5225
159.360	160.530
159.3675	160.5375
159.375	160.545
159.3825	160.5525
159.390	160.560
159.3975	160.5675
159.405	160.575
159.4125	160.5825
159.420	160.590
159.4275	160.5975
159.435	160.605
159.4425	160.6125

(5) Low power mobile stations of 100 mw or less output power used for one-way, non-voice medical telemetry operations in hospitals or in medical convalescent centers are subject to the provisions of §90.238.

(6) The frequency band 33.00–33.01 MHz may be used for developmental operations subject to the provisions of subpart Q of this part. Any type of emission other than pulsed emission may be used if the bandwidth occupied by the emission is contained within the assigned frequency band.

(7) A railroad licensee, i.e., a licensee eligible for frequencies listed in §90.35(b)(3) of this section that are coordinated by the railroad coordinator (LR), may operate radio units at fixed locations and in moving railroad locomotives/cars that transmit on the frequency 24.10 GHz, both unmodulated continuous wave radio signals and modulated FM digital signals for the purpose of alerting motorists to the presence of an approaching train. Unattended and continuous operation of such transmitters will be permitted without additional authorization from the Commission, provided type accepted equipment or equipment authorized pursuant to §§90.203(b)(4) and (b)(5) of this part is used, and all other rule provisions are satisfied.

(e) *Limitation on number of frequencies assignable.* Normally only one frequency, or pair of frequencies in the paired frequency mode of operation, will be assigned for mobile service operations by a single applicant in a given area. The assignment of an additional frequency or pair of frequencies will be made only upon a satisfactory showing of need, except that:

(1) Additional frequencies above 25 MHz may be assigned in connection with operation of mobile repeaters in accordance with §90.247 notwithstanding this limitation.

(2) Frequencies in the ranges 30.56–30.57 MHz, 35.00–35.01 MHz, 35.99–36.00 MHz, and 37.00–37.01 MHz are available for developmental operation by applicants in this service subject to the provisions of subpart Q of this part, notwithstanding this limitation.

(3) Frequencies in the 25–50 MHz, 150–170 MHz, 450–512 MHz and 902–928 MHz bands may be assigned for the operation of Location and Monitoring Service (LMS) systems in accordance with the provisions of subpart M of this part, notwithstanding this limitation.

(4) Authorizations for multiple frequencies for geophysical operations will be granted on the frequencies governed by the limitations in paragraphs (c)(3) and (c)(4) of this section. However, each geophysical exploration party may use a maximum of four frequencies at any one time.

(5) Authorization for more than one mobile frequency in the band 72–76 MHz will be issued notwithstanding this limitation.

(6) This limitation shall not apply to paragraph (c)(1) of this section.

(7) Frequencies in the 457 and 467 MHz bands may be assigned collectively as provided by paragraph (c)(60) of this section notwithstanding this limitation.

(f) *Limitation on itinerant operation.* Base or mobile stations being utilized in itinerant operation will be authorized only on base or mobile frequencies designated for itinerant operation under paragraphs (c)(10) or (c)(17) of this section, or on other frequencies not designated for permanent use.

(g) The frequencies 10–490 kHz are used to operate electric utility Power Line Carrier (PLC) systems on power transmission lines for communications essential to the reliability and security

of electric service to the public, in accordance with part 15 of this chapter. Any electric utility that generates, transmits, or distributes electrical energy for use by the general public or by the members of a cooperative organization may operate PLC systems and shall supply to a Federal Communications Commission/National Telecommunications and Information Administration recognized industry-operated entity, information on all existing, changes to existing, and proposed systems for inclusion in a data base. Such information shall include the frequency, power, location of transmitter(s), location of receivers and other technical and operational parameters, which would characterize the system's potential both to interfere with authorized radio users, and to receive harmful interference from these users. In an agreed upon format, the industry-operated entity shall inform the FCC and the NTIA of these system characteristics prior to implementation of any proposed PLC system and shall provide monthly or periodic lists with supplements of PLC systems. The FCC and NTIA will supply appropriate application and licensing information to the notification activity regarding authorized radio stations operating in the band. PLC systems in this band operate on a non-interference basis to radio systems assigned frequencies by the NTIA or licensed by the FCC and are not protected from interference due to these radio operations.

[62 FR 18874, Apr. 17, 1997]

EFFECTIVE DATE NOTE: At 64 FR 36262, July 6, 1999, §90.35 was amended by revising entries in the table in paragraph (b)(3) and by adding paragraphs (c)(80) and (c)(81), effective Aug. 5, 1999. At 64 FR 50467, Sept. 17, 1999, paragraphs (c)(80), (c)(81), and the following entries in the table in paragraph (b)(3) were stayed:

153.035 MHz through 153.4025 MHz, 153.4025 MHz through 153.4625 MHz, 153.485 MHz through 153.5225 MHz, 153.545 MHz through 153.5825 MHz, 153.605 MHz through 153.6425 MHz, 153.665 MHz through 153.6675 MHz, 158.145 MHz through 158.1825 MHz, 158.205 MHz through 158.2425 MHz, 158.265 MHz through 158.3325 MHz, 158.355 MHz through 158.3775 MHz, 158.415 MHz through 158.4375 MHz, 173.250 MHz, 173.300 MHz, 173.350 MHz, 451.175 MHz, 451.225 MHz, 451.275 MHz, 451.375 MHz, 451.425 MHz, 451.475 MHz, 451.525 MHz, 451.550 MHz, 451.575 MHz, 451.600 MHz, 451.625 MHz, 451.650 MHz, 451.675 MHz, 451.700 MHz, 451.750 MHz, 452.325 MHz, 452.375 MHz, 452.425 MHz, 452.475 MHz, 452.775 MHz, 452.825 MHz, 452.875 MHz, 456.175 MHz, 456.225 MHz, 456.275 MHz, 456.375 MHz, 456.425 MHz, 456.475 MHz, 456.525 MHz, 456.550 MHz, 456.575 MHz, 456.600 MHz, 456.625 MHz, 456.650 MHz, 456.675 MHz, 456.700 MHz, 456.750 MHz, 457.325 MHz, 457.375 MHz, 457.425 MHz, 457.475 MHz, 457.775 MHz, 457.825 MHz, 457.875 MHz, 462.475 MHz, 462.525 MHz, 467.475 MHz, and 467.525 MHz

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting §90.35, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

Subparts D–E [Reserved]

Subpart F—Radiolocation Service

§ 90.101 Scope.

The Radiolocation Service accommodates the use of radio methods for determination of direction, distance, speed, or position for purposes other than navigation. Rules as to eligibility for licensing, permissible communications, frequency available, and any special requirements are set forth in §90.103. Provisions for the Location and Monitoring Service (LMS) are contained in subpart M of this part.

[60 FR 15252, Mar. 23, 1995]

§ 90.103 Radiolocation Service.

(a) *Eligibility.* The following persons are eligible for authorizations in the Radiolocation Service to operate stations to determine distance, direction, speed, or position by means of radiolocation devices, for purposes other than navigation:

(1) Any person engaged in a commercial, industrial, scientific, educational, or local government activity

(2) A corporation or association that will furnish radiolocation service to other persons.

(3) A corporation that will furnish a nonprofit radio communication service to its parent corporation, to another subsidiary of the same parent, or to its own subsidiary where the party to be served is regularly engaged in any of the eligibility activities set forth in this paragraph.

(b) *Frequencies available.* The following table indicates frequencies

CHAPTER 10

COMMUNICATIONS

Section I. GENERAL

10-1. General

The communication systems and techniques employed by Special Forces in unconventional warfare vary from conventional signal operations in support of activities located within friendly territory to clandestine systems and techniques between the SFOB and the deployed detachments in the UWOA.

10-2. Extent and Type of Communications

a. Communications Within Friendly Territory. Communications between the SFOB and other headquarters or activities in friendly territory generally are the same as those required by any headquarters of comparable size. Normally, facilities of the theater army area signal system are used to the maximum extent possible; however, when backup or special circuits are necessary, they are provided by radio or radio-teletype operated by the Special Forces group. Communications in this area present no unique operational or technical signal problems.

b. Communications to and from the UWOA. When a detachment is committed, the primary, and often the only, means, of communications with the SFOB is by radio. Clandestine communication techniques are employed. Other methods may be used, when practical, such as infiltration of couriers, exchange of messages during resupply, or through use of existing communication facilities.

c. Communications Within the UWOA. As a general rule, communications within the UWOA progress from clandestine to conventional systems as the guerrilla movement gains strength. The extent and type of system depends on factors such as size of the area, the size of the guerrilla force, activities of the enemy and the guerrillas, the technical proficiency of both the enemy and the guerrilla communication organization, and the required speed of response to the orders of the area command. Any and all means which satisfy the requirement for communications and provide the required security are used. Certain clandestine communication systems may be used, but these should be tightly controlled by the commander (see FM 31-20A). All the following are considered:

(1) Messenger.

(2) Radio.

(3) Telephone.

(4) Audible signals.

(5) Visual signals.

(6) Local communication systems.

(7) Pigeons or trained animals.

d. See FM 31-21.

10-3. Communication Media

a. Messenger. In the early developmental stages of a UWOA, messengers may be the only secure means of communication. In the UWCA, messenger (courier) service is organized using clandestine, nontechnical communication techniques described in FM 31-20A. During the organization and development of the UWOA, security remains a paramount consideration; therefore, communication means will be dictated by the status of training and capability of the resistance force.

b. Radio. Radio can provide instantaneous, generally reliable communications; however, any radio transmission is vulnerable to interception and jamming by an enemy. The advantage of its speed must be balanced against the probable loss of security. Low-powered, frequency-modulated radios operating in the VHF or UHF band can be used under some conditions, with little risk. Generally, when considering the use of radio, the deciding factors are the nature of the message text and the probable enemy reaction time if the message is intercepted. For example, enemy reaction to last-minute control instructions during a raid or ambush

Figure 10–1. Expedient Ground return circuit.

would not be rapid enough to affect the operation. On the other hand, the interception of plans or instructions involving future actions could result in disastrous compromise. Within a UWOA the availability of radio equipment may be the governing factor. Maintenance, spare parts, and resupply of batteries are important considerations. The use of even the simplest radio requires training of operators and maintenance personnel.

c. Telephone. In the early stages of development of a UWOA, telephones may be used extensively, possibly between a security outpost and a base camp, or during an ambush to warn of the approach of a convoy or train. When using a telephone under these conditions, it is often advantageous to use a ground-return circuit, allowing the telephones to be operated with a single metallic conductor connecting them. A section of barbed wire fence, unused power line, unused telephone line, or one side of a railroad track already inplace can be used as the conductor. The conductor must be insulated from the ground and the other terminal of the telephone must be connected to a good ground connection (fig 10-1).

d. Audible Signals. Audible signals are useful for short distances. Church bells, vehicle horns, musical instruments, sirens, dogs barking, or voices may be used as audible signals. Quite often, audible signals can be planned in such a way that the sound is routine and recognizable as a signal only to someone trained in the system.

e. Visual Signals. Visual signals are limited only by the imagination of the person planning the signals and by the equipment available. Visual signals include

(1) Flashlight signals at night or by using sunlight reflected from a mirror. The use of any flashing light requires some prearranged code.

(2) A housewife hanging laundry on a clothesline in a predesignated pattern to serve as a

warning; light, smoke, a fire, or a person walking over a given road at a specified time. Normal actions are the guide for developing visual signals.

(3) Flags used to transmit messages either by means of semaphore or wigwag. In semaphore two flags are used. The position of the flags designate a certain letter. Wigwags can be used to send a message by Morse code. The flag on one side of the body indicates a dash, on the other side a dot (see FM 21-60).

f. Local Communication Systems. Many areas of the world have extensive, local communication systems. Without any special equipment, part or all of these systems may be used. When considering the use of the local communication systems, security must be paramount. The local language or dialect must be used in apparently innocent conversation.

g. Pigeons or Trained Animals.

(1) Homing pigeons, obtained locally or from the SFOB, may be used for the rapid, secure transmission of messages within the operational area. Since they require a few days to acquaint themselves with the home loft area, homing pigeons should be used when the guerrilla base is relatively static. Extremely cold weather limits the use of pigeons.

(2) Locally-procured, trained animals (usually dogs) may also be used as a means of communication; however, dogs are usually more susceptible to interception or diversion than homing pigeons.

Section II. COMMUNICATION TRAINING

10-4. Communication Training

a. General. Radio personnel assigned to Special Forces operational detachments are confronted with problems different from those faced by radio operators assigned to a conventional military unit. When committed to a UWOA, operators must be able to communicate over long distances, up to 2,500 miles, using low-powered equipment. They must do this in a manner that will result in minimum loss of security. Technical assistance and maintenance support are not readily available. Messages are encrypted using paper and pencil cryptographic systems. On progressing from clandestine to overt operations within the UWOA, machine crypto systems may be employed. The radio operators must also be prepared to assist and advise the detachment commander on any communication problem with the area to include the communication training of the resistance force.

b. Code Speed and Procedures. A Special Forces radio operator must be able to transmit and receive Morse code at the rate of 18 words per minute. He must be thoroughly familiar with radio-telegraph procedure as described in ACP-124B. Once these standards have been achieved, they must be maintained by constant practice. Before infiltration, the SOP is established for the actual radio-telegraph procedure to be used in the operational area. Sufficient time must be allocated for radio operators to become familiar with this specific procedure. Other members of the detachment must be familiar with these procedures as well.

c. Maintenance and Use of Equipment. Normal maintenance support is not available within a UWOA. In the detachment deployed in a UWOA, any repair of signal equipment is done by the operator, assigned signal maintenance man, or when feasible, by friendly members of the local populace or resistance elements. Radio operator training includes sufficient theory and practice so that the operator can perform direct support maintenance on the primary detachment radio set. He is sufficiently schooled in theory so that he can make sound recommendations on the use of enemy equipment captured within the operational area.

d. Radio Propagation. The radio frequencies to be used between the UWOA and SFOB are contained in the detachment's Signal Operation Instructions (SOI). These radio frequencies are determined before infiltration on the basis of published radio frequency prediction charts and tables. Detailed information on selecting frequencies for long-range communications can be found in TM 11-666 and radio propagation charts which are procured from the U.S. Army Strategic Communications Command, Communications Engineering Department, Fort Huachuca, Arizona 85613. These charts are published monthly and must be requested for the particular area of operations.

10-5. Message Writing

a. The writer of a message must express his thoughts clearly and concisely. Additional transmission time caused by unnecessary message length gives the

enemy a better opportunity for interception and radio direction-finding, and furnishes more traffic for analysis.

b. The following basic rules are applied to all messages:

(1) *Preparation*. All outgoing messages to the SFOB are prepared or reviewed by the detachment commander or his executive officer before transmission.

(2) *Content.* Write the message and then read it back. First consider any portion that can be eliminated. Many times the bulk of a message is used to say something that is obvious by the very fact that the message is being sent. Consider each portion. Does each portion tell the addressee something or could that whole sentence or thought be eliminated? Once this has been done, consider whether the thought of the message is expressed as clearly and concisely as possible.

(3) *Writing.* Print carefully to avoid any confusion about the meaning of the message. An encrypted message may be made completely useless by one misunderstood letter.

(4) *Abbreviations*. Use authorized abbreviations and only when they will not be misunderstood (see AR 310-25).

(5) *Punctuation*. Do not punctuate unless necessary for clarity. Do not use the expression STOP in a message. If punctuation is necessary, use authorized abbreviations such as QUES, CLN, PAREN, PD, CMM, PARA, and QUOTE-UNQUOTE.

(6) *Repetition.* Repeat only to avoid errors, not for emphasis. For example,' repeat unusual names to ensure correct spelling.

(7) *Numbers.* Numbers may be written as digits or spelled out. When spelled out, they are expressed in words for each digit except in exact hundreds or thousands, when the word hundred or thousand is used. Some cryptographic systems require the numbers to be encoded without spelling. As a general rule, numbers should be spelled out before encrypting. If the message is completely understood the first time it is transmitted, the result will be less time on the air. Example: 1234 is written as ONE TWO THREE POINT FOUR; 500 is written FIVE HUNDRED and 20,000 as TWO ZERO THOUSAND.

(8) *Isolated letters.* If necessary to use isolated letters, use the phonetic alphabet for each isolated letter.

c. Codes Are Normally Used for Brevity. Extensive brevity codes can be developed by proper planning which can greatly enhance message brevity and clarity. Codes that may be employed by Special Forces detachments in their operations are (see sample, app F)

(1) The Catalog Supply System (CSS) which provides an operational detachment with a brevity code in which single or several associated logistical items may be requested on resupply operations (see sample Catalog Supply System, app F):

(2) The Q and Z signals used by radio operators (ACP 131).

(3) Operation codes (SOI).

Section III. ANTENNAS AND COMMUNICATION SECURITY

10-6. Antennas

Special Forces radio operators use field expedients to ensure reliable communications. Because of rigid limitations on size and weight of equipment, the radio used by Special Forces is not issued with a prefabricated antenna. Only antenna wire is issued. Although there is little the radio operator can do to increase the designed power output of his transmitter, he can maximize the propagation of his signal by use of an efficient antenna system. Antenna theory and construction are presented in FM 24-18 and TM 11-666. The Special Forces radio operator must understand the material covered in the manuals in order to provide longrange communications. Various types of antennas which can be used with Special Forces-issued radio equipment are shown in figures 10-3 through 10-10.

a. Field Expedient Insulators. When constructing an antenna, it is important to insulate the antenna from its supports or from the ground. It is often necessary for the radio operator to make use of whatever materials are available. Almost any kind of wire can be used when constructing an antenna. Although glass and porcelain may be the best materials for insulators, it is better to use a second best (such as wood) rather than none at all. The antenna diagrams shown in this manual cannot be understood without a basic knowledge of antenna theory. These diagrams picture antenna configurations which can be used with issued radio equipment in limited space (see fig 10-2).

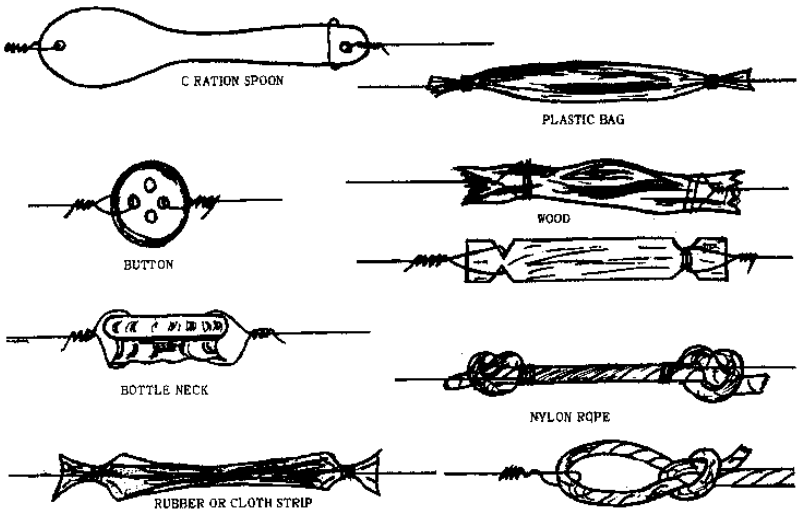

Figure 10–2. Expedient insulators.

b. Quarter-Wave Antenna. The quarter-wavelength antenna is normally erected vertically. Its length (in feet) is computed by dividing 234 by the operating frequency in megahertz. It is omnidirectional, making it an ideal antenna for a net control station (NCS) when operating with different teams and the exact team locations are not known. It can be used with any type of radio and is normally used when a groundwave is desired. In the case of standard FM radios it makes use of space waves (line-of-sight). When a quarter-wave antenna is used, a good ground system is essential (fig 10-3).

c. Half-Wave Doublet Antenna. A typical halfwave antenna is the doublet, or dipole antenna. It is constructed by using one-quarter wavelength wire for each side and fed in the center by coaxial cable or, as a field expedient, a twisted pair of field wire. It can be used with any type of radio and can be constructed in a horizontal or vertical plane. When in a horizontal position (fig 10-4), it radiates broadside

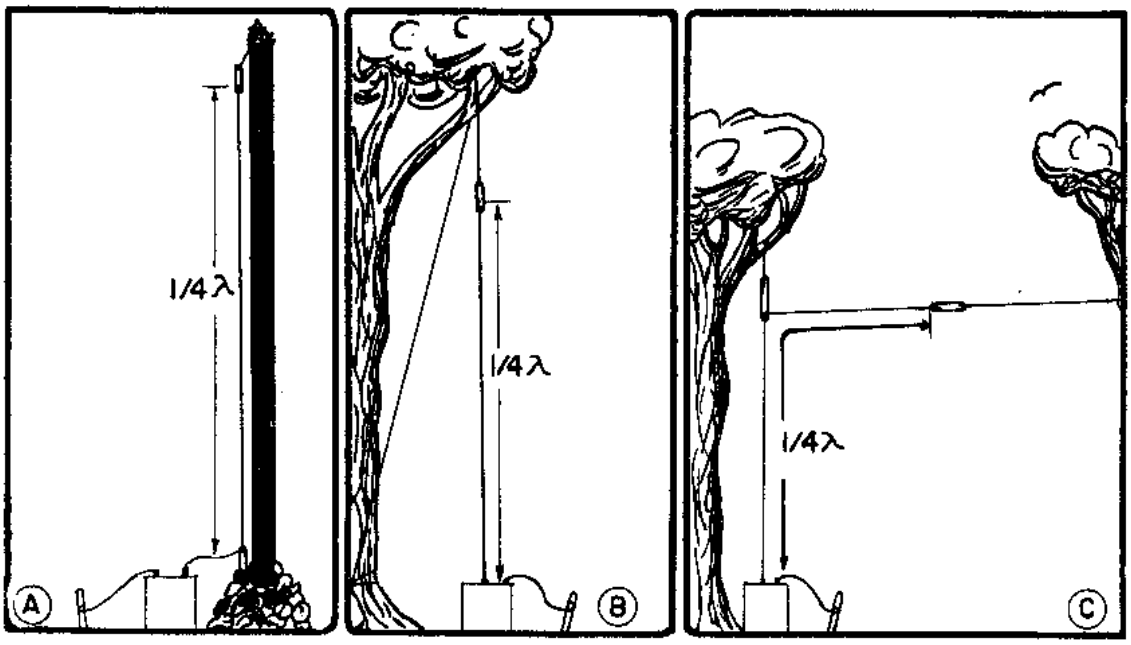

Figure 10–3. One-quarter-wavelength antenna (vertical).

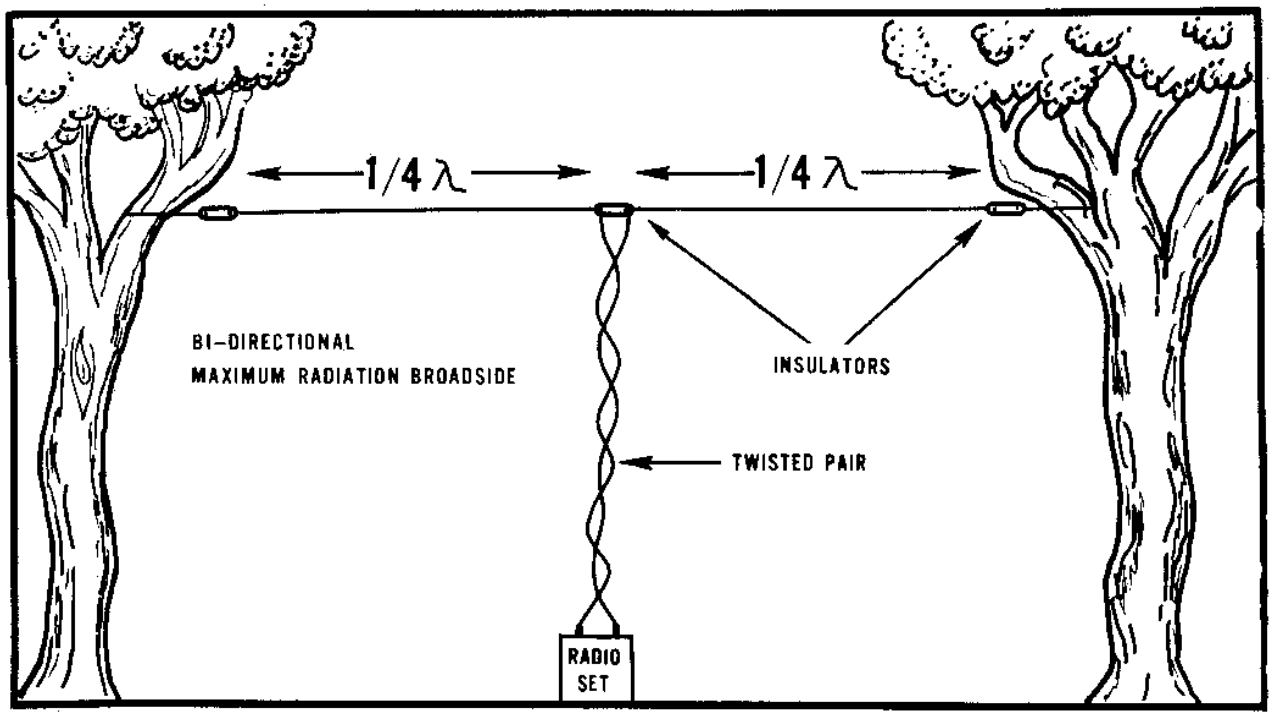

Figure 10–4. Half-wave doublet antenna.

at a 90° angle from the antenna. When it is constructed in a vertical plane, it has a radiation pattern of 360 degrees. This antenna is superior to the quarter-wave-length antenna. When connecting this antenna to the radio set, one lead goes to the antenna binding post; the other goes to the ground

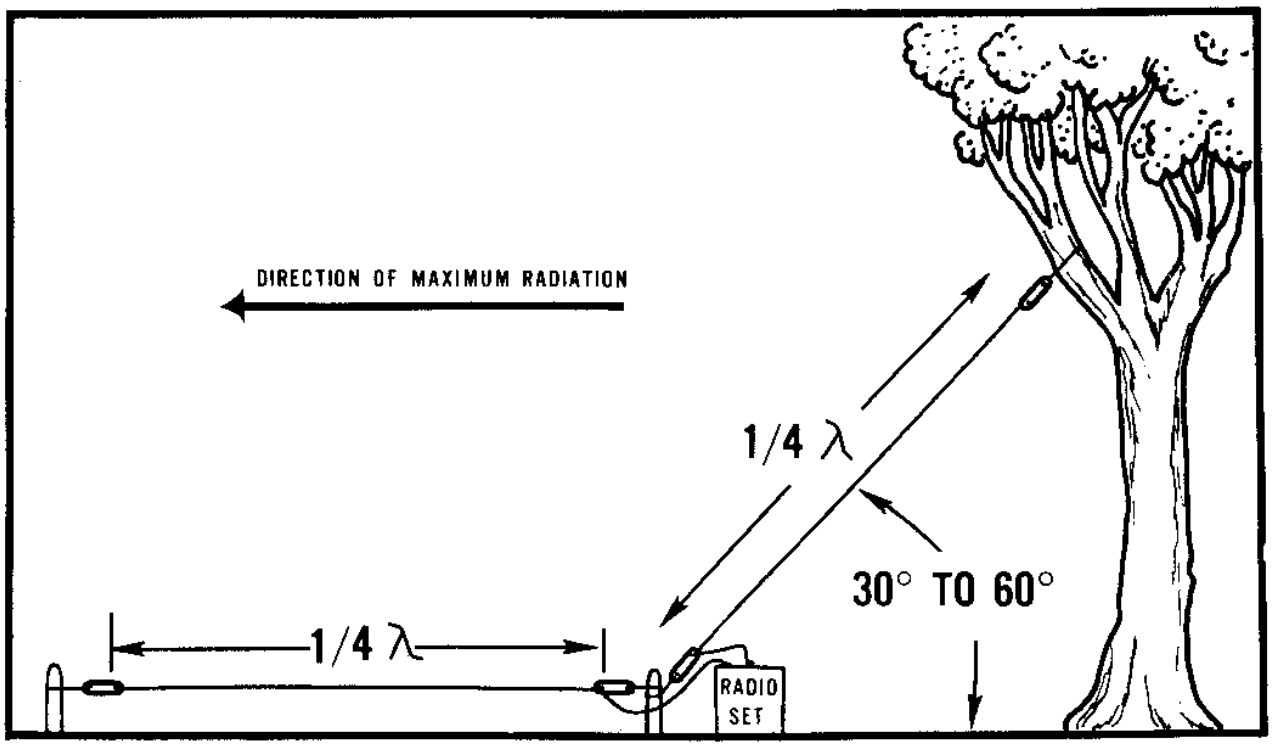

Figure 10–5. Slant-wire antenna.

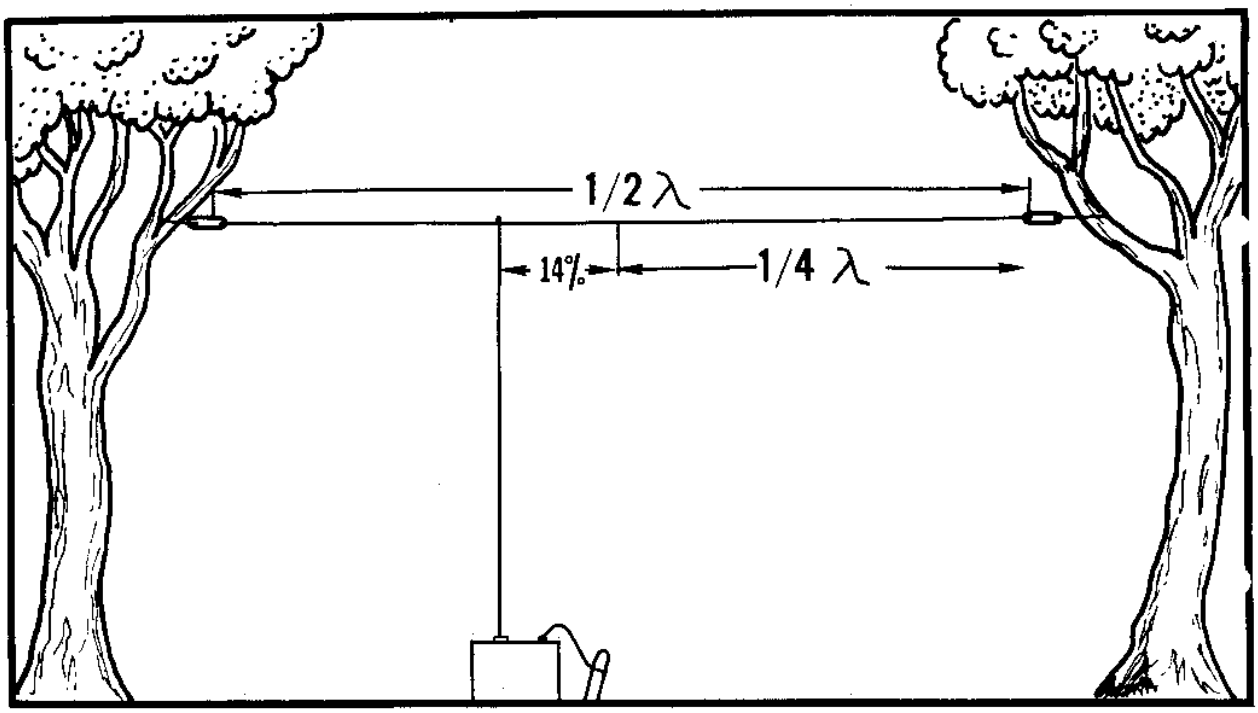

Figure 10–6. Fourteen percent off-center fed antenna.

binding post. No additional ground is necessary.

d. Slant-Wire Antenna. The slant-wire antenna is an efficient radiating system using only a single antenna support. Two pieces of wire, each one a quarter-wavelength long, are used to make up the antenna. One piece is slanted down from the antenna support at an angle of 30 ° to 60 ° and is connected to the antenna post on the transmitter. The other wire is used as a counterpoise just above the ground and laid out from the transmitter away from the slanting wire. If the wire used as a counterpoise is not insulated, it must be insulated from the ground; the counterpoise is connected to the radio ground post. Maximum radiation occurs in the direction of the counterpoise (see fig 10-5).

e. Fourteen Percent Off-Center Fed Antenna. In the event no suitable transmission line is available such as coaxial cable, or twisted pair, a suitable antenna can be constructed using an antenna one half-wavelength long and feeding it with a single wire at a point 14 percent of a one-half wavelength, or the total length of the antenna. This antenna is suitable for use with radios such as the AN/GRC-109 and AN/GRC-87. Maximum radiation occurs at 90° from the antenna (see fig 10-6).

f. Indoor Antennas. There are times when a Special Forces radio operator must operate from inside a building. When this is necessary, a suitable antenna can still be constructed. Any of the antennas mentioned in this chapter can be used if there is space available inside the building.

(1) If space is limited, a loop antenna may be constructed (fig 10-7). This antenna is a full wavelength long and is fed directly in the center. It is limited to frequencies whose wavelengths will not exceed the dimensions, of the room.

(2) For operation tin lower frequencies, a half-wave, square-loop antenna (fig 10-8) may be used inside a building. Excellent results may be obtained if care is taken in constructing and tuning the antenna. This is important when operating the AN/GRC-109 since the indicator lamp of the antenna will not glow brightly with either the full-wave loop or the half-wave open loop. Although these antennas may be used indoors, it must be remembered that best results are obtained when operating with an outdoor system.

g. Other Antennas. It may be necessary to have patrols operating outside the normal range of FM radio sets. When this is necessary, an antenna system can be constructed which will allow communications beyond the normal range of current radios. This can be

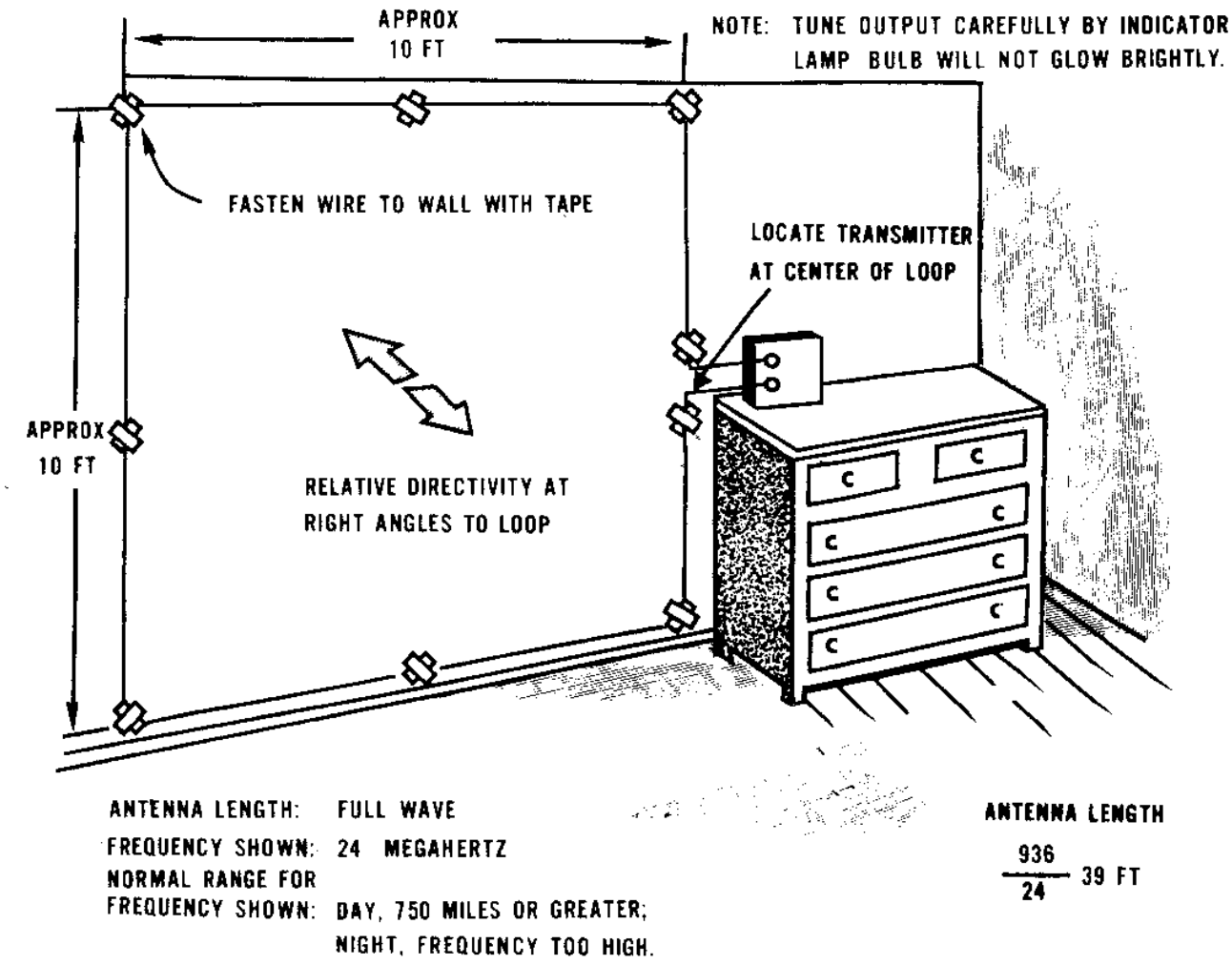

Figure 10–7. Full-wave square-loop antenna.

accomplished through the use of the jungle antenna (fig 10-9) or the half-rhombic antenna (fig 10-10). When operating on frequencies above 30 MHZ, the transmission range can be increased by improved antennas. The use of any one of these antennas should more than double the range of standard FM radio sets.

10-7. Communication Security

a. Security is of particular importance to a Special Forces detachment located in a UWOA. A violation of any of the principles of communication security endangers the detachment. Communication security is the protection resulting from all measures designed to deny unauthorized persons information of value which might be derived from a study of communications. Communication security is obtained through proper physical security, transmission security, and cryptographic security.

b. Physical security is defined as that element of security which results from the physical measures taken to safeguard communication documents, equipment, and personnel. Within the SFOB, physical security measures are similar to those of any military organization.

(1) Operational detachment personnel obtain security clearance before infiltration. The detachment commander must use his judgment and discretion in dealing with indigenous personnel and allowing them access to classified information. Information on cryptographic systems used by Special Forces is never released to indigenous personnel.

(2) Classified material is kept on the person of one of the detachment members or under constant

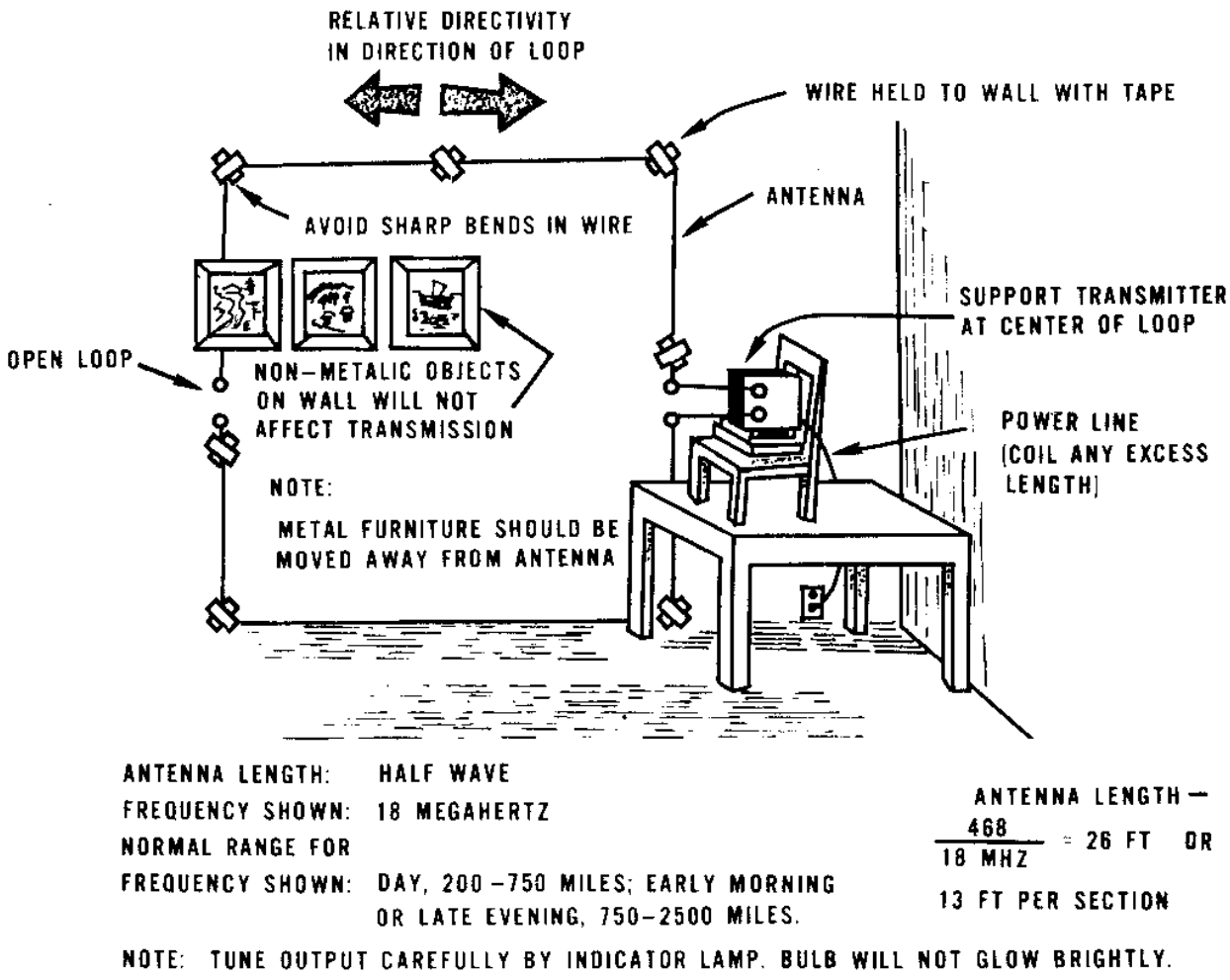

Figure 10–8. Half-wave square-loop antenna.

guard. The physical security of the radio set is maintained by choosing goon transmission and storage locations and by having a minimum number of persons know these locations. Techniques of physical security applicable to Special Forces in a UWOA are:

(a) Avoid easily identifiable and prominent geographical locations such as mountaintops.

(b) Move the radio after each transmission.

(c) Sterilize radio sites.

(d) Place surveillance on radio sets before and after transmission.

(e) Post guards when waiting for, and during, actual transmission.

(f) Do not carry classified material to transmission site.

(3) Detachment cryptographic systems and SOI's must not fall into enemy hands. Care must be taken not to destroy these items prematurely since replacement is difficult. Remember, however, that destruction by burning is not complete unless the ashes are destroyed.

c. Transmission security includes all measures designed to protect transmissions from interception, traffic analysis, direction finding, and imitative deception. Some techniques of transmission security applicable to Special Forces operations in a UWOA are:

(1) Make minimum transmissions.

(2) Do not tune transmitters until exact contact times.

(3) Locate transmitter sites so that known direction finding stations are beyond groundwave distances.

(4) Transmit on an irregular schedule.

(5) Never transmit from the same area twice.

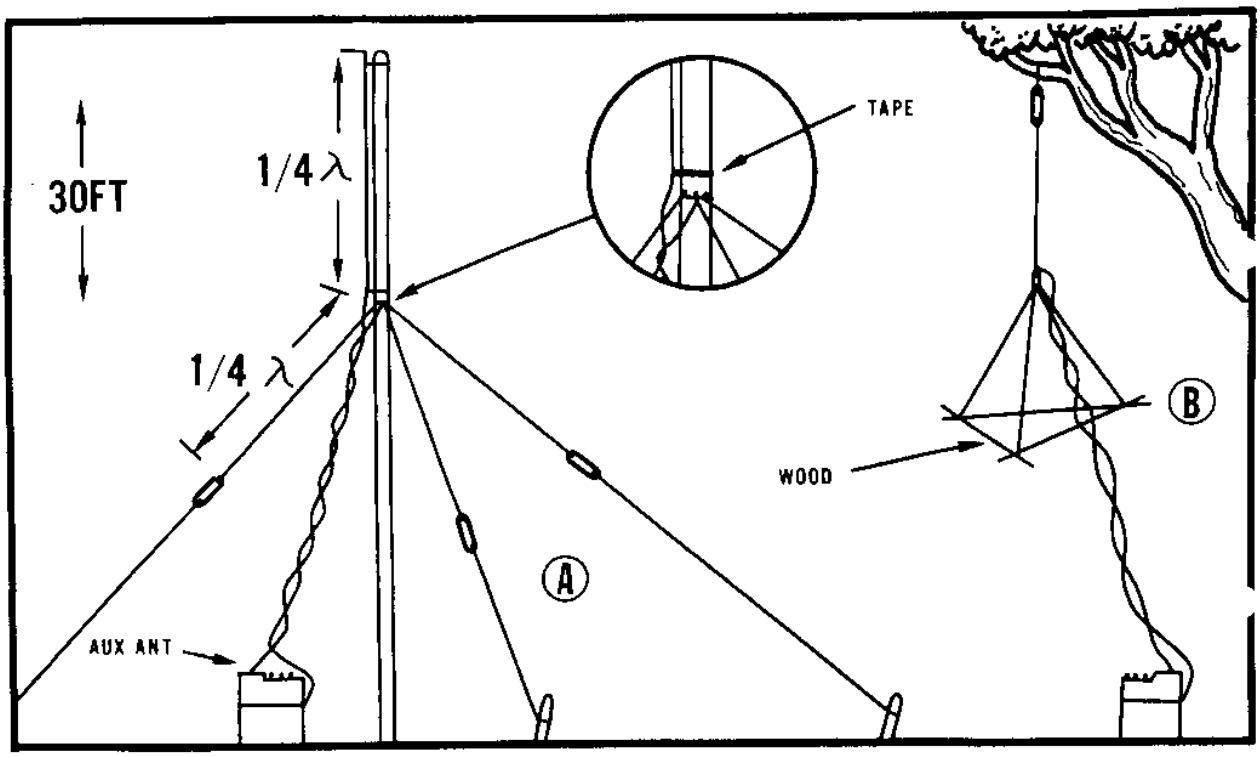

Figure 10–9. Jungle antenna.

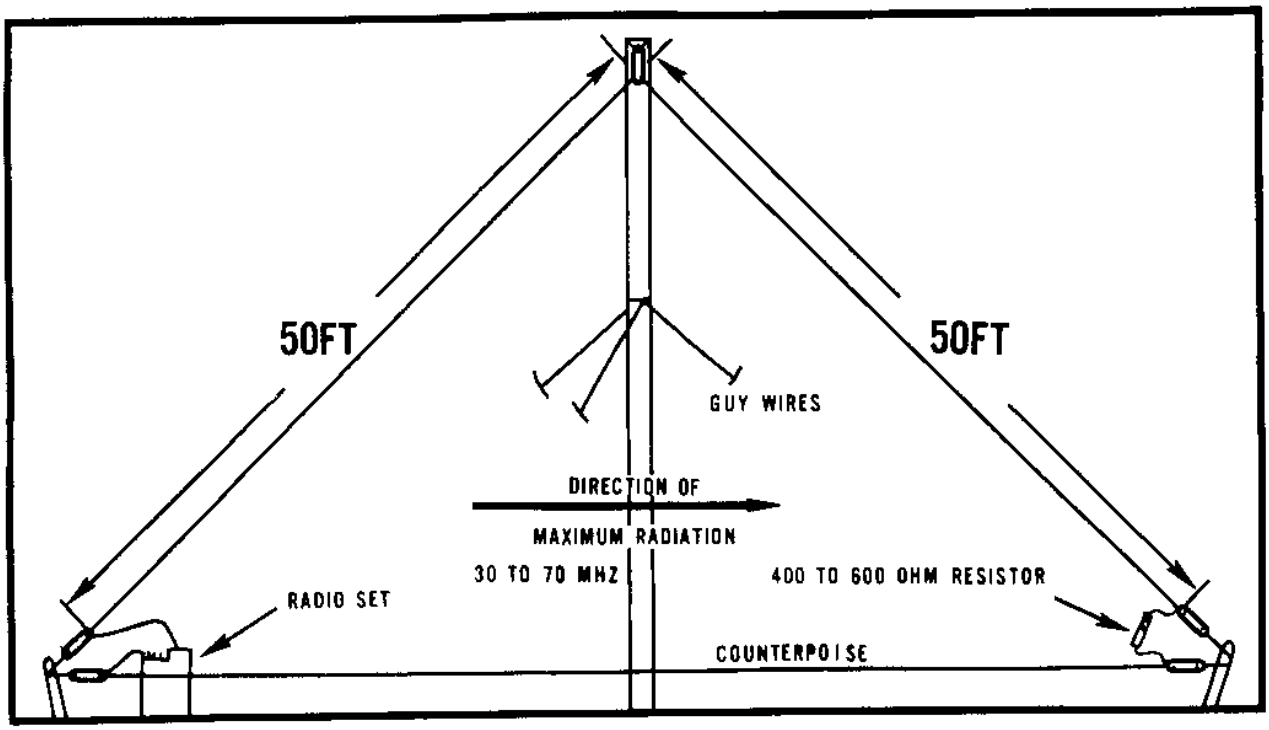

Figure 10–10. Half-rhombic antenna.

(6) Send short messages.

(7) Use, highly directional antennas.

d. Many times it may be necessary, in the interest of transmission security, to compromise between technically favorable transmission sites and transmission sites which meet the physical and transmission security criteria outlined above.

e. Cryptographic security results from the proper use of technically sound cryptographic systems. Systems and means available to the SFOB and the detachment commanders will vary with missions and operational areas. Specific instructions, techniques, and methods to be used are covered in premission briefings on a need-to-know basis.

f. See FM 31-21.