



The Little Green Radio Book

This guide describes everything you need to know in order to buy, operate and care for two way radios. At the end you'll find a [Buying Guide](#), a [Radio Dealer Selection Guide](#) and a [Free Trial Form](#) you can use to request a demonstration of two-way radios at your location.

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Introduction

Radios are an invention of the early twentieth century. Hand held two way radios like we use today didn't appear until the early 1960's with the introduction of the Motorola HT200 hand held radio that weighed in at a hefty 2 pounds and 1 ounce. (By comparison many of today's full powered, full featured radios weigh less than 10 ounces.)

Despite the size and weight hand held two way radios were an immediate hit. They saved steps, made it easy to communicate, made the workplace safer, and increased productivity.

These same benefits are still available today to every business that uses two way radios. The cost for two way radios is so little most schools, municipalities and businesses that use radios do not account for their costs separately but instead lump it into their other telephone and communication expenses.

I hope you use the following information to become more efficient, increase your productivity and make your workplace safer.

Hand Held, Mobile and Desktop

Some people called them "walkie talkies" or "handy talkies" or "hand held radios" or "base station radios" or "mobile radios." These are all essentially the same in terms of how they operate and in the commercial world are called "land mobile radios."

Land mobile radios come in three styles; the hand held style, the mobile style and the base station style.

Hand held radios are radios that you can hold in your hand and move about while you are operating them. Today these radios are usually between 9 and 16 ounces in weight and are typically between 4 and 8 inches tall (not counting the antenna).



5 Watt Commercial Radio



2 Watt Commercial Radio



1/2 Watt FRS Radios

Hand held radios are regulated (by the Federal Communications Commission) to no more than 5 watts of power.

Be careful here – there is a big difference between the Family Radio Service (FRS) radios that transmit at 1/2 Watt and the commercial grade radios that transmit at 2 Watts, 4 Watts and 5 Watts.

WATCH OUT FOR “typos” where you see 5 Watts and it should be .5 Watts (1/2 Watt) or you see 500mW (500 Mmilliwatts) which is actually 1/2 Watt and radios claiming 27 and 30 miles of range in FRS or GMRS (General Mobile Radio Service).

Beware of advertising on the lower priced, “discount” radios that make claims on the range of the radios being 18 miles, 27 miles, 30 miles, etc. Ask for a demonstration to prove it before you spend your money on them.

Mobile and Base station radios are usually more powerful than hand held radios and may have as much as 100 watts of transmit power.



Mobile and base station radios are essentially the same except for how they are mounted and used. A mobile radio is mounted in a vehicle and uses the battery of the

vehicle for power. Additionally the mobile radio has a separate antenna that is mounted on the roof, external mirror, fender or someplace else on the vehicle.



The same mobile radio becomes a base station radio when it is placed on a desk or counter and connected to regular house current as a power supply. The base station typically uses an exterior antenna that is mounted on the roof of the building.

Hand held, mobile and base station radios are two way radios because they receive radio signals and also send radio signals.

Hand held, base station and mobile radios are completely compatible and operate with each other seamlessly.

Radio Waves and Frequency

The AM/FM radio in your car or at home is a one way radio. These radios can only receive a signal. You can listen to your AM/FM radio but you can't talk back to the radio station. Two-way radios let you listen and talk.

Radio waves are created by some vibrating or "oscillating" mechanism inside a radio. Years ago radios used crystals as oscillating mechanisms. An oscillating mechanism is basically an electrical switch that turns on and turns off at a specific rate. The rate at which the switch turns on and off is its "frequency." When a switch is turned on and turned off at a very rapid rate electromagnetic fields are created that we call radio waves. The specific frequency at which the switch is turned on and off creates a radio wave of a specific size.

Each channel on a radio (this could be a popular radio station or a land mobile two way radio) is broadcast on a specific frequency. A popular radio station is known by its frequency; Talk **790** AM or Sunny **95.5** FM. **790** and **95.5** are these stations' frequencies (measured in kilo hertz – thousands of cycles per second - for AM radio or mega hertz – millions of cycles per second - for FM radio.) Likewise, every two way radio broadcasts on a specific frequency. Two-way radios for business, industry, education and public safety are approved by the FCC to broadcast in the VHF range (very high frequency) or UHF range (ultra high frequency).

The difference between VHF and UHF is like the difference between AM and FM for public radio stations. (In more technical terms the difference between AM and FM relates to amplitude rather than just frequency.)

Both VHF and UHF radio frequencies are measured in million of cycles per second MHz. There are certain properties that are associated with VHF and UHF frequencies.

The VHF radio band for commercial radios is between 130 – 174 MHz. The biggest advantage to using VHF radios is distance. VHF radios with comparable power and antenna size tend to travel further and provide more coverage in terms of distance than UHF radios.

The UHF radio band for commercial radios is between 400 – 512 MHz. The biggest advantage to using UHF is penetration. UHF radios with comparable power and antenna size tend to reach further inside buildings, through solid obstacles and heavy forests than VHF radios.

UHF radios are usually the best choice because the signal that is produced has better ability to travel around and through objects like trees and buildings. People use VHF radios when they are going to be used in an airplane, on a boat, or outside where there is little between the sender and the receiver. Under these conditions VHF travels further than UHF.

Each specific frequency produces a radio wave of a specific length. Lower frequencies produce longer radio waves. For example, a VHF radio frequency of 150.00 MHz will produce a radio wave about 7 feet long. A UHF radio frequency of 450.00 MHz will produce a radio wave about 2 feet long. Visualize trying to push a 7 foot long pole into an area with a lot of obstructions. Now visualize pushing a 2 feet long pole into the same area. Can you see why VHF radio waves tend not to penetrate?

The second factor in broadcasting is the power of the signal measured in “watts.” A commercial radio broadcast station might broadcast at 5,000, 10,000 or 50,000 watts. The more wattage or power the further the signal will travel. Hand held two-way radios usually broadcast at 1-5 watts. Mobile radios, the kind you might find in a fleet of delivery trucks, broadcast at 5 - 100 watts.

Some radio manufacturers rate the wattage on their radios in “peak wattage.” Peak wattage is the maximum wattage the radio can attain but not necessarily the radio’s actual operating wattage. A radio that operates at a constant 1 watt can outperform a radio that boasts a 5 watt peak power. Special measuring equipment is needed to learn if a radio’s specifications are based on peak or constant power. A reputable radio manufacturer or dealer can give you this information.

The third factor in broadcasting is those things that might block a radio signal. If a radio signal is blocked by buildings, walls, trees or mountains the signal won't reach the receiving radio. To solve this problem commercial radio stations broadcast from tall towers. This way the signal is beamed out and down to people wanting to listen to the station. It doesn't take much power if a receiving radio doesn't have anything between it and the sending radio tower or antenna. For example the radios that the astronauts used on the moon to talk to earth were able to successfully communicate with less than 1 watt because there is nothing between the moon and earth to block the signal.

We are not on the moon and we can expect much less coverage from our two way radios. A general rule is to expect a 1 watt radio on flat land to provide about 1 mile of coverage. Doubling the power increases the range by 1/3. A 2 watt radio on flat land talks about 1.3 miles. You can improve range by increasing antenna height. The higher the antenna the further you can talk. For example, a 1 watt radio might talk 10 miles to an unobstructed mountain top.

Don't be fooled

You may have seen radios at a discount store or the local sporting goods store advertising radios with talk distances of 10 miles or 12 miles or 18 miles. This is purely bogus. If bogus sounds too harsh to you just ask the seller to demonstrate the advertised coverage. He will not be able to do it.

Multiple Channels

Two-way radios can have multiple channels just like an AM or an FM radio and can be tuned to different stations. Most commercial grade radios have between 4 and 16 channels. (Radios that are used by the police or fire department for public safety may have as many as 256 different channels.) Each channel has a different frequency so people listening and talking on channel 1 won't hear people talking on channel 2 or one of the other channels.

This is particularly important to radio users that want a group of people to be able to talk to each other without interfering with other groups. For example in a hotel the housekeeping staff can use one channel, the maintenance staff can use another channel and the banquet staff can use a third channel without everyone hearing everything that is being transmitted. Talk groups can be divided by department, work category, location or anything that helps people communicate better.

Scanning

A radio with scanning capability can automatically lock onto an active frequency or radio signal. Once that frequency goes silent the radio continues scanning until it finds the next active frequency. The traditional use of scanning was to monitor police, fire and other emergency services that use several different frequencies but only with sporadic use of each.

Most modern automobile AM/FM radios have a scanning feature. The user pushes a single button and the radio will scan for the next channel. Once the next channel is found the scanning stops for 10 seconds and then continues to the next channel. The user turns off scanning as soon as a good station is found.

Two way radios that have more than one channel can also be equipped with a scanning feature. However land mobile radios only scan the frequencies that have been programmed in the radio. For example a hotel is using 8 channel radios.

They have assigned the channels:

1. General use – All call
2. Housekeeping
3. Maintenance
4. Banquet and catering
5. Bell hops
6. Parking
7. Front desk
8. Manager

In our example the radios are programmed for each department. The housekeeping staff's radios are programmed to scan channel 2 and channel 1. These folks leave their radios on channel 2 all day and communicate with each other. If they want to talk to the front desk they would turn their radio to channel 7. If they wanted to talk to someone in maintenance they would turn to channel 3. If there is a call on channel 1 their radios will pick it up because they are scanning channel 2 and channel 1.

The Maintenance department's radios are programmed to scan channel 3 and channel 1. They can turn to another channel to reach another department and other departments can reach maintenance by turning to channel 3.

If there is an emergency or a message everyone needs to hear anyone can turn their radio to channel 1 and broadcast a message to all radios (because all radios are scanning channel 1).

Programming

Some years ago radios used crystals to determine the frequency on each channel. Each channel had two crystals. One crystal determined the transmit frequency and one crystal determined the receive frequency. Crystals were cut to a specific size to create a specific frequency. Using crystals radio frequencies were separated by 0.025 MHz. For example frequency spacing would be 450.00 – 450.025 – 450.050 – 450.075 – 450.100. This 0.025 spacing is referred to as “wide band.”

Today radios use a device in the radio called a “voltage controlled oscillator” to control specific transmit and receive frequencies. The “voltage controlled oscillator” is accessed through the audio port on the side of the radio and programming cable that goes from a computer to the radio. The use of a “voltage controlled oscillator” is much more precise than the use of crystals. This greater precision allows for radios to be programmed with frequency spacing at 0.0125. For example frequency spacing can be 450.00 – 450.0125 – 450.025 – 450.0375 – 450.050 – 450.0625 – 450.0750 – 450.0875 – 450.100. The 0.0125 spacing is referred to as “narrow band.” Narrow band allows for twice as many frequencies to be available.

Most recently manufacturers are able to build digital radios with .00625 spacing, referred to as “very narrow band” allowing for even greater availability of radio frequencies.

In addition to more precise frequency choices modern computer programmed radios also allow for “interference elimination codes.” Interference elimination codes are also known as “private line codes” “PL codes” or most accurately “Squelch codes.” Instead of only needing to be receiving on the same frequency as others in your group, radios using elimination codes require all radios to have the same channel/privacy code in order to communicate. In order for a radio to open up and receive a broadcast, it must first hear the elimination code and then the channel’s frequency. (The tone actually cannot be heard, it is sub-audible.) Effectively this eliminates hearing other radios that are in the vicinity broadcasting on the same frequencies.

Keep in mind that by using elimination codes you will not hear other radios using your frequency however others using your frequency but not using an elimination code may still hear you.

Elimination codes are particularly useful with FRS (Family Radio Service) GMRS (General Mobile Radio Service) and MURS (Multiple User Radio Service) frequencies.

FRS frequencies are 7 specific frequencies that were set aside by the Federal Communications Commission (FCC) for non commercial use and do not require a license to operate. Radios that use the FRS frequencies are limited to 0.5 watts of transmit power. There are VHF and UHF FRS frequencies available.

GMRS frequencies are 15 specific frequencies that were set aside by the FCC for non commercial use. Radios that use GMRS frequencies typically use 1-5 watts of power. The FCC offers a 5 year license for using these frequencies. The license application is a short form and costs \$85. You can apply for this license online at www.fcc.gov.

MURS frequencies are 5 specific VHF only frequencies that were set aside by the Federal Communications Commission for personal or business use and do not require a license.

Several radio manufacturers offer radios that are pre or partially programmed to the FRS, GMRS and MURS frequencies.

From Analog to Digital – a Note on FCC Licensing and “Narrow banding”

Just as TV is switching to digital, so is two-way radio - and for the same reasons. Digital technology is more efficient than analog, meaning more information can be transmitted in a given bandwidth.

Do not panic! Your two-way radios are not going to become worthless or obsolete over night. If you have purchased two-way radios from Fast Radios in the last six years it is very likely your radios meet the new requirements set by the Federal Communications Commission (FCC).

But you need to be aware of your options going forward so please read on.

Two-way radios operate in licensed bands, such as VHF (very high frequency) or UHF (ultra high frequency). There are blocks, or channels of radio spectrum within those bands that are regulated through the FCC.

Historically, commercial two-way radio users use 25 kHz wide channels for a single voice path. Since only a fixed amount of radio frequency spectrum is available for two-way radio applications, and as the number of users has increased over the years, the availability of spectrum has decreased.

The FCC has foreseen this issue and has mandated all business and public safety radio users in the U.S. to transition from 25 kHz channel spacing to at least 12.5 kHz wide channels by the end of 2012. The two-way radio industry calls this "narrow banding."

Fast Radios has been ahead of this curve. We have been recommending commercial quality two-way radios to our valued customers that are capable of the narrow band 12.5 kHz channels since August 2003. And if you were new to two-way radios when we met, we set you up with 12.5 kHz narrow band programming in your radios. If you already had radios when we met and your radios were programmed to operate in 25 kHz wide band, we recommended radios that are capable of either wide (25 kHz) or narrow (12.5 kHz) and we programmed them to work with your existing radios in the wide (25 kHz) band. Those radios will need to be re-programmed from wide (25 kHz) to narrow (12.5 kHz) **before the deadline of December 31, 2012.**

More importantly, the FCC has stated that 12.5 kHz narrow banding is not enough and is already looking past 12.5 kHz and "strongly urges" business radio users to migrate to 6.25 kHz very narrow band channels. It is important to note that the FCC has not yet set a date certain for required migration to very narrow 6.25 kHz channel width.

So Fast Radios is staying ahead of the curve again and wants you to be aware of your options. To prepare for the migration, you should start assessing your radio system and planning for replacements or upgrades. You should inventory your current equipment to ascertain what can be converted to 12.5 kHz and what will need to be replaced before December 2012 so you are in compliance by the deadline of January 1, 2013.

You should consider replacing old radios with new units that not only comply with the narrow band (12.5 kHz) requirements but units that are capable of digital two-way radio and therefore capable of very narrow band (6.25 kHz).

New two-way radios are now available that will communicate with each other in digital mode as well as with your older units in analog mode. That means you can make the transition or "migration" from wide channels to narrow and very narrow as quickly or as slowly as you wish. And digital radios offer superior audio quality as well as a host of features to enhance your two-way radio system performance adding value to your investment.

Batteries

There are three primary battery chemistries; nickel cadmium (Ni-CD), nickel metal hydride (Ni-MH) and lithium ion (LI-ION). Nickel cadmium is the oldest chemistry and in many ways is still the best. The capacity of each of these types of batteries is measured in milliamps (mAh).

Nickel cadmium out performs other battery chemistries in both high and low extreme temperatures. These batteries are also more resistant to overcharging and have a longer life expectancy. Generally nickel cadmium batteries cost less per mAh. However nickel cadmium batteries are larger and heavier than other types and tend to develop "memory burn." **Memory burn** occurs when a battery is re-charged before it is

completely discharged. The battery remembers this smaller partial charge and adjusts to accept this amount as a full charge. Memory burn can be reduced or eliminated by regularly discharging the battery to full exhaustion. It is not unusual to see nickel cadmium batteries last for more than 2 or 3 years.

Nickel metal hydride batteries are similar to nickel cadmium except they tend not to develop “memory burn.” Nickel metal hydride batteries are somewhat lighter, more compact and cost only slightly more than nickel cadmium batteries. These batteries are less tolerant of overcharging and have a shorter life expectancy. Typically a nickel metal hydride battery has a life expectancy of 1 – 2 years.

Lithium ion batteries weigh less than the others, are more compact, do not develop any “memory burn” and cost the most per mAh. Lithium ion batteries have a specific number of charges they are capable of receiving. (The amount might be 500, 750 or 1000 charging cycles depending on the manufacturer and design.) Once the battery has experienced the specific charging cycles it will not accept a charge. Lithium ion batteries also require a more advanced charger that is typically able to recharge the battery in a couple of hours rather than the traditional overnight charger.

Generally all these batteries provide an 8 hour duty cycle for every 1000 mAh of capacity.

The industry standard for measuring duty cycle is “5 – 5 – 90.” This supposes you talk 5% of the time, listen 5% of the time and you are on stand-by for 90% of the time. The duty cycle takes into consideration the capacity of the battery and the consumption rate of the radios.

| Feature | Type Battery | | |
|------------------------|----------------|----------------------|-------------|
| | Nickel Cadmium | Nickel Metal Hydride | Lithium Ion |
| Size/Weight | Good | Better | Best |
| Extreme Temperature | Best | Good | Poor |
| Memory Burn | Good | Better | None |
| Deep Discharge Ability | Good | Poor | Poor |
| Overcharge Tolerance | Good | Poor | Poor |
| Charge Cycle Life | Best | Good | Good |
| Price | Best | Better | Good |

Emergency Battery Charging

Natural and manmade disasters and emergencies can result in power outages that can last for a few hours or even days.

- Even if you do not use two way radios as part of your regular day to day operation keep your radio batteries charged and conduct a radio check once a week. The weekly radio check will reinforce how to use the radios and instill good radio habits.
- A weekly radio check will reveal if there are any equipment or personnel issues. During an emergency having to train personnel will consume rather than conserve battery power.
- Have spare two way radio battery equipment available and handy. Many commercial two way radio chargers have a slot for an additional battery. By keeping two batteries charged you effectively double the useful life of radios in an emergency. Additionally some commercial two way radios can be equipped with standard size alkaline batteries. These alkaline batteries have a long shelf life and can come in handy if the power outage is lengthy.
- If you have an uninterrupted power supply (UPS) battery backup for your computer it can be a source of power for re-charging two-way radio batteries. Just plug your charger into the UPS and you'll have enough power to re-charge your radio battery to last at least a full day, and maybe even more. Make sure to shut down your computer at the first sign of a power outage. It increases the UPS power that you can draw on for charging batteries.
- If it's safe to go outside, you can charge your radio battery in your car or truck by using your charger with an inverter that plugs into the vehicle's cigarette lighter. If the power outage lasts a short while, this can provide enough juice to keep things going during the crisis. If it looks like power is going to be out for several days keep in mind that this charging process is also impacting your vehicle's gas.
- You can use your two-way radio during a power outage emergency if you have a solar rechargeable battery pack. Solar power is becoming increasingly popular as a source of alternative energy. It doesn't even have to be a bright and sunny day for it to work effectively. Solar power battery recharging kits can service your two way radio batteries. You'll find a solar kit with a quick Internet search or call your two way radio dealer.

Antennas

An antenna is designed to send and receive radio signals. When the antenna is receiving it converts electromagnetic waves into radio frequency electrical currents. When the antenna is sending it converts radio frequency electrical currents into electromagnetic radio waves.

As mentioned earlier each specific frequency produces a specific length radio wave. Lower frequencies produce longer radio waves. For example, a radio frequency of 150.00 will produce a radio wave about 7 feet long. A radio frequency of 450.00 MHz will produce a radio wave about 2 feet long.” Antennas of these sizes would be totally inappropriate for a hand held radio.

Fortunately radio manufacturers have learned two important lessons. First, radios perform well as long as the antenna size is relatively close to the wave length. This means that a 7 foot long antenna will provide good transmission and reception for a range of radio waves from 5 to 10 feet in length. Secondly antennas can be fractional sizes of the wave length and still perform well. For example the average size UHF radio wave is approximately 2 feet tall. However a 1 foot or 0.5 foot or 0.25 foot antenna will also work well. Because the actual antenna may be coiled around an antenna mast it is difficult to see the antenna’s true length without taking the antenna apart.

Many radio users are choosing “stubby antennas” (antennas that are just a couple of inches in length). Stubby antennas are more convenient and comfortable to use because a shorter antenna does not get in the way (much the way short tailed cats seem to have a less accident prone life style).

A stubby antenna has a full size antenna however the active antenna is spiral coiled around the mast to create a shorter profile. These antennas provide nearly equal performance in all but the most extreme circumstances.

Antenna performance is a critical factor in distance and coverage of radio signals.

Passive Antenna

A passive antenna is a coaxial cable with an antenna on both ends. Think about 2 antennas that are connected by a cable. The purpose of a passive antenna is to provide a path way for radio signals. For example, a hospital has an X-ray room that is equipped with lead lined walls. Radio signals have difficulty in penetrating these walls. One end of a passive antenna system (the 1st antenna) is placed outside the room where radio signals can reach it. The other end of the passive antenna system (the 2nd antenna) is placed inside the room. These antennas are connected by a short cable and provide a path way so radio users can communicate inside and outside the room.

If a radio user can receive and send signals outside a building but not from inside: a passive antenna maybe the solution.

Passive antennas are an inexpensive way of overcoming penetration issues.

Repeater



A repeater is an electronic device used to increase the distance and quality of radio broadcasts. A repeater works by receiving a radio signal on one frequency and re-broadcasting the signal with more power on another frequency.

A specific channel on a commercial grade two way radio can be programmed to transmit on one frequency and receive on a different frequency. For example, channel 1 can be programmed to transmit on 450.00 MHz. When the push to talk button is pressed the radio broadcasts on 450.00 MHz. This same radio can be programmed for channel 1 to receive on 455.00 MHz. When this radio is receiving on channel 1 it is receiving at 455.00 MHz. The repeater picks up the radios transmission at 450.00 MHz and simultaneously rebroadcasts the signal with more power at 455.0 MHz. Others radio users in the area hear the broadcast on 455.0 MHz and respond at 450.0 MHz.

Repeaters extend radio range. Suppose you and your partner are too far apart to receive each other's radio signal. Now suppose there is a repeater and antenna located between you and your partner to boost your signal. Presto you're communicating.

Repeaters work well at changing "the line of sight." Suppose you and your partner are standing on either side of a mountain. Your radio signal cannot penetrate the mountain and you are unable to communicate. Now suppose there is a repeater and antenna at the top of the mountain. Your radio can see the repeater's antenna and your partner's radio can see the repeater's antenna. Presto you're communicating.

Repeaters come in sizes ranging from just a couple of watts to over 100 watts. Just like radios, the repeater's antenna is critical to the performance.

Trunking

A repeater is a single channel device. Repeaters can only receive on one frequency and send on one frequency. Consequently a single repeater can serve a limited amount of radio users. Typically a single repeater can serve about 75 radio users. With more than 75 users the channel becomes over loaded and users can't get a turn sending their message.

Sometimes a second repeater can be added. The radio users are divided by the work they do, their department or the area they are working in. Some workers use a channel on one repeater and other workers use the other repeater. By doing this the 2 repeaters serve about 150 radio users in total. A third repeater could serve another 75 people bring the total to 225 radio users.

A Trunking system links 2 or more repeaters together and allocates a radio signal to which-ever repeater is not in use. This resource allocation increases the amount of radio users the system can serve. For example, while three repeaters can serve a maximum of 225 radio users, a three repeater Trunking system might serve as many as 1000 radio users.

While nearly all commercial grade radios can be programmed to use a repeater only special (Trunking capable) radios can be programmed to use a Trunking system. The most popular Trunking protocols are LTR and Passport. A radio has to be specifically enabled to use LTR in order to use an LTR Trunking system. A radio has to be specifically Passport enabled to use the Passport Trunking system.

Police, fire and other public safety departments are the typical users of Trunking systems.

Repeaters and Trunking systems can be equipped with a telephone interconnect. A telephone interconnect allows regular analog telephone calls to be sent through the repeater. This telephone interconnect option is particularly useful in areas where cell phone coverage is poor. Another application for the telephone interconnect is for transferring a telephone call to a radio when the person receiving a call is out of their office, out on campus, in the plant or otherwise away from a phone.

Repeaters and Trunking systems can improve radio signals inside a facility or extend the effective range for using radios to across town, throughout the county or even across the state.

Licensing

The Federal Communications Commission (FCC) governs private and public radio communications. The FCC requires all radios be licensed with a few exceptions. The noteworthy exceptions are Family Radio Service (FRS) radios and Multiple User Radio Service (MURS).

Another exception to the rules of licensing is the General Mobile Radio Service (GMRS) which can be licensed with a short form and nominal fee of \$80 for 5 years of licensing. All of the exceptions come with limitations. For example, FRS radios can broadcast at a maximum of ½ watt and can be used for person and family use only. Commercial use of these radios is not allowed.

The FCC licenses the radio user not the radio itself. For example the FCC will issue a license to the Jones Company to use a specific frequency or group of frequencies to be used in a specific geographic area. The Jones Company may be using 2 radios or 200 radios and the license would be the same.

A typical FCC license is for the use of 5 frequencies for 10 years. You can learn more about FCC licensing and download forms at www.fcc.gov. Unfortunately applying for a license is confusing and time consuming. Fast Radios can help you get frequencies granted and licensed for 10 years – the cost is usually between \$700 and \$1,200 depending on the number of frequencies you want and how many repeater pairs you want. Fast Radios includes the creation of a FCC file and the Construction Notice fee that is issued nine months after your license is granted.

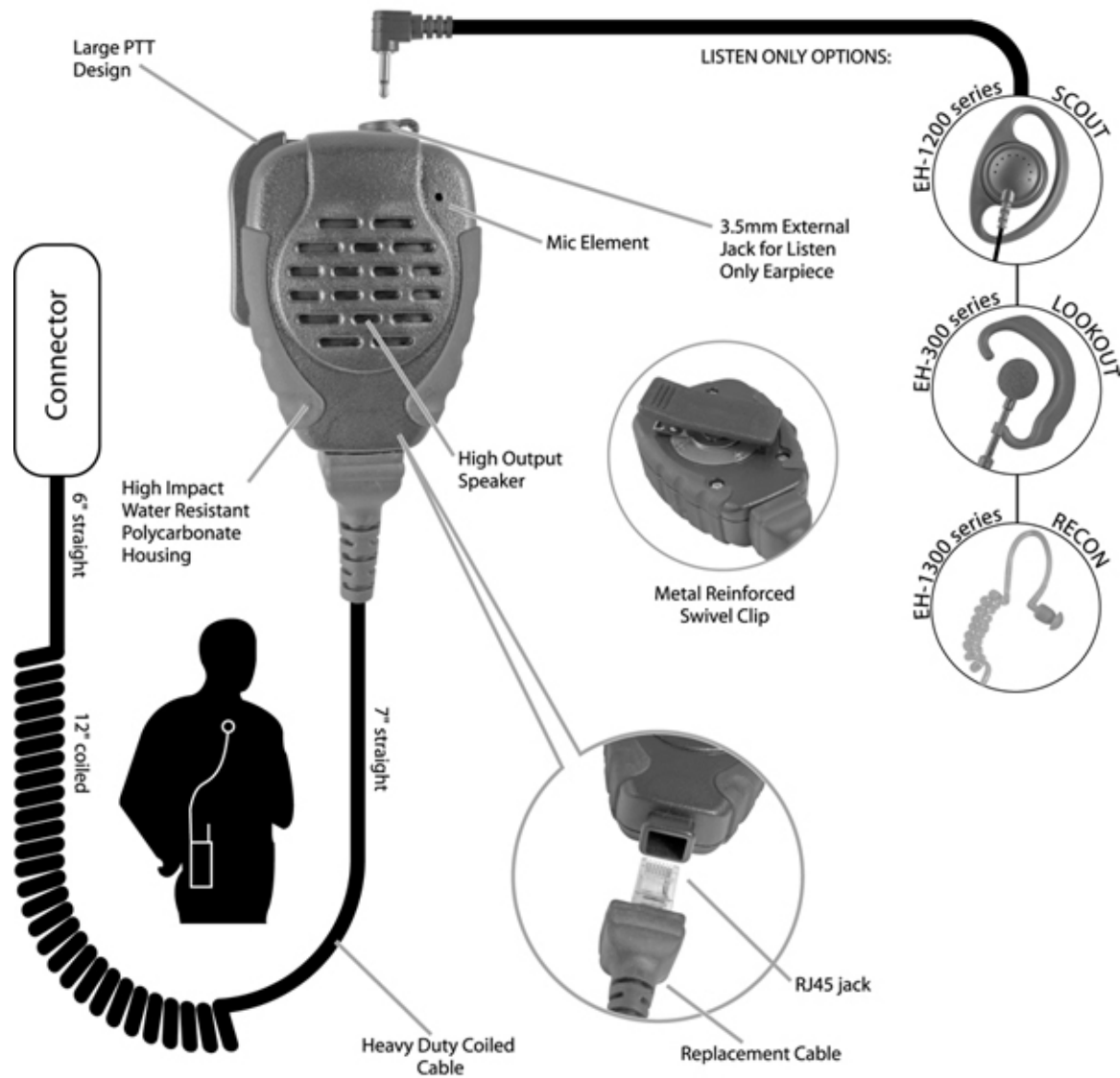
Accessories

The most popular accessories for two way radios are audio accessories, protective cases and special charging units.

Audio Accessories

Speaker microphones come in several different styles and sizes but in general plug into the radio's audio port (typically located on the top or side of the radio) and clip to the user's collar, shirt pocket or on their shoulder epaulet. Generally, this type of speaker microphone is called a shoulder style "speaker mic".

Speaker mics allow the user to send messages without taking the radio off of their belt. Additionally speaker mics place the sound closer to the user's ear in a noisy environment.



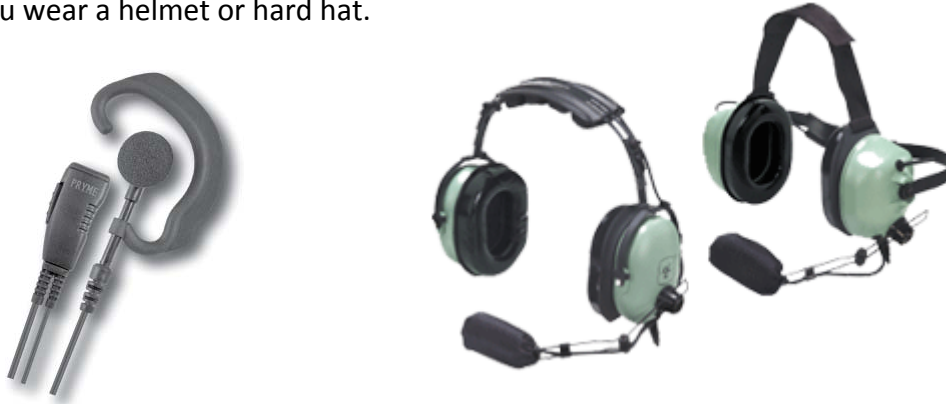
Some radios are equipped with a voice activation feature (VOX). When voice activation is turned on the radio becomes sensitive to sound and opens or broadcasts without the need for anyone to push the “push to talk” button. Speaker mics and earpieces are available that include the voice activation feature.

Loudness is a subjective term that describes your ear’s perception of a sound. On the other hand, *volume* is an objective term that describes the amount of air that is being affected by sound. For example if someone snapped their fingers close to your ear it

would seem loud. However you would not be able to hear this sound if you were in the next room.

Volume is demonstrated in a movie theater when one of the actors whispers. The whisper fills the entire theater (it moves a large volume of air). Here we have lots of volume but very little loudness.

Earpieces fit around the ear like eyeglasses fit around your ear and have a small microphone that clips to your collar. Headsets are worn over your head or behind your head if you wear a helmet or hard hat.



Some earpieces actually fit in the ear canal. Both of these accessories provide loudness while a speaker mic (the type worn on the user's shoulder produces volume).

An additional advantage to the ear piece is privacy. By wearing an earpiece others in the immediate area will not be able to hear what is being broadcast on the radio. This is particularly useful in customer service situations, in hospitals, schools and for tour guides.

Follow this link <http://www.fastradios.com/two-way-radio-accessories.php> to the three most popular audio accessories

Protective Cases



Cases come in nylon, plastic and leather and are a great way to protect your radio.

The swivel on most holsters and cases makes it easier to put on and take off the radio.

When you use a protective case and an audio accessory the chances of dropping the radio are greatly reduced.

Additionally some cases completely enclose the radio. This protects the radio against extreme conditions where there is substantial risk from moisture or airborne dust and dirt.

Charging Units



Good commercial two-way radios usually come with a desktop charger; either an “overnight” charger that is also known as a “trickle” charger, or a rapid-rate charger.

Rapid chargers usually charge the battery in two or three hours where the trickle charger takes 12, 14 or even 16 hours to charge a battery, depending on the capacity of the battery.

Most radio manufacturers and accessory manufacturers offer multiple unit battery charges. These charging stations are popularly referred to as “gang chargers.”

Gang chargers are a great way of keeping track of radios by charging them at a central location and occupying only one AC wall outlet.

The down side of gang chargers is their relatively high cost (the cost is even higher considering most commercial grade radios came with an individual charger that was included in the price of the radio and will not be used).



Additionally if the gang charger becomes faulty the ability to charge all radios has been interrupted. It is a good idea to keep the individual desktop chargers as spares.

Advanced chargers are available for conditioning nickel cadmium and nickel metal hydride batteries. These chargers will have a button to press that completely discharges the battery. The process of complete discharge and re-charging is called “conditioning” or “exercising” and can add years of life to your battery.

Durability - Military Specifications, Ingress Protection - and Intrinsically Safe

The Defense Logistics Agency is the US Department of Defense's largest combat support agency. The Defense Logistics Agency provides guidelines and criteria for supplies and materials that are used by the US Military. These guidelines and criteria as they apply to commercial grade radios are referred to as Military Specification Standard or "Mil Spec." The guidelines call for radios to be able to withstand shock, vibration, humidity, temperature extremes and a host of other criteria. Passing "Mil Spec" testing is an indication of a superior product.

The European Committee for Electro Technical Standardization offers a method for classifying the degree of protection provided by an enclosure. These methods are designed to numerically rate an electrical product on the level of protection its enclosure provides. By assigning different number codes, the product's degree of Ingress Protection can be identified quickly and easily. In the code IP 54, for example, IP identifies this standard, the 5 describes the level of protection from solid objects, and 4 describes the level of protection from liquids. A radio that meets the IP 54 standard can withstand blowing rain and dust.

Intrinsically Safe radios are certified by Factory Mutual Global to not spark. Factory Mutual Global is an industrial property insurance and risk management organization specializing in property protection. Factory Mutual Global establishes the criteria for certification and insures against the loss if there is a mishap.

Intrinsically Safe radios are offered by the major radio manufacturers and are used in areas where there is a risk of explosion, ignition or fire.

Fast Radios Connect - Connecting Multiple Locations with Radio over Internet

The internet and the World Wide Web have changed the way many of us communicate and how we send and receive information. Along with all the other changes in our lives, the internet has brought about dramatic change in two-way radio communication.

The "range" or distance between radios is now virtually unlimited thanks to the internet. [Please see the Fast Radios Connect Diagram at the end of this booklet.](#)

Two (or more) locations separated by tens, hundreds, even thousands of miles can be in communication by combining two-way radios and the internet. Some solutions are complicated and the equipment is expensive and cumbersome.

Fast Radios Connect is a software-based solution. It is more affordable than the hardware centered solutions and much easier to use.

Here is a simple example of how using Fast Radios Connect improves productivity, boosts efficiency and increases safety:

A company has two facilities separated by a mountain range. There is no cellular service in many areas, and in other areas the cellular service is intermittent and unreliable. Both facilities use commercial two-way radios for communication around the facility, but can't get the radios from one facility to talk with the radios at the other facility because of the mountain range.

So the only way the production manager on duty at Facility A can communicate with the manager on duty at Facility B is to go inside the office and pick up the telephone. That means the person who answers the phone at Facility B must call the manager there with the two-way radio and have her come in the office to take the call.

With a Fast Radios Connect workstation at each location Manager A simply pushes the talk button on his two-way radio and Manager B hears the call on her radio – they can instantly communicate because they are each transmitting and receiving over the internet with their two-way radios.

Facility A and Facility B could be across town from each other, across the state, or even across the country from each other. It doesn't matter as long as each facility has internet service.

And the internet service can even be wireless!

With the Fast Radios Connect application for smart phones, a manager can leave the facility and go hundreds or thousands of miles away and still communicate with the staff back at the facility on their two-way radios.

Radio Manufacturers & Brands

There are a dozen or so manufacturers of commercial two way radios. The list includes Motorola, Kenwood, ICOM America, Tekk International, Hytera America, Maxon, Vertex Standard, Relm, Ritron and others. Additionally there are more than a hundred brands of two way radios, both commercial grade and consumer grade that are manufactured and private labeled by other companies.

Some years ago you could shop by company to find the best two way radios. Motorola truly dominated the market place. Motorola radios were durable and full featured. Motorola still enjoys a good reputation for their commercial grade radios. However there are now several leading brands that offer comparable and sometimes superior models at a much more competitive price.

Comparing radios to cell phones... Try This On A Cell Phone...

Sometimes we hear someone say “cell phones might be an alternative to two way radios.” They think they can combine the ability to make and receive phone calls with the walkie talkie feature that many cell phone companies now offer.

Don't get trapped!

Here are a few things you should know before you commit your company to lengthy and expensive cell phone contracts:

1. Two way radios are easier to use. Push a button and start talking.
2. The right two way radios will provide better reception in hard to reach areas of your property. Cell phones transmit with only ½ watt of power and are prone to dead spots or areas of poor reception and transmission. (Have you ever noticed how people have to go outside the mall or grocery store to make or receive a call on their cell phone?)
3. Two way radios equipped with a “telephone interconnect” can make and receive telephone calls through your existing telephone equipment and carrier for no additional monthly charge.
4. You can immediately reach everyone with two way radios. Cell phones require a separate number to call each person individually. Having to call everyone individually is completely inappropriate in an emergency.
5. Two way radios equipped with “selective calling” let you speak privately with one person at a time or with everyone at once. Two way radios equipped with “selective calling” also have a caller id display so you know who you are talking to.
6. Two way radios (intrinsically safe versions) can be used in highly flammable or explosion areas without fear of sparking.
7. The “man down option” available on some two way radios will send a distress signal when a worker remains horizontal for more than 30 seconds.
8. Two way radios come with a multiyear parts and labor warranty. Cell phones usually have warranties of only 90 days.
9. After several recent natural disasters, many people have learned that two way radios continue to work in an emergency when cell phones and even land lines become useless.
10. Two way radios (properly equipped) are available for use in high noise areas, dusty, dirty or wet environments, when hands free operation is necessary, when security is paramount or covert communications are required.

Two way radios are easy to use, are loaded with options, are effective in all locations and have no monthly fee or service contract.

Two way radios are simple, affordable and reliable. Two way radios increase safety, boost productivity and improve efficiency.

Shopping Guides

Shopping for radios can be confusing. The following two charts can help you compare various models and brands and who you should buy them from.

| | | | | | | | |
|-----------------------------|---------------------------|--|--|--|--|--|--|
| Radio Shopping Guide | Price per unit | | | | | | |
| | Special Feature | | | | | | |
| | Duty Cycle of the Battery | | | | | | |
| | Height | | | | | | |
| | Weight | | | | | | |
| | Channel Capacity | | | | | | |
| | Transmit Power in Watts | | | | | | |
| | Brand & Model | | | | | | |

| | | | | | | | |
|------------------------------|--------------------------------|--|--|--|--|--|--|
| Dealer Shopping Guide | Trade in Policy | | | | | | |
| | Loaner Policy | | | | | | |
| | Repairs | | | | | | |
| | Pick up & Delivery | | | | | | |
| | Information & Personal Service | | | | | | |
| | Free Trial | | | | | | |
| | Warranty Period | | | | | | |
| | Dealer's Name | | | | | | |



FREE TRIAL ON COMMERCIAL TWO-WAY RADIOS

fast radios

**Improve Safety
Increase Efficiency
Boost Productivity**

- Full Four-year Warranty
- Free Two Way Radio Guide
- Free Trial on new 2 way Radios
- Complete one-on-one Customer Service

fast radios
USA LUGE
Fast Radios
The Official Two-way Radio
Supplier for USA Luge

Simple. Reliable. Affordable.
800-691-3970
www.FastRadios.com

We hope this guide has been helpful to you in your effort to understand your options as you shop for two way radio communications.

Attached is our **Free Trial** form and our credit card authorization form. Fast Radios will send you a pair of new two-way radios to test at your facility for a week. We do an authorization on a credit card for the value of the equipment we are sending - we don't take the funds - only a "hold" or authorization.

Please complete the trial form and the card authorization form and fax or e-mail them back to us. We'll call you to confirm when we receive them and get a trial order on the way to you.



Free Trial Form

Print this form, complete it and fax it to 866-656-2938
or scan and e-mail to Help@FastRadios.com

CALL Bill Richards at 800-691-3970, #23 WITH ANY QUESTIONS.

Please ship me: Fast Radios Connect Portable Two-way Radios Desktop Base Radios
 Protective Cases Earpieces Speaker Microphones Headsets Surveillance Audio Equip.
for a seven (7) day FREE TRIAL. By signing this request, I understand and agree that:

- The TRIAL begins the day the equipment is delivered to my location and will last seven (7) days.
- If I decide to return the equipment rather than purchase it, or to purchase some of the items but not all, I will call **800-691-3970**, obtain a return authorization number and promptly return the equipment postage paid. I will pay for the return shipping.
- I will be responsible for any damage to or loss of the equipment during the trial, including the packaging materials and any user manuals. I will pay for any packaging or equipment not returned.
- Equipment not returned in a timely manner after I have received my return authorization number is considered purchased and I will honor the FREE TRIAL inventory tracking invoice I'm going to receive.

Company, agency or institution: _____

Mailing/Invoicing address: _____

Physical/Shipping address: _____

Name: _____ Signature: _____

E-Mail: _____ Phone: _____ Fax: _____

Please respond to each question and check all that apply.

1. To be successful, the two-way radios must cover
 500 ft 1,000 ft 1/2 mile 1 mile 2 to 3 miles more than 3 miles
2. Our facility is: 1 story 2 stories 3+ stories Multiple Buildings Outside
3. Our budget per radio, with any necessary accessories to solve our problem is:
 \$200 per unit \$250 to \$300 per unit \$300 to \$450 per unit \$450 to \$600 per unit
4. We currently use two-way radios: No Yes
5. (If Yes) Our experience with repairs has been: usually less than a week one to two weeks
 It usually takes more than two weeks to get my repaired radio back.
6. I make recommendations for purchases at my organization I am authorized to purchase on behalf of my organization

IMPORTANT: We can program new radios to work with your existing radios. If you currently use two-way radios and you want new units to work with them, please attach a list of your frequencies or call our office for a return form to send a radio to our repair shop for a FREE scan of frequency information.

Please complete this form and FAX or E-MAIL to Bill Richards

(Fax) 866-656-2938 (Email) Help@FastRadios.com

Credit Card Authorization Form



For: _____
Please print your company, agency or institution name here

I authorize **Fast Radios, Inc.** to charge my (circle one)

Visa • MasterCard • American Express • Discover

for (check one):

all charges accrued under our account

The one-time amount of _____

Card Number: _____

Expiration Date: _____ / _____

Name as it appears on the card: _____

The mailing address where you receive the monthly statement for the card:

Street Address: _____

City: _____ State: _____

Zip Code: _____ Country: _____

3 Digit ID Code on the back of the card: _____

Signature of Cardholder: _____

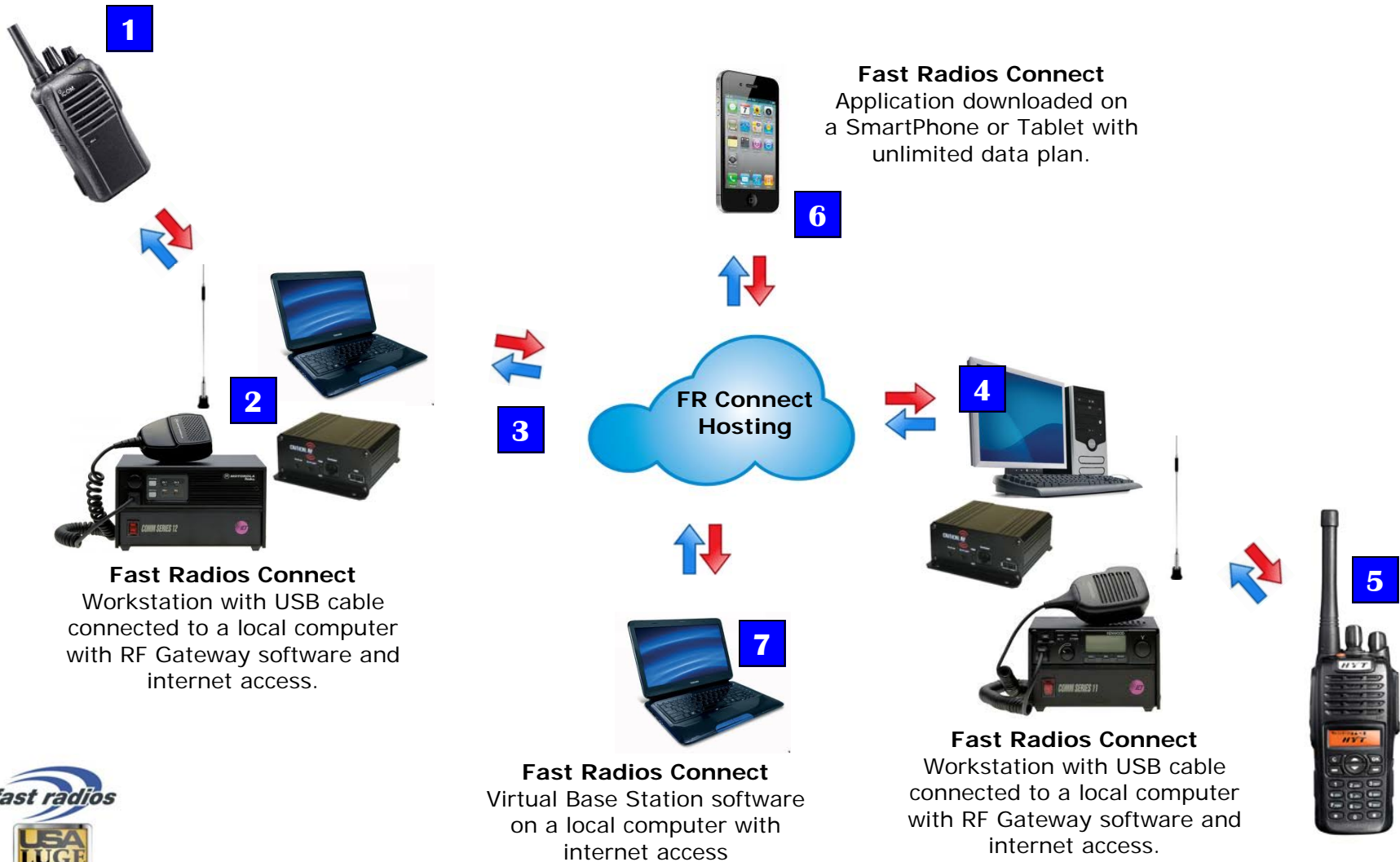
Date Signed: _____ Phone: _____

Fax to **866-656-2938** or email to Help@FastRadios.com

Call Bill at 800-691-3970, #23 if you have any problems with this form.

Fast Radios Connect

Two-way Radio communication over the internet to multiple locations with iPhone, Android or Blackberry SmartPhones and Virtual Base Station computers.



Fast Radios
The Official Two-way Radio
Supplier for USA Luge

800-691-3970
www.FastRadios.com

Fast Radios Connect

Two-way Radio communication over the internet to multiple locations with iPhone, Android or Blackberry SmartPhones and Virtual Base Station computers.

- 1** Handheld two-way radios in use at a facility. They are used by teams of people in production, maintenance, security, grounds keeping, housekeeping, management, administration, etc.
- 2** A Fast Radios Connect Workstation connected to a local computer with internet access. As long as the handheld radios **1** are in range of the workstation the handheld radios can transmit and receive over the internet through the RF Gateway Software.
- 3** Push-to-Talk audio flows to and from the handhelds in range of the workstation to and from the internet hosting server.
- 4** A Fast Radios Connect Workstation at a second location connected to a local computer with internet access . As long as the handheld radios **5** are in range of the workstation the handheld radios can transmit and receive over the internet through the RF Gateway Software.
- 5** Handheld two-way radios in use at a second facility. Just like in **1** they can transmit and receive over the internet.
- 6** An Apple iPhone with the Fast Radios Connect app—is now a “soft radio” with a Push-to-Talk button on the display. Using data, not minutes, the iPhone can communicate with the handheld radios at any location with a FR Connect Workstation.
- 7** A desktop computer or lap top with an air card running the Fast Radios Connect Virtual Base Station (VBS) software can communicate with any of the other seats as long as it has a microphone and speakers.



Fast Radios
The Official Two-way Radio
Supplier for USA Luge

There can be multiple locations with workstations, multiple workstations at one location, multiple iPhone users and multiple virtual base station users. The “soft radio” application is available for several tablets and SmartPhones. Two-way radios are not required for SmartPhone or tablet or computer VBS use.

800-691-3970
www.FastRadios.com