TWO-WAY RADIO GUIDE

A Helpful Resource For Understanding Two-Way Radio Communication

Discount Two-Way Radio

EST 1997

WE KNOW RADIOS, SO YOU DON'T HAVE TO!

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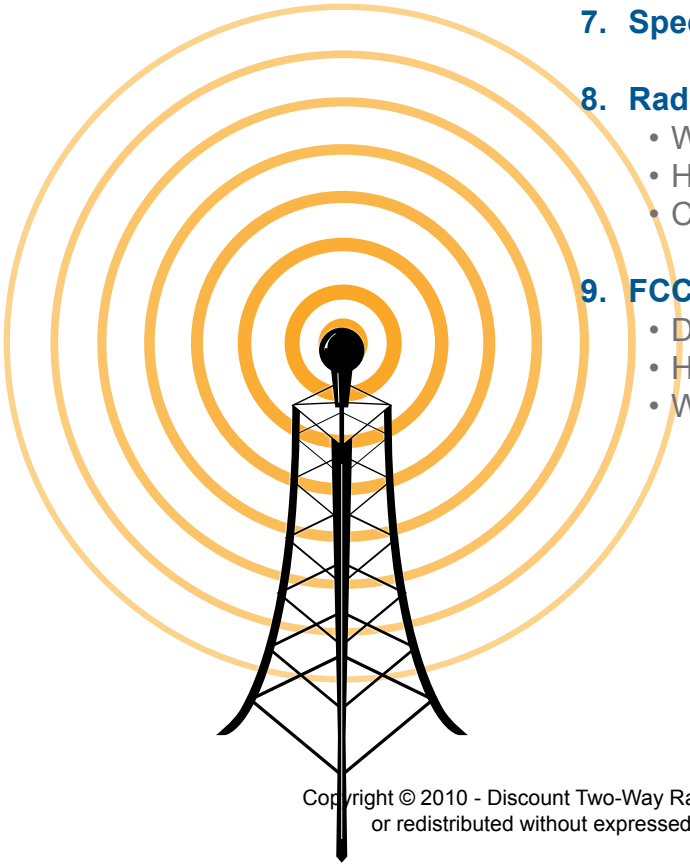

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1. Two Way Radios - Power, Durability, Range

Why would you pick one or the other?

You wouldn't if you already have an existing radio system. However, if you were starting from scratch, purchasing brand new radios, you would choose UHF. Why? Because in almost every situation, in all of the tests we have conducted, indoors and outdoors UHF works much better than VHF. UHF penetrates concrete and steel where as VHF just bounces off the walls and has difficulty penetrating. VHF is normally reserved for state and local law enforcement and UHF is reserved for business use. Although physics theory would suggest that VHF works better outdoors because it follows the curvature of the earth, in all the tests we have conducted, including line of sight, UHF has always outperformed VHF.

Why FRS and GMRS radios types don't really work in a business or industrial environment:

FRS and GMRS radios are consumer grade radios made of plastic that just breaks too easy in the most mild environments, such as a dental offices or day care centers, because FRS and GMRS are not made to perform 40 hours a week. In addition, the battery life just doesn't last long enough to make it through a normal work day. Many light industrial radio customers are initially satisfied with their FRS/GMRS purchase, but then the radios start falling apart and they have to start replacing them every few weeks. When using AA batteries with FRS/GMRS in a commercial environment just adds to the radio customer's frustration, since it is extremely tedious and annoying having to constantly change batteries every few days.

Making a sound investment in a real commercial radio that meets military standards for durability is not only a satisfying experience because you do not encounter the headaches that come with consumer grade radios, but you increase safety, productivity, and efficiency for your company or department by instant responses and understanding clearly what each co-worker is doing, which is a major asset when coordinating tasks or encountering safety issues.

Commercial radios normally include a two-year warranty and the rechargeable batteries that come with them have a one year warranty. Since they are made to withstand harsh conditions, they can endure the dropping and abuse that comes with forty hour industrial work weeks. They also have the option or come with a one hour rapid charger which is extremely critical when the radio customer works more than an eight hour shift. It is also beneficial if someone forgets to put their radio back in the charger at the end of their work day, doesn't put the radio in the charger correctly, the power goes out, or the charger wasn't plugged in correctly.

TYPES OF TWO-WAY RADIOS

PORTABLE RADIOS

Portable (handheld) - The most common two-way radio also called walkie-talkie or handie-talkie. It comes with a rechargeable battery and charger. They normally come in 2 watts (UHF and VHF), 4 watts (full power for UHF) or 5 watts and normally can cover a high-rise building without any additional expensive equipment to boost the signal.

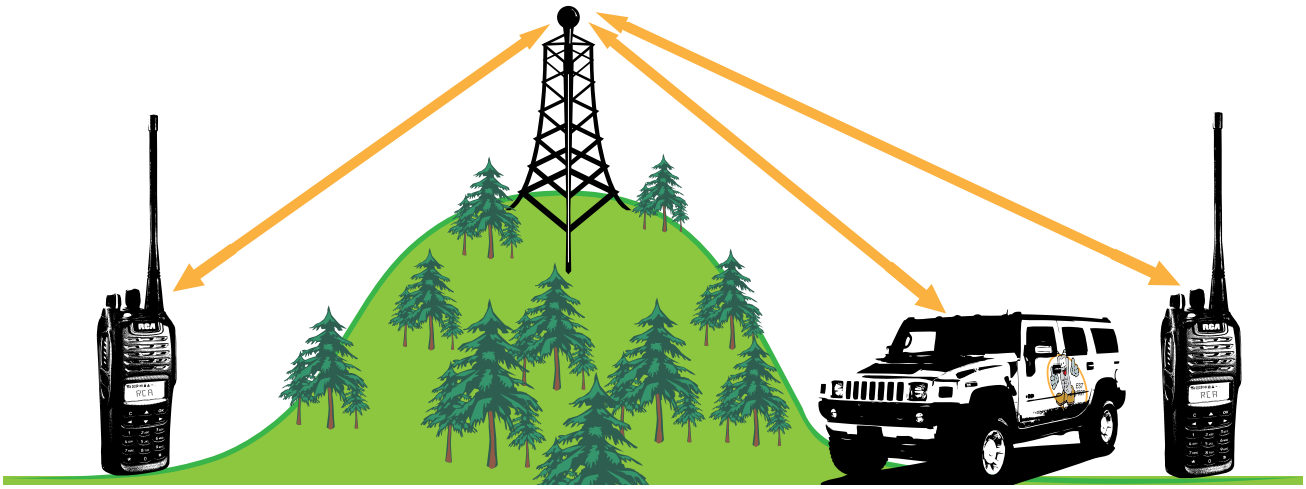
MOBILE RADIOS

Mobile radio (vehicle mounted) – Commonly used in fire fighting, law enforcement, EMS, taxi cabs, any type of shuttle bus or delivery vehicle. These radios are very high powered and come in 25, 50, and sometimes over 100 watts. These radios are used to cover great distances and are commonly used in conjunction with a repeater (similar to a cellular telephone tower) that state and local governments have installed at great expense.

DESKTOP BASE STATIONS

Desktop Base Stations (Radio that rests on a desk and plugs into the wall for power) is for radio users who are always at one location, do not want to have to deal with recharging batteries and do not want the radio to be misplaced or lost. Often used in office situations or manufacturing plants where the radio is operated from a desk or table top.

Do I need them?
How do they help?



Repeaters are electronic devices that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances without degradation. The repeater helps you to cover larger areas or really tall buildings in cases that you have dead spots or even problems covering a desired area. 50% of the time 4 Watts of Power "Econo" System will do the job at a cost of $1300.00. If not the total cost of a turnkey system along with the additional required licensing in most cases will be $3600 or less.

3. Wireless PA System

What are they for?

Wireless Public Address (PA) systems are useful when needing to broadcast important information over a wide area and/or to groups of people. Increasing communication, safety / security and productivity, a wireless PA system is the perfect cost effective solution when a hard-wired PA is impossible or too expensive to be installed, or if the application is only temporary. A wireless PA system receives the broadcast signal from your existing two-way radios, thus eliminating the need for trenching and running wires to connect your PA system.

How can I use them?

Designed for easy setup and simple usage, you will be able to transmit your messages to a large property or campus through the use of your two-way radio. This is the perfect solution for sending security, safety and emergency information, making announcements, and coordinating events in a large area.

Are they compatible with my radio system?

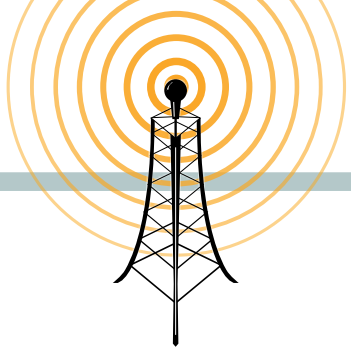
The wireless PA system is fully compatible with your existing two-way radio system, and can be configured into Multiple Zones for communication with specific areas of the property. Individual radios or channels can be programmed to transmit over the wireless PA system to ensure that only authorized users are allowed to transmit over the PA system.

Where can I use them?

Places and Applications:

Solar Panel systems provide you with cost-effective photovoltaic power that will keep your repeater and two way radio systems working efficiently in virtually any climate. These systems are useful in situations where electrical power from the grid is unavailable such as Rural Areas, Disaster Zones, Ski Resorts, Mountains, Deserts and Oil Fields. A simple Turn Key Installation eliminates the need for Trenching or Drilling!

5. Special Types of Radios



INTRINSICALLY SAFE

Intrinsic safety (IS) is an approved protection technique for safe operation of electronic equipment in explosive environments such as Chemical Plants, Oil Refineries and Gas Companies, where flammable liquids and gasses are present. Intrinsically safe radios are designed to ensure that the available electrical and thermal energy in a unit is always low enough to prevent ignition of a hazardous atmosphere.

WATERPROOF

These radios meet the IP67 standard for dust-tight and waterproof protection. This means they can usually withstand complete submersion in water up to 1m deep for up to 30 minutes, and they have a dust-tight construction that prevents dust from entering the unit.

P25 DIGITAL

Project 25 (P25) or APCO-25 refer to a suite of standards for digital radio communications for use by federal, state/province and local public safety agencies in North America to enable them to communicate with other agencies and mutual aid response teams in emergencies. Although developed primarily for North American public safety services, P25 technology and products are not limited to public safety alone and have also been selected and deployed in other private system application. P25-compliant systems are being increasingly adopted and deployed. Radios can communicate in analog mode with any other conventional two-way radios, and in either digital or analog mode with other P25 radios. P25 may be used in “talk around” mode without any intervening equipment between two radios, in conventional mode where two radios communicate through a repeater or base station without Trunking or in a Trunked mode where traffic is automatically assigned to one or more voice channels by a Repeater or Base Station.

TRUNKING

In two-way radio communications, Trunking refers to the ability of transmissions to be served by free channels whose availability is determined by algorithmic protocols. In conventional (i.e., not trunked) radio, users of a single service share a one or more exclusive radio channels and must wait their turn to use them. This can be likened to the operation of a group of cashiers in a grocery store, where each cashier serves their own line of customers. The cashier represents each radio channel, and each customer represents a radio user transmitting on their radio. When the grocery store gets busy, shoppers get backed up and congested as some cashiers have long lines and other cashiers sit idle. Trunked radio systems pool all of the cashiers (channels) into one group and use a store manager (site controller) that assigns incoming shoppers to free cashiers as determined by the store’s policies (TRS protocols). Trunking Systems are widely used by The Police, Fire Departments and all Government and State Administrations.

6. PL Tones / Codes

"PL Tones can be thought of as lanes on the highway"

-S. Vassilev / CTO Discount Two-Way Radio Corporation

WHAT DOES IT ALL MEAN?

A PL tone (Private Line tone) is a sub-frequency that filters out other radio user's transmissions on the same frequency in the area.

Each channel on your radio is programmed with a radio frequency. This is the frequency that it transmits and receives on.

Radio frequencies can be thought of as a highway. There are many cars that have to share the highway and PL tones can be thought of as the lanes on the highway. PL tones, or lanes, keep each radio user in their own lane so they can share the frequency or highway.

Frequency interference is usually only a problem in a large metro area where there are many radio users, just like in a large city where there is lots of car traffic.

When you have a PL tone on your channel it will filter out everyone else on the same frequency who is using a different PL tone so you won't hear them, and they won't hear you.

However, when someone else is transmitting on the same frequency, even when they are using a different PL tone, they tie up the frequency so you won't be able to transmit until the other person finishes transmitting. This can be thought of as a stop sign where only one car can cross the intersection at a time to prevent collisions or interference.

Of course, just like on a highway, occasionally collisions do happen. Once in a while there will be someone in the area who is using the same frequency and same PL tone (this is rare though) so you will hear them and they will hear you. This is why most radios are programmed with multiple channels so you can change channels if you are getting interference.

7. Special Signaling, Encryption and Scanning

SIGNALING- Standard two way radios use UHF and VHF Signaling bands in order to transmit data, this data is transmitted by a frequency or channel which serves as a physical medium or link carrying communicated information.

ENCRYPTION – Many two way radios have the ability to block out users transmitting on their frequency by adding an additional sub frequency as a form of encryption. This ensures only the intended users will be heard across the selected channel. On some radios it can also be used as a way to directly contact a specific user.

SCANNING – Radios often have a scanning option that can be programmed into a specific channel. This option allows the user to hear all conversations being transmitted on all channels currently programmed into their radio.

SIGNALING TYPE – Two way radios use various signaling methods to transmit packets of data. These packets of data may contain information about the radio itself, the user's location or even a specific set of commands. Examples of radio signaling are MDC 1200, single- tone, two-tone and CTCSS. This is also the technology used to encrypt radios and wirelessly control electronics.

MAN DOWN – This safety feature is available on radios capable of MDC1200 Signaling. The feature sends an alert to all radios operating on the same channel when a radio has been lying on its side for longer than the pre-allotted amount of time. If used with the appropriate base station this signal can even provide you with information about which radio is currently down. The feature alerts other users that a co-worker is in need of help even if the worker is unable to pick up his radio.

Will my existing radios work with my new radios?

How can we match them?

When considering purchasing new radios to add to an existing set of radios, there are two major points to be concerned with:

ARE MY EXISTING RADIOS VHF OR UHF?

Finding out if your radios are VHF or UHF can be as simple as looking at the Antenna. Many Antennas will have either VHF or UHF imprinted on them. You may also find this information on the box that your radios came in. If neither of these are the case you may want to try removing the battery from the radio and looking for a model number. Once you have found your model number you can call us here at Discount Two-Way Radio and we will be happy to pull up that information for you. **Just dial 800-895-5122 to immediately speak to our knowledgeable technicians.**

WHAT MHZ DO MY RADIOS OPERATE ON?

Your radios MHz rating identifies the bandwidth your radio is capable of operating in. (Think of this like cable TV Vs. Satellite TV. If your neighbor has satellite and you have cable he will have the ability to view channels you cannot and vice versa.) Now Imagine you could send messages through these channels, if you do not receive the same channels as your neighbor you obviously cannot send messages back and forth. The same is said for radios with different MHz bands.

Starting to seem a bit complicated?

No worries! Luckily your MHz band and VHF or UHF have a direct link. UHF frequency band used for two-way radio communication is between 380 and 512 MHz. The VHF frequency band used for two-way radio communication is between 136 and 174 MHz.

- **450–470 MHz:** Is the standard frequency range for use within the UHF band as well as, General Mobile Radio Service, and Family Radio Service two-way “walkie-talkies”.
- **150–174 MHz:** Is the “VHF Business band,” the unlicensed Multi-Use Radio Service (MURS), and other two-way land mobile/two-way “walkie-talkies.

Once you have identified this information you should be able to easily tell what type of radio you have and which type of radio will work with yours. Our programming team will take it from there, assuring your radios arrive ready for use!

9. FCC Licensing

DO I NEED AN FCC LICENSE?

The short answer is yes. The FCC requires a license for any operator operating two-way radios with an output greater than .5 watts. However, you can still order and use radios without a license. It is your responsibility to obtain a license from the FCC. We always recommend that you have a license to operate two-way Radios.

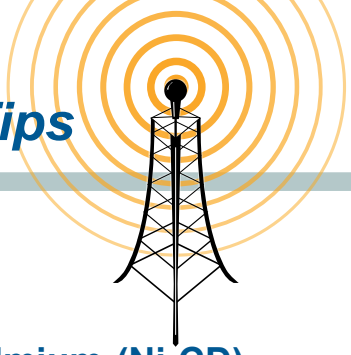
HOW CAN I APPLY FOR AN FCC LICENSE?

If you purchase radios from Discount Two-Way Radio Corporation and would like to apply for an FCC License, we can help! You can also apply for a license by going to http://wireless.fcc.gov/ or by calling 1-888-CALL-FCC.

WHAT IF I ALREADY HAVE AN FCC LICENSE?

If you already have a license we can program your radios to work with the frequencies given to you by the FCC. Whether you are ordering new radios or have existing radios we can program your radios to work with your licensed frequencies. If you have any questions about programming please call us at 1-800-895-5122.

10. Battery Types, Chemistries and Charging Tips



There are three main types of two-way radio batteries: Nickel-Cadmium (Ni-CD), Nickel-Metal Hydride (Ni-MH) and Lithium-Ion (Li-Ion). In order to choose the best battery, you have to consider environment, weather conditions and type of use to choose the battery which will work best for you.

	Ni-CD (Nickel-Cadmium)	Ni-MH (Nickel-Metal Hydride)	Li-Ion (Lithium-Ion)
Approximate Lifetime	up to 4 years*	up to 2.5 years*	up to 2 years
Memory effect	Yes	Much less than Ni-CD	No
Capacity	Low - Standard	Standard - Ultra High	Standard - High
Weight	Heavy	Medium	Light
Maintenance	Cycle the battery by fully charging it and then use it until it is completely drained as often as possible.	Cycle the battery twice a month.	No special maintenance needed.
Why you need it	• Extra Durable for use in harsh conditions (low temperatures, heat etc.) • Long lifetime (w/ right maintenance)	• Durable • Very high charge capacity	• Very light • Easy to maintain

*Ni-CD and Ni-MH batteries build up memory if not charged correctly and will last less than the specified time. These numbers can vary significantly depending on how the radios are used so please take this as a general guideline and not an absolute rule.

- Ni-CD batteries have the longest life span if they are well taken care of. This means using them until they are drained completely and then FULLY charging them. Customers who have taken good care of their batteries have reported using them for over 4 years.
- Ni-MH batteries typically last **2-2.5 years**. And this is without any special care.
- Li-Ion batteries trade light weight and high power for the shortest life span. Typically they last **1.5 - 2 years.**

Before you use your new batteries for the first time you must charge them fully. They should also be cycled – fully charged and fully discharged – 3 or 4 times before the batteries reach their peak performance and capacity. It is very important that you **do not charge the battery while the radio is turned on** *- this will dramatically shorten the life of your battery!*

If you are currently using a **rapid charger** (1 to 3 hour) you can use that charger with all three battery chemistries: Ni-CD, Ni-MH & Li-Ion.

If you have a **slow/overnight charger** you can only use it with Ni-CD & Ni-MH batteries. If you want to use Li-Ion batteries instead you will have to purchase a rapid charger.

11. Chargers

SINGLE VS MULTI-UNIT CHARGERS

Single chargers are usually included in the price of your two-way radios and provided with them. They can be slow, rapid or even have the capability to condition your batteries. They are perfect to use when you have a small group of users or in situation where the users are responsible of taking care of their own equipment. When you have many two-way radio users having single chargers becomes a major disadvantage as they take a lot of space and consume more energy which ultimately reflects on your energy bill – in this case Multi Unit Six Bank Chargers are recommended.

Multi-Unit Chargers have also slow, rapid and conditioning versions. Their usage is identical to the single unit chargers but they safe space and energy by charging up to 6 radios at a time. Greatly recommended to work environments with multiple departments or crews when you have many users and radios are typically left at a particular place at the end of the work day. They are usually sold as an option but they can be found in special packages sold with 6 radios and variety of different accessories. Typically a 10% discount is offered with the special packages.

STANDARD CHARGERS

A Standard charger is considered to be a slow / overnight charger. They are a little bit cheaper than the rapid chargers but also they need about 12 hours to charge your battery. Slow chargers continue to charge your battery even after it is fully charged. Over time this can shorten the life of your battery. With a slow charger it is important to remove the battery after it is fully charged to maximize the life of your battery.

RAPID CHARGERS

A Rapid Charger will charge your battery typically in 1 to 3 hours. Once the battery is fully charged it will switch to a trickle charge mode so that it does not overcharge your battery. Generally if you have a rapid charger (1 to 3 hour) you can use that charger with all three battery chemistries: Ni-CD, Ni-MH & Li-Ion. They are great solution for work environments with multiple shifts.

SMART CHARGERS / ANALYZERS AND CONDITIONERS

Smart chargers will typically charge your battery in the same amount of time as a Rapid charger but they will also discharge, analyze, condition, and perform cycle tests on your batteries. In most cases they will double the life of your batteries by preventing memory build up, overheating and overcharging. In most cases you can safely leave the battery on the charger for extended periods of time without the risk of overcharging.

What about the antenna?

The performance of an antenna is an important factor in the range and coverage of radio signals. Antennas have practical uses for the transmission and reception of radio frequency signals. Electromagnetic waves are frequency electrical currents when an antenna is receiving a signal. Frequency electrical currents turn into electromagnetic radio waves when it's signaling out. The type of frequency is what determines the size of the radio wave. If a radio frequency is 450.00MHz it means it will give a wave of about 2 feet long. Radio manufacturers learned that if the antenna is close to the size of the wave length it will work better. For example a 6 foot long antenna will give you a good reception and transmission for a radio wave that might be 4 to 8 feet in length. Also, antennas can be half the size of the wave length and still work. The reason is that the antenna might be coiled around an antenna mast. Most of our radios come with stubby antennas. Stubby antennas are full size antennas, but its spiral is coiled around the mast to make it shorter looking.

PORTABLE UNIT ANTENNAS

Handheld (portable) units have antennas that connect to the top of the unit via a screw in connector. They have long and short style antennas available that can be interchangeable depending on your need or application.

MOBILE UNIT ANTENNAS

Mobile unit antennas mount to the roof of your vehicle using a powerful magnet or bolt-on configuration. The magnetic connection makes it easier to remove and replace the antenna when needed, while the bolt-on connection makes it's placement permanent.

REPEATER ANTENNAS

Repeater antennas are used with your Two-Way Repeater System to increase your two-way radio coverage. Typically they are made of heavy duty fiberglass and come in different styles, sizes, frequency ranges and amplifications. They are usually mounted to a pole using a metal bracket and can be easily moved if necessary.

13. Accessories

HOLSTERS

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 from your belt. When you use a case and a speaker mic 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.

SPEAKER MICS

Speaker mics come in several different styles and sizes but in general they 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 mic is called a shoulder style speaker mic. Speaker mics allow the user to send messages without taking the radio off their belt. Additionally speaker mics move the sound closer to the user's ear in a noisy environment.

HEADSETS

A headset is a headphone combined with a microphone. Headsets provide the equivalent functionality of a two-way radio handset with hands-free operation. They come in different styles and mainly are divided into two groups:

High Noise Reduction Headsets for use in high noise environments such as Airports, Manufacturing Plants and Racing Teams.

Lightweight Headsets are usually very light, less visible and more comfortable. They have only one earphone and in most cases will be best for Tour Guides, Restaurants and Hotels.

SURVEILLANCE KITS

Surveillance kits allow users to privately receive messages through an earpiece and are ideal when environments require discreet communication. Standard surveillance kits usually consist of an earpiece that wraps around the ear, a small microphone and a small PTT (Push-to-Talk) button. Surveillance kits come in many different shapes and sizes and are typically one, two or three wires depending on the style.