

how to choose a commercial
intercom
system
or two way radio



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How to Choose a Commercial Intercom System or Two Way Radio.

By [David Onslow](#)

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Introduction

This book is about using intercom systems, two-way radios, and other communication devices for improving communication in your business. The results of this improved communication will vary, but depending on your application, they can include increased safety, improved productivity, better customer or employee satisfaction, increased profits, or other benefits.

While intercom system usage declined from where it was in the 60s or 70s when it was cool to install a system in your house, there are still lots of applications where they work better than any other solution. Sure you can use telephone systems and cell phones to communicate, but there is no faster way to communicate than just pressing a single button and not having to worry about a misplaced a cell phone, dead batteries, or dialing a phone number.

This book will show you applications for intercoms that you've likely never thought of. We will also show you products that you likely didn't know existed and ways you can use them to your advantage.

Since you likely have a specific need, start by searching the index for sections of this book that sound like they would meet that need and just read those. Many sections have links to relevant videos so it is best to read this book on a PC with an Internet connection.

Commercial Intercom Systems

Often when a business is looking for a commercial intercom system, what they really need is a telephone system along with an external paging system. The telephone system allows employees to either call specific areas of the building, or with an external paging amplifier and speakers, they can page the entire building. A door phone can be added to the telephone system to enable visitors to an external door of the building to press a button to call someone inside, and that inside person could press a button to unlock the door.

However, there are times where a telephone system is not what is needed. Telephone systems are expensive and the labor required to run the wires throughout the building is just as expensive.

If all that is wanted is the door phone application, then you can get an intercom system that has a single outdoor monitor along with a desktop or wall mounted indoor station. Then there is only one wire to run between the door and the inside station. Or you can also choose a wireless intercom for this application.

Sometimes there are just a few areas of the business where some form of communication is needed and there is no desire to run wires to them. That's where a wireless commercial intercom is needed.

One problem with a wireless intercom in many commercial intercom applications is that the environment is more challenging for the wireless equipment. In manufacturing companies there is a lot of equipment that may produce interference. The building construction often consists of metal framed walls and more electrical wiring to handle office equipment. Many commercial buildings are made of concrete walls and floors. These conditions will greatly reduce the range of a wireless intercom.

So when you look for wireless commercial intercom systems you want to make sure a system has a much longer range than you actually need. The longer range the intercom system has, the more power it has to overcome the obstacles in a commercial environment.

If you're looking for a wired intercom you may just want to skip to the wired intercom sections of this book. Since the majority of people are looking for wireless and the question of how far they communicate is one of the top questions, we suggest you read the next section.

Wireless Intercom and 2-Way Radio Range: How Far Can They Communicate?

If you're going to sell long-range wireless products, you'll need a basic understanding of wireless frequencies and communication distances, which is covered here.

One of the most common questions people ask when they are in the market for a two-way radio or wireless intercom is how far do they communicate? Unfortunately asking this question is along the lines of asking, "How far is up?" There are lots of variables involved and no easy, definitive answer. A brief lesson on radio signal transmission is required to understand the whole range issue.

If you are old enough to remember when AM radio was popular you may remember listening to radio stations that were hundreds of miles away. For frequencies like these below 2 Megahertz (MHz), these signals follow the Earth's curvature because they are reflected off the atmosphere. AM radio signals in low-noise environments can be received by radios that are way below the horizon hundreds of miles away.

The two-way radios and intercoms available for you to purchase usually fall in the frequency range of 150MHz to 900MHz. Unlike the AM radio waves, radio waves in these frequencies travel in straight lines and as a general rule cannot travel over the horizon or behind solid obstacles.

But as in all general rules, there are exceptions to the rules. Even though these frequencies travel via "line-of-sight" paths, radio signals can travel through many non-metallic objects and be picked up through walls or other obstructions. Even though we can't see between antennas of a transmitter and receiver, this is still considered line-of-sight to the radios. Also, radio waves can be reflected, or bounce off surfaces so the straight line between radios, may not always be so straight.

Knowing that our radio waves travel in straight lines, then to figure out their maximum range for a two way radio we have to factor in the curvature of the Earth. When you stand on Earth and press the talk button on your radio, the radio waves are going straight and they will eventually just go straight off into space once they pass the horizon. So the distance of the horizon is technically the maximum communication range for a two way radio. But you have to factor in antenna height as well.

To find the line of site distance to the horizon for a given antenna height we can use this formula: horizon in kilometers = 3.569 times the square root of the antenna height in meters. Figure 1 below illustrates this formula.

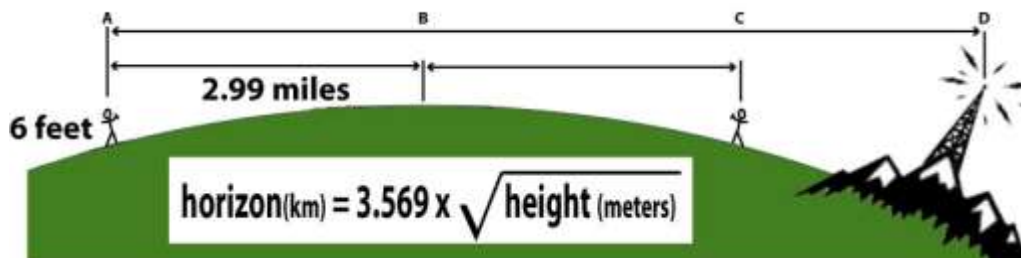
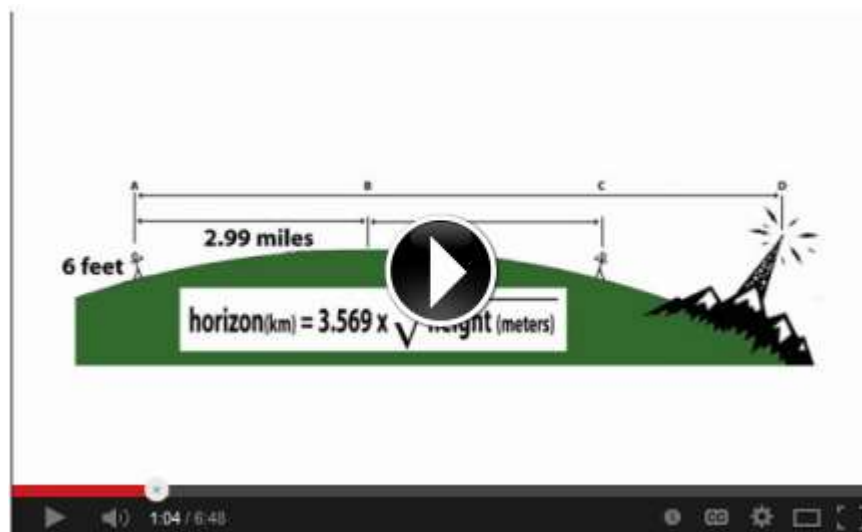


Figure 1

So if the antenna height of a radio is at 6 feet, or 1.82880 meters tall, the horizon is 4.83 kilometers, or 2.99 miles away, which is Point B in the illustration. Of course this calculation assumes the receiving antenna is lying directly on the ground so raising the height of it would extend line of site.

Point C in the illustration shows another radio with the antenna at 6 foot so theoretically you should be able to communicate almost 6 miles. So realistically, for two people carrying a handheld two-way radio, the maximum communication distance on flat ground with no obstructions is around 4 to 6 miles.



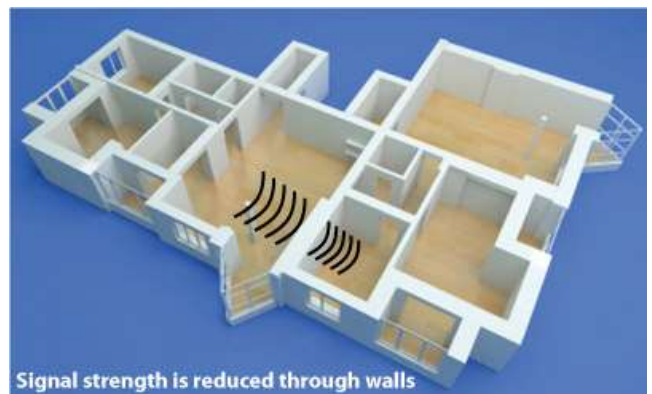
You may be wondering why you see radios that have range claims of 25 miles or higher. Technically they could communicate that far. Point D on Figure 1 shows a tower sitting on top of a mountain. If you are standing on top of this tower, now your antenna height overcomes a whole lot of the Earth's curvature and you can communicate much further.

There are other factors that affect the range of a two-way radio too such as weather, exact frequency used, and obstructions. The radio's power output has a factor too.

Radio Power

Another important factor in the distance a two-way radio or wireless intercom will communicate is its power output. This power output is measured in “watts.” You’ve likely heard an FM radio station say they are broadcasting at 50,000 or 100,000 watts. Well, a handheld business-type two-way radio usually broadcasts at 1-5 watts. A vehicle mobile radio may broadcast anywhere from 5 to 100 watts. The more watts a radio has, the farther it can transmit.

Why is this? When water moves through a pipe it loses pressure along the way. When electricity flows along a wire it loses current. When an object is rolling, it will eventually stop rolling due to friction. Radio waves operate by the same laws of physics as everything else so there will be signal loss along the way. But if you apply more water pressure, more electrical current, or get the rolling object moving faster, you'll get more distance out of all of them. The same is true for a radio signal.



Increasing the power in watts at the source helps overcome any "resistance" along the way.

Keep in mind that for battery-powered handheld radios more watts are not always a good thing. The higher the wattage, the quicker your batteries run down.

Radio Frequencies

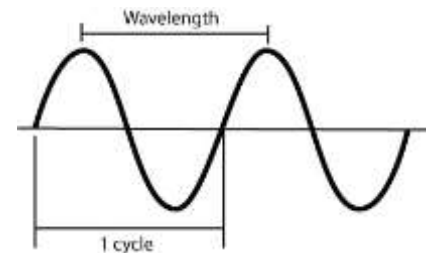
One more factor in determining how far a two-way radio will communicate is the frequency it uses and the environment that frequency is used in.

There are two major formats for most two-way radios. They are Ultra High Frequency (UHF) radio and Very High Frequency (VHF) radio. Neither frequency band is inherently better than the other. They each have their pluses and minuses. Both formats are effective ways to communicate with another person so deciding on the right radio for you depends on your application.

Two-way radios communicate with each other through use of radio waves. Radio waves have different frequencies, and by tuning a radio receiver to a specific frequency you can pick up a specific signal.

Radio waves are transmitted as a series of cycles, one after the other. You will always see the "Hz" abbreviation used to indicate the frequency of a radio. Hertz is equal to one cycle per second.

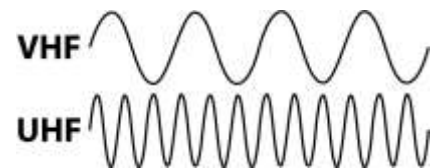
Radio waves are measured by kilohertz (kHz), which is equal to 1000 cycles per second, or megahertz (MHz), which is equal to 1,000,000 cycles per second--or 1000 kHz. The relationship between these units is like this: 1,000,000 Hertz = 1000 kilohertz = 1 megahertz.



You may also hear the term "wavelength" when you hear about radio waves. This term is from the early days of radio when frequencies were measured in terms of the distance between the peaks of two consecutive cycles of a radio wave instead of the number of cycles per second. Lower frequencies produce a longer wavelength (the width of each cycle gets bigger on lower frequencies).

What is significant about wavelength for two-way radios is that it affects transmission range under certain conditions. A longer wavelength, which corresponds to a lower frequency, as a general rule lets a radio signal travel a greater distance.

Lower frequencies or longer wavelengths also have greater penetrating power. That's one of the reasons they are used for communicating with submarines. VLF (Very Low Frequency) radio waves (3–30 kHz) are used to penetrate sea water to a depth of approximately 20 meters. So a submarine at shallow depth can use these frequencies.



So from what you read above you may think VHF is always the better choice for a two-way radio no matter where you are using it since it has a lower frequency than UHF and the signal can travel a greater distance. That's not necessarily true. Even though VHF has better penetrating capabilities and can travel farther, that doesn't necessarily make it the better choice for use in buildings. Remember the conversation about wavelength above? Wavelength has a big impact on transmission distance.

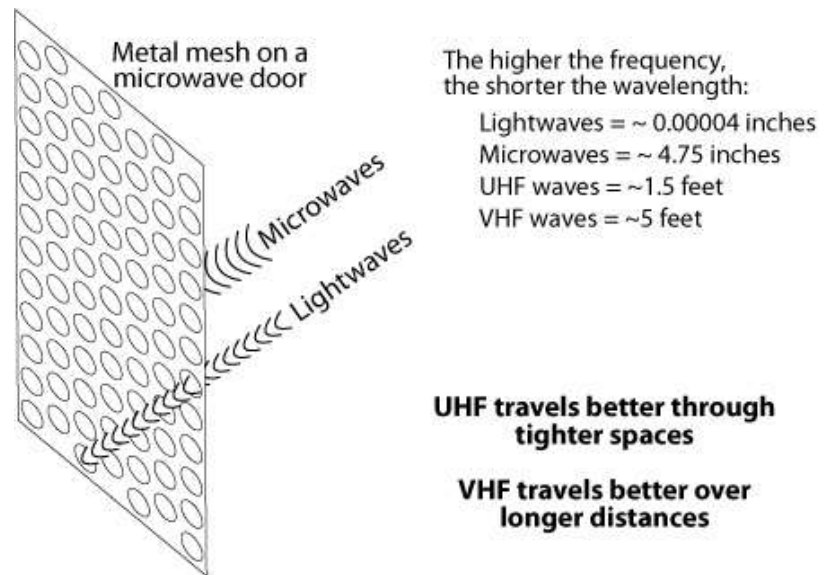
To explain this let's assume we are communicating from one side of a metal commercial building to the other. In between these two points is a metal wall with a three foot doorway. Metal is an enemy to radio waves and they typically don't pass through it.

For our example let's assume that the UHF wavelength the radio uses is about a foot and a half wide and a similar VHF radio is around five feet wide. These are in the ballpark of their normal wavelengths.

When the UHF radio transmits its signal the foot and a half wide wave will pass through the door since the door is wider than the wavelength. The VHF signal will be totally reflected since it is wider than the opening of the door.

Your microwave oven provides an example of this. The glass front door has a metal mesh with very small holes. Microwaves being an extremely high frequency have wavelengths that are only several inches long. The mesh keeps the microwaves trapped in the oven but it allows you to see inside because light waves have a microscopic wavelength.

Just imagine walking through the building carrying a five foot wide pole. You will encounter the same challenges a VHF signal encounters. Now imagine walking through the building with a pole that's only a foot and a half wide like a UHF wave. There are lots fewer doorways you couldn't get through.



The one caveat is that wireless signals will penetrate through drywall, masonry, human bodies, furniture, wall paneling, and other solid objects. All these objects will reduce the signal strength though. The more dense the object, the more it reduces the signal. VHF will penetrate these obstacles better than UHF, but that doesn't necessarily mean that VHF is better for indoor applications as we continue to discuss the reasons why in the UHF section below.

In our example above we assumed you had a metal wall with an opening. If you reverse this and you have a three foot metal object in front of the transmitting radio, then VHF would win. Since the object is three foot wide it will totally block the UHF signal whereas the VHF signal will get around it. Lower frequencies such as VHF diffract around large smooth obstacles more easily, and they also travel more easily through brick and stone.

For most applications, lower radio frequencies are better for longer range. A broadcasting TV station illustrates this. A typical VHF station operates at about 100,000 watts and has a coverage radius range of about 60 miles. A UHF station with a 60-mile coverage radius requires transmitting at 3,000,000 watts.

So there is no clear choice for which is better, VHF or UHF. There is a lot of "black magic" to radio technology so it's not always easy to tell which will work better for your application. To help you decide on the best technology for you, more detail about each one is included below.

UHF Radio

The UHF radio band for commercial radios is between 400 to 512 MHz. Until not long ago, it wasn't widely used. Now, the UHF radio frequency is used for two-way radios, GPS, Bluetooth, cordless phones, and WiFi.

There are more available channels with UHF so in more populated areas UHF may be less likely to have interference from other systems. The range of UHF is also not as far as VHF under most conditions, but this reduced range may be a positive in some cases. Since UHF has lower range, there is less chance of distant radios interfering with your signal.

While VHF may be better at penetrating physical barriers like walls that doesn't mean it will give you greater coverage in a building. The shorter wavelength of UHF means that it can find its way through more spaces in your building as we discussed above. In the walking around with a pole example we gave you, the UHF signal has fewer obstacles that totally block it.

To highlight the differences in indoor range, below is an excerpt from a brochure of a leading two-way radio maker on the predicted range of one of their lines of handheld VHF and UHF two-way radios:

“Coverage estimates: At full power, line-of-sight, no obstructions the range is approximately 4+ miles. Indoor coverage at VHF is approximately 270,000 sq ft and 300,000 sq ft at UHF. Expect about 20 floors vertical coverage at VHF and up to 30 floors at UHF. Note: Range and coverage are estimates and are not guaranteed.”

The greater wavelength of VHF makes it more difficult for it to bounce its way through walls, buildings and rugged landscape. Therefore range will be reduced for VHF radios in these environments. That may not necessarily be a problem if the range needed is only a few hundred feet. You can also add an external antenna to an indoor VHF base station that will reduce or eliminate some of the problems encountered.

One of the downsides to UHF is that the FCC requires you to get a license to operate in these frequencies, although many frequencies in the VHF business band also require a license too. If you choose a radio in the VHF MURS frequencies you can operate it without a license (discussed below in the VHF section).

One other advantage of the short wavelength that is produced by the higher UHF frequency is that the antenna on the radio can be shorter than an equivalent VHF radio. That can make it more convenient to carry around as a portable radio, although most manufacturers find a way to make the antennas shorter on their VHF portable radios as well.

VHF Radio

FM radio, two-way radios, and television broadcasts operate using VHF. The VHF radio band specifically for commercial radios is between 130 – 174 MHz.

Both UHF and VHF radios are prone to line of sight factors, but VHF a little more so. The waves make it through trees and rugged landscapes, but not always as well as UHF frequencies do. However, if a VHF wave and a UHF wave were transmitted over an area without barriers, the VHF wave would travel almost twice as far. This makes VHF easier to broadcast over a long range.

If you are working mostly outdoors, a VHF radio is probably the best choice, especially if you are using a base station radio indoors and you add an external antenna. The higher you can place the antenna, the further you can transmit and receive. One exception to using a VHF radio outdoors is if you are using it in a heavily wooded area. Under these conditions a UHF radio may be able to transmit better through the trees.

VHF radios also have a smaller number of available frequencies. Interference with other radios could be more likely to be a problem. However, the FCC recently made this less of a problem when they opened up a two-way radio spectrum called the MURS service. MURS stands for Multi-Use Radio Service. This service is for use in the United States and some countries that follow FCC regulations. It is a low power, short range service in the VHF 150 MHz radio spectrum. There are 5 channels in the MURS frequencies with 38 privacy codes under each one that enable you to only pick up conversations from radios transmitting your code. The FCC does not require users of products for MURS to be licensed.

With MURS you can add a larger or external antenna to improve range. If you want to put an antenna on top of your building or a tower, you can do it with MURS. Some antenna manufacturers claim an external antenna can increase the effective radiated power of a transmitter by a factor of 4. These MURS intercoms can transmit up to several miles, and perhaps more with an external antenna depending on the terrain and height of an antenna (the antenna can be up to 60 feet above the ground). See the MURS Technology Guide below for more info on MURS.



One benefit of VHF wireless radios is that battery life is almost always better than for similar UHF units. For handheld radios this is a plus.

In summary, if you are planning on using your two-way radios mainly inside buildings, then UHF is likely the best solution for you, but in lots of applications VHF could still work fine since it doesn't have to transmit far. If you are mainly using your two-way radios for communication outside, then VHF would be a good choice, unless the area you are covering is heavily wooded or there are lots of buildings in the way of the radio signal.

Either radio technology can work for you if you don't really have a long range to cover. There are also repeaters you can install that relay a UHF signal, but this is usually very complex to do. You may be able to find a repeater service in your city that will do this for you for a monthly fee. For most applications a repeater is not necessary and VHF or UHF radios by themselves will do the trick.

MURS Wireless Intercom

This wireless intercom system is not so much of a system from one manufacturer as it is a compilation of wireless intercoms and two-way radios. This "system" is based on compatible products in the MURS radio frequency. As talked about above, MURS stands for Multi-Use Radio Service and is a two-way radio service consisting of five frequencies in the VHF (Very High Frequency) spectrum. Unlike most frequencies in the VHF range, MURS does not require an FCC license to operate.

Even though there are only 5 channels, each channel can choose between one of 38 "quiet codes" or sub-channels to keep you from hearing conversations of other users on that channel. You will only hear conversations from radios set to the same channel and quiet code as your radio. In most areas the MURS frequencies are very lightly used so you won't find a lot of competition for the airwaves.

The biggest benefit of [MURS intercoms](#) is the range they offer. Some manufacturers claim a range of four miles. Of course this range is a line of sight with no obstructions between intercoms. Range can even be increased with these



intercoms by adding an external high-gain antenna on top of your business, or even a car if you use a unit there.

What's nice about MURS is that you can get handheld two-way radios, commercial-duty base station and outdoor intercoms/callboxes, and even motion detectors that transmit a verbal alert message to other MURS devices. For business, industrial, or commercial applications a MURS system excels since it can overcome a lot of interference and obstacles these applications present.

If you need a wireless PA (public address) system, there is a wireless PA device that works with all the MURS radios. For retail business that service customers directly, there is even a wireless MURS device that enables customers to press a button and call for assistance via a transmitted recorded message.

Since any manufacturer can create a MURS wireless device, choosing a MURS system keeps you from being locked in to whatever products a particular manufacturer chooses to offer.

MURS Radio...Multi-Use Radio Service Technology Guide

On May 23, 2002, the Federal Communication Commission (FCC) in the United States updated their rules regarding five Industrial/Business Pool VHF frequencies known as the VHF "color dot" frequencies. These frequencies were moved from Part 90 to Part 95 and became a new Citizens Band Radio Service (CB) named the Multi-Use Radio Service (MURS).

The Commission defines MURS as a private, two-way, short-distance voice or data communications service for personal or business activities of the general public. The FCC defines short distance this way: "The usual range of communications between MURS devices is less than a few miles; connecting the unit to an external antenna can extend the range to ten miles or more." The range you actually achieve could be far less depending on your surroundings and height of receiving and transmitting antennas.

The most common use of MURS spectrum is for two-way communications using small, portable hand-held devices that function similar to walkie-talkies. See the section titled MURS Products for a description of available devices.

No License Required

The Multi-Use Radio Service (MURS) is "licensed by rule". This means an individual license is not required to operate a MURS device. You can operate a MURS device regardless of your age and for personal or business use so long as you are not a foreign government, representative of a foreign government, and you operate it according to the rules.

Channel	Frequency	Bandwidth
1	151.820 MHz	11.25 KHz
2	151.880 MHz	11.25 KHz
3	151.940 MHz	11.25 KHz
4	154.570 MHz	20.00 KHz
5	154.600 MHz	20.00 KHz

The channels authorized to MURS systems are available on a shared basis only and will not be assigned for the exclusive use of any entity. Those using MURS transmitters must cooperate in the selection and use of channels in order to reduce interference and make the most effective use of authorized facilities. Channels must be selected in an effort to avoid interference to other MURS transmissions. All communications on MURS must yield to any emergency communication on the same channel.

The frequencies available in the Multi-Use Radio Service are shown in the table.

Authorized Locations

MURS operation is authorized:

- Within or over any area of the world where radio services are regulated by the FCC. Those areas are within the territorial limits of:
 1. The fifty United States
 2. The District of Columbia

Caribbean Insular areas:

 3. Commonwealth of Puerto Rico (see rules below if near the Arecibo Observatory)
 4. Navassa Island
 5. United States Virgin Islands (50 islets and cays)

Pacific Insular areas:

 6. American Samoa (seven islands)
 7. Baker Island
 8. Commonwealth of Northern Mariana Islands
 9. Guam Island
 10. Howland Island
 11. Jarvis Island
 12. Johnston Island (Islets East, Johnston, North and Sand)
 13. Kingman Reef
 14. Midway Island (Islets Eastern and Sand)
 15. Palmyra Island (more than 50 islets)
 16. Wake Island
- Any other area of the world, except within the territorial limits of areas where radio services are regulated by:
 1. An agency of the United States other than the FCC (You are subject to its rules.)
 2. Any foreign government (You are subject to its rules.)
- Aboard any vessel of the United States, with the permission of the captain, while the vessel is traveling either domestically or in international waters.
- MURS operation is NOT authorized aboard aircraft in flight.

Operating MURS Near Arecibo Observatory in Puerto Rico

Anyone intending to operate a MURS unit on the islands of Puerto Rico, Desecheo, Mona, Vieques, and Culebra in a manner that could pose an interference threat to the Arecibo Observatory shall notify the Interference Office, Arecibo Observatory, HC3 Box 53995, Arecibo, Puerto Rico 00612, in writing or electronically, of the location of the unit. Operators may wish to consult interference guidelines, which will be provided by Cornell University. Operators who choose to transmit information electronically should e-mail to: prcz@naic.edu.

The notification to the Interference Office, Arecibo Observatory shall be made 45 days prior to commencing operation of the unit. The notification shall state the geographical coordinates of the unit.

After receipt of such notifications, the Commission will allow the Arecibo Observatory a period of 20 days for comments or objections. The operator will be required to make reasonable efforts in order to resolve or mitigate any potential interference problem with the Arecibo Observatory. If the Commission determines that an operator has satisfied its responsibility to make reasonable efforts to protect the Observatory from interference, the unit may be allowed to operate.

MURS in Canada

In Canada, many commercial/industrial mobile and public safety licensees are authorized on the five MURS frequencies. A large number of these frequencies are licensed on a private/commercial basis. The remaining users are made up of government (i.e. municipal, provincial or federal government) and public safety (i.e. police, fire and ambulance). It is expected that the operation of MURS devices will cause, in certain situations, harmful interference to land mobile use. Also, operation of MURS devices could, in certain situations cause interference to users on adjacent land mobile frequencies, as set out in the suballocation channelling plan in Standard Radio System Plan 500, Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 138-144 MHz and 148-174 MHz (SRSP-500).

Industry Canada (IC) established a long transition period for licensed incumbents before permitting the sale and distribution of MURS devices for consumers. In accordance with Spectrum Utilization Policy Gen, General Information Related to Spectrum Utilization and Radio Systems Policies (SP-Gen), a five-year transition period from the issuance of the spectrum policy was proposed. Notification has been provided to licensed incumbents at the start of the transition period (Year 0) and will again two years before the end of the transition period (starting at Year 4).

This plan will permit the use of MURS in Canada starting June 2014. IC has not yet published rules for MURS, other than frequency limits.

MURS Rules

- You can operate a MURS device in any place where the FCC regulates radio communications.
- FCC Rules require that you transmit on a MURS frequency only with a radio model certificated for MURS.
- You do not need to identify your MURS station by any particular call sign or other designation.
- A MURS device must be certified by the FCC. A certified MURS device has an identifying label placed on it by the manufacturer.
- None of the MURS channels are assigned for the exclusive use of any system. You must cooperate in the selection and use of the channels in order to make the most effective use of them and to reduce the possibility of interference.
- No MURS unit, under any condition of modulation, shall exceed 2 Watts transmitter power output. No power boosters are allowed, but there is no limit on antenna gain.
- A MURS station is not required to transmit a station identification announcement.
- MURS stations may transmit voice or data signals as follows: A MURS transmitter must transmit only emission types A1D, A2B, A2D, A3E, F2B, F1D, F2D, F3E, G3E. Emission types A3E, F3E and G3E include selective calling or tone-operated squelch tones to establish or continue voice communications. (Info on emission types: http://en.wikipedia.org/wiki/Types_of_radio_emissions)
- ALL A3E emissions are limited to 8 kHz.
- Bandwidth transmissions of a maximum of 11.25 KHz per channel bandwidth, with +/- 2.5 KHz deviation are permissible on all five MURS channels. The older +/- 5 KHz deviation signals (with a maximum 20 KHz channel bandwidth) are also permitted (but not required) on the two upper channels (in the 154 MHz band).
- Emissions other than A3E on frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz are limited to 11.25 kHz.
- Emissions other than A3E on frequencies 154.570 and 154.600 MHz are limited to 20.0 kHz.
- Data communications in MURS can only occur on radios certificated for data communications, or of those transmissions otherwise comply with the rules and those transmissions can be imposed on a

conventional voice emission. You may not make any internal modifications or additions to a MURS radio to transmit data communications.

- MURS frequencies may be used for remote control and telemetering functions.
- The FCC prohibits image, video, and radio-facsimile transmissions on MURS.
- The FCC rules do not address transmission of music over MURS.
- MURS transmitters may not be operated in the continuous carrier transmit mode. (The FCC has not yet defined what "continuous" means or yet set specific transmitter time limits)
- MURS users shall take reasonable precautions to avoid causing harmful interference. This includes monitoring the transmitting frequency for communications in progress and such other measures as may be necessary to minimize the potential for causing interference.
- Antenna height is limited to 20 feet above a structure or 60 feet above ground, whichever is the greater.
- MURS stations are prohibited from operating as a repeater station or as a signal booster. This prohibition includes store-and-forward packet operation.
- MURS stations are prohibited from interconnection with the public switched network. Interconnection Defined: Connection through automatic or manual means of MURS stations with the facilities of the public switched telephone network to permit the transmission of messages or signals between points in the wireline or radio network of a public telephone company and persons served by MURS stations. Not considered to be interconnection: Wireline or radio circuits or links furnished by common carriers, which are used by licensees or other authorized persons for transmitter control (including dial-up transmitter control circuits) or as an integral part of an authorized, private, internal system of communication or as an integral part of dispatch point circuits in a MURS station.

Military use of MURS Radios

In some military applications, two-way radios normally require a frequency clearance via a DD 1494, APPLICATION FOR EQUIPMENT FREQUENCY ALLOCATION before they can be used. However, if a DD 1494 is submitted using radios on MURS frequencies, the it will be rejected because the MURS frequencies are not allocated for federal usage.

Even though the MURS frequencies are not allocated for federal usage, regardless they can be and are still used by government and military agencies.

The five MURS frequencies are "licensed-by-rule" which means they do not require the user to obtain a license. Therefore even government agencies do not need a frequency clearance for MURS devices.

For military applications, there may still be a need to evaluate [MURS radios](#) for Hazards of Electromagnetic Radiation to Ordnance (HERO) Impacts for each facility due to the types of ordinances stored there.

MURS Products

MURS devices are not limited to just handheld two-way radios. There are a variety of devices available as detailed below:

Handheld Radios: There are a few [handheld two-way radios](#) that have MURS capability. These operate like any two-way radio, but specifically use the MURS frequencies.

Base Station Intercoms: a [base station intercom](#) is essentially a handheld two way radio in a desktop form. Instead of holding it in your hand it sits on a horizontal surface, or in some cases it can be wall-mounted.

Wireless Call Boxes: A [wireless call box](#) uses two-way radio technology in a water resistant housing that can be used outdoors. Vandal proof versions are available as well.

Wireless Public Address: A [wireless public address system](#) uses receive only two-way radio technology. You can use a base station intercom or two-way radio to make announcements from long distances.

Wireless Switch Control: A [wireless switch control](#) device is used for any ideal for any application where a contact closure is needed to remotely control a light, turn on/off a pump, activate a siren, or other application.

Voice Notification Wireless Monitor: A [voice notification wireless monitor](#) is a wireless radio transmitter that reports changes in the status of switches by transmitting user-recorded voice messages to handheld two-way radios or base station intercoms. It transmits a recorded voice message when the switch change occurs, and at intervals you select.

Wireless Customer Service Intercoms: A [customer service intercom](#) provides a fast, and easy wireless method for customers to summon a sales associate to a specific department or store location. When a customer presses the button on the intercom, it transmits user-recordable voice messages to two-way radios, wireless intercoms, or a wireless PA system.

Motion Sensor Devices: A [motion sensor device](#) can detect people, vehicles, or large animals, and then send an alert message to the MURS base station or handheld.

Wireless Call Box

When you need a way for clients, students, employees, or anyone else to communicate with you from distant areas of your campus or property, a [wireless callbox](#) or call box is one way to do it. A call box is a box made of metal or fiberglass that contains electronic circuitry that enables someone to press a button or pick up a handset and call a central location for assistance. Some callboxes also allow calling a portable radio so that assistance can be mobile.

There are two main types of callbox units available, wired and wireless. A wired callbox involves running a cable to it from the central location. This section is about the other kind, the wireless units.



The benefit of a wireless callbox is that you save money by not having to do trenching and running expensive cable to the unit. You also don't have to pay any air-time or telephone service fees with these wireless systems. As mentioned, another benefit is that since the unit is wireless, people monitoring the units can carry handheld 2-way radios that communicate with the callbox. That allows your monitoring people to be mobile.

The range of these units is several miles, which can be extended by adding an external antenna. Some units can use radio repeaters to extend this range even more.

If you have existing two-way business radios, you'll want a system that can integrate with them. Some callboxes can be programmed to be compatible with virtually any brand of VHF or UHF business band radio.

You can get call boxes that require an FCC license, or you can get units that are certified for use on special FCC License-Free MURS Business Frequencies.



One problem you may have in placing a call box is the lack of available power. You'll want to choose a system that lets you use battery or AC power. You can also get units that have optional solar power so that they can run for several days on a single day of sunshine.

If you need to remotely control gates, magnetic door locks, or barrier arms from your portable 2-way radio or desktop base station intercom, then select a unit that has this capability. With this ability you can let someone in a gate or door when they call you. There are units that also let you turn on a strobe light at the callbox location to help draw attention to it.

Another useful feature is the ability for call boxes to store a voice message that is played when someone presses its button. This could be a message that gives the caller specific instructions on what to do. These units can also send a second and different voice message alert to the monitoring central location or portable radios. This message could give the callboxes location or it could be an emergency message of some type.

If you have several callboxes in use and you need to know the location of the unit calling in, then you can get a call box that transmits a unique numeric identifier to a radio that has the ability to decode this identifier. This is like having a telephone with Caller ID capability.

By adding a motion detector or some other detection device, you can be alerted when that detection device is activated. Some callboxes will send either a tone alert or a custom voice alert when the detection sensor status changes. If this voice message is not immediately answered, the alert message is resent multiple times.

If you are running your system on battery power, you need a unit that has battery conservation mode. In this mode, only the absolute necessities for operation are powered, and the unit cannot accept calls to it; it can only make calls. You can attach an external sensor to automatically put the unit into full power mode when someone is detected near the box. This will allow you to make a call to it.

Other useful features:

- If you want to listen to what's happening around the call box, then you'll need a unit that can be paged so you can use the callbox microphone to monitor the sound around it.
- A low battery alert or external power fail tone is sent to the monitoring portable radio or base intercom.
- A paging feature allows selective calling of individual boxes or a group of callboxes simultaneously.
- The busy channel feature prevents someone from transmitting if someone else is using the radio channel.
- Wireless callboxes have fast installation since no wiring is required.
- Entry keypad with built-in relay lets people enter a code at the call box to open a gate or door. Remote opening of the gate by monitoring personnel can still happen also.



These callboxes are being used for applications like parking lots, college campuses, airports, hospitals, construction sites, manufacturing facilities, resorts, hotels, farms, warehouses, delivery docks, campgrounds, gated facilities, or anywhere people may need assistance. So by using call boxes, you can put clear wireless voice communication anywhere you need it, quickly, without expensive trenching and monthly air-time fees.

Wireless Base Station Two-Way Radios

Sometimes there will be a need for two-way communications, but a handheld two way radio is not the right solution. The application may need a radio that sits on a table top or is mounted on a wall. That's where a wireless call box or a base station intercom that communicates with handheld two-way radios is needed.



A base station intercom is simply a two way radio that is in a form that sits permanently on a desk or mounts on a wall. It has much of the same functionality as a handheld two-way radio, but it is not portable. This can be a good thing if a user cannot carry a radio for some reason, you constantly have radios go missing, or if the person needing the radio is always in the same location. You can simply mount or place these base stations wherever you need them.

A wireless call box is like a base station intercom but it is only wall mounted and usually more durable since it is vandal and weatherproof. The callbox is a box made of metal or fiberglass that contains electronic circuitry that enables someone to press a button and call for assistance from someone on a two-way radio, base station intercom, or even another callbox.

The range of these units is several miles, which can be extended by adding an external antenna. Some units can use radio repeaters to extend this range even more.

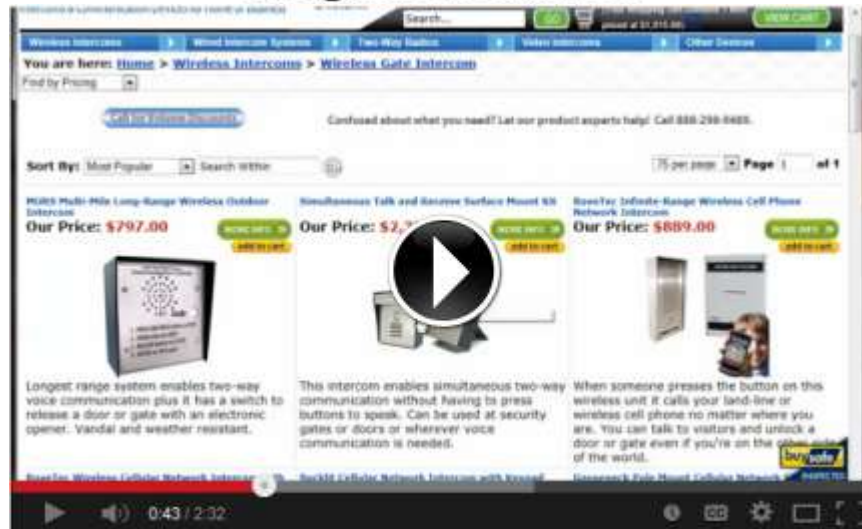
If you have existing two-way business radios, you'll want a system that can integrate with them. Some callboxes can be programmed to be compatible with virtually any brand of VHF or UHF business band radio.

One problem you may have in placing a call box is the lack of available power. In that case you'll want to choose a system that lets you use either battery or AC power. You can also get units that have optional solar power so that they can run for several days on a single day of sunshine.

If you need to remotely control door locks or turn on lights from your portable 2-way radio or desktop base station intercom, then select a unit that has a built-in remote control relay. With this ability you can let someone in a gate or door when they call you. There are units that also let you turn on a strobe light at the callbox location to help draw attention to it.

Wireless Intercom for Security Gates

With concern about crime, vandalism, and terrorism continuing to increase, the need for security increases, and the place most businesses and residences start is with installing a perimeter security system such as fence with a gate. When a gate is installed, a wireless intercom becomes an essential part of the system so visitors can still get in.



A wireless intercom at the gate must be water resistant, but it should also be vandal resistant as well. It will be exposed to the elements and to people who may want to damage it. Therefore the chosen intercom must be very durable.

If wires cannot be installed in the ground, then a wireless intercom is needed. The range these devices can transmit varies widely, but you can get intercoms that transmit as much as a mile or more.

A wireless callbox such as the RoveTec MURS Multi-Mile Long-Range Wireless Outdoor Intercom can communicate at distances up to a couple of miles and it provides remote opening of the gate. It communicates with two-way radios and base station intercoms.

What is a GSM or Cell Phone Network Intercom?

GSM stands for Global System for Mobile Communications and is the world's most popular standard for mobile telephony. Here in the U.S. it is used by AT&T and T-Mobile as well as the services that contract to use the networks of these two companies. Other providers in the U.S. such as Verizon and Sprint use a technology called CDMA (Code Division Multiple Access).

Given that GSM is more widely used across the world, and cell phone network intercoms have been popular in other countries such as Europe, at this point only GSM intercoms are available. Manufacturers want to develop equipment that can be used by the widest variety of markets so they can quickly recover development cost and make a larger profit. These intercoms have not been available in the U.S., but are now becoming popular here as well, especially since analog landlines are starting to disappear as confirmed by these statistics:

- Telecom industry trade association US Telecom says that traditional wire-line service dropped from 95 percent of U.S. households to 40 percent in 2011.



- AT&T wants to get rid of this “dying technology” because the cost of subsidizing remaining customers is becoming prohibitive.
- The Technical Advisory Council (TAC) to the FCC recommended that the FCC set a date for the end of the public switched telephone network rather than let the service fade slowly into oblivion as it’s now doing.
- According to the Centers for Disease Control, as of the second half of 2011, one in three U.S. households (34.0%) had only wireless telephones.
- 70% of responders to a “Wholesale Voice Buyer Survey” by research firm ATLANTIC-ACM stated that the death of plain old telephone service (POTS) was one of the most disruptive factors impacting responder’s businesses.



To use a one of these intercom you simply sign up for a service that uses GSM and you take what's called a SIM (subscriber identification module) card that you get when you sign up, and you place it in a slot inside the intercom control module. When someone presses the button on the intercom, it dials out on the cell phone network and places a call to any landline or mobile telephone, no matter where that phone is. As long as there is cell phone service at the location you want to place the intercom, then you can place it there. You can even power the unit via solar power.

Most of these intercoms can dial multiple telephone numbers until someone answers so visitors at a door or gate are more likely to reach someone. The person reached can press a key on their telephone to activate a switch in the intercom that can be used to open a door or gate remotely. Some GSM intercom enable you to use text messaging to send a message to the intercom to do the same thing.

Another nice feature is their ability to preprogram telephone numbers into the system so certain visitors can just call the intercom, and based on their caller line ID, the door or gate will open. With these intercoms you can:

- Let family members, who forgot their keys, enter the house.
- Let delivery people in with instructions on where to leave packages.
- Not have to run over to an intercom to answer the door.
- Use text message to latch a gate open for parties.
- Have convenience and peace of mind from having all of the above.

GSM Intercoms are called Cell Phone Network Intercoms in the U.S. and they are now available from RoveTec.

Wireless PA System

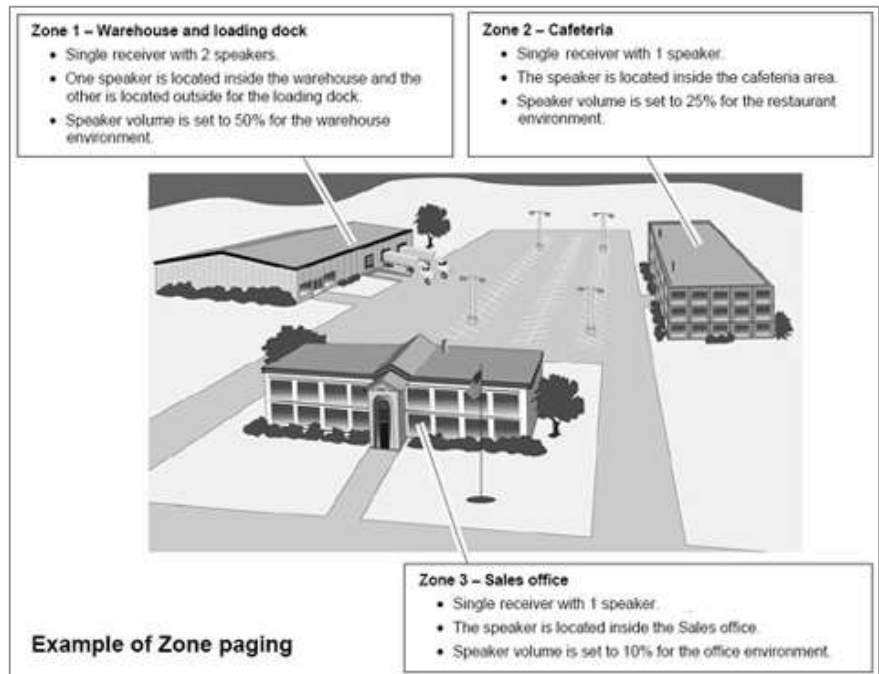
When installing a wireless PA system, the single biggest expense is usually the wiring. It's not the cost of the wire, but rather the installation cost. As in the diagram below, there is often concrete or asphalt between locations where the public address system is to be installed.



Trenching through parking lots is both expensive and messy. The expense doesn't stop once you get inside the building and you have to start running wires through walls too.

Going with a wireless PA system instead can save you money. The PA system consists of a receiver unit with antenna that receives transmissions, amplifies them, and then sends them to an attached PA horn speaker. Up to two speakers can be attached to a single receiver. As shown in the diagram below, each zone can be set to different volume levels depending on the environment.

One benefit of a wireless PA system over a wired system is that you can use handheld two-way radios to make pages. So no matter where you are, you can page someone or make announcements. Even if you are up to two miles away! The transmitter can be in the form of a portable 2-way radio, mobile vehicle radio, or base station intercom



One more benefit is that VHF versions of these units can also be programmed to receive transmissions from NOAA Weather Radio so employees will know instantly when bad weather is approaching.

Someone who wants to make a page to the wireless PA system just has to set the transmitter to the same channel as the wireless PA and then press the push-to-talk button on the transmitter.

The system has a range of up to a couple of miles and the range can even be extended by adding an external antenna to the Wireless PA, the transmitter, or both. These units are available in both UHF and VHF frequencies and can be programmed to work with your existing radios.

The wireless PA does need a 110 volt power source; however there is a rechargeable battery pack that will power the unit for up to 10 hours. There is also a solar power package to operate the unit on solar power.

This long range wireless PA system has applications for schools, hotels, factories, office buildings, hospitals, airports, marinas, country clubs, warehouses, lumber yards, salvage yards, boat yards, rental yards, parking lots, construction sites, amusement parks, golf courses, special events, sporting events, and lots of other uses.

Long Range Wireless Motion Detector with Two-Way Voice

Some wireless callboxes can use an attached outdoor motion sensor, and when it detects motion sends an alert message to an inside intercom.

A Callbox with Gate Relay has the ability to send a warning tone when a change in a Sensor Input is detected. The Sensor Input will respond to an OPEN or CLOSED switch. So you could add a motion detector device that triggers this sensor input, which would tell you that someone is near the Callbox. Since the Callbox does not provide power for the motion sensor you would need to add your own power supply (typically ~+12vDC). You can use any type of security system motion detector as long as it provides relay contact closure or opening.

If you want to monitor the sound around the callbox you'll need a two-way radio or base-station intercom that has the 2-tone encode feature. This allows you to send a signal to the Callbox to turn on its microphone/speaker so you can "Listen In" to what's happening around the Callbox for a predetermined time. The microphone will be activated and you will not be able to transmit to the unit during this time (5-30 seconds). After that you can transmit your voice to the Callbox if you want to speak to whoever set off your motion detector.

You can also send a signal to the Callbox to activate a switch output, which is a simple 1-Amp relay contact closure that can be used to OPEN and CLOSE a gate, turn on a video camera, switch on a light, sound an alarm or any other application where remote control of an ON/OFF switch is required. The Callbox can be programmed to alternately OPEN and CLOSE the switch using a single 2-tone code, or can be programmed for separate OPEN and CLOSE 2-tone codes.

Golf Course Order System

Increase Revenue from Restaurant and Bar Sales While Speeding Play

On a golf course property the restaurant and bar at the club house are usually significant sources of revenue. The more golfers can be moved through, the more money can be made. One way to do that is to install an intercom system on the 9th hole that communicates back to the kitchen or bar. When golfers reach the 9th hole they simply press the button to speak with someone who can take their order. When they get to the clubhouse, their order is waiting for them

The problem with this solution has been the huge expense and mess created by trenching to run the wire. Also, the length of the wire needed is often prohibitive since most intercom systems have a maximum wire length of around 1500 feet.



The most attractive solution is to install a wireless callbox. A [wireless callbox](#) is essentially a two-way radio in a vandal and weather resistant housing. It can communicate with multiple base station intercoms or handheld two way radios back in the kitchen, bar, or wherever you have personnel who can take orders. One of the additional benefits of wireless is that order takers can be completely mobile so they

don't have to be tied to one location.

This system also encourages players to move faster through the final 9 holes since they know they have food waiting for them. That enables you to make more revenue from green fees as well. Also since many golfers are higher income earners who consider their time to be extremely valuable, providing faster service to them means they are more likely to take advantage of this new time-saving service.

To increase revenue even more, you could add callboxes in different locations around the course to take drink orders that you then deliver to the golfers during play. You could set callboxes on different channels so you know which one is calling in. Each channel represents a different location on the course. Since you want the golfers to keep moving, you ask them the shirt colors of everyone in their party so you can track them down, and you also tell them watch for the drink cart so they can flag it down.



Another advantage of the system is that it is capable of receiving NOAA weather alerts so you'll automatically know when severe weather is approaching. Since these callboxes are part of a complete long-range communication system, you could also use your handheld radio or base station intercoms to broadcast emergency messages to a [Wireless PA system](#) so you can warn golfers to take cover. You can use these callboxes for other emergency use as well. Placing them in strategic locations around the course as a defibrillator deployment system could save someone's life.

The callbox can be fully solar powered so there is no need for trenching at all and a solution can be installed in a few hours. The range on these callboxes is up to a mile or even more with the use of an external antenna.

This golf course 9th-hole order system is available at www.IntercomsOnline.com

www.IntercomsOnline.com

sales@intercomsonline.com



Golf Course Order System

Wireless Customer Service Call Button

If you've ever walked around a store bewildered searching for something, you know how frustrating it can be when you can't find store personnel to ask for help. It never seems like there's someone there when you need them.

How nice it would be to press a button, sort of like the "Easy" button you see in Staples™ office products commercials, and someone comes to your assistance. Well, with the MURS Indoor Customer Service Callbox customers can do exactly that.



The MURS Customer Service Callbox provides a fast and easy wireless method for customers to summon a sales associate to a specific department or store location. When a customer presses the button on the Callbox, it transmits user-recordable voice messages to two-way radios, wireless intercoms, or a wireless PA system. The Callbox enhances customer service and promotes productivity of sales associates, which increases store sales.

This Callbox solves one of the most costly problems retail store owners have. That is the loss of customers who gets frustrated when they can't find store personnel to ask questions. Frustrated customers generally leave without buying.

A recent National Retail Federation survey found "...in the previous six (6) months 62% of [all] respondents indicated...walking out of a store without making a planned purchase." Why? "...because they could not find a sales clerk to help." The MURS Customer Callbox Service solves this costly problem.

To further enhance staff efficiency, when an employee arrives to help the customer, a hidden reset button is pushed on the Callbox to activate an "All Clear" voice message to other personnel – permitting them to assist other customers, or tend to other duties.

The Callbox is completely wireless, and battery powered, which makes it easy to install virtually anywhere without costly remodeling.

There is no need for any external power, special wiring, expensive remodeling, airtime charges, or dedicated phone lines. Plus there's no disruption to operations since the Callbox is completely wireless and battery operated. It can be installed anywhere in literally minutes. What's more it can be relocated as needed in a flash.

Use the MURS Indoor Customer Service Callbox...

- Cutting stations
- Locked cabinet displays
- Unstaffed and part-time counters or registers
- Question-intensive merchandise areas
- Outdoor departments...Lumber, Nursery, Patio
- Hard to see areas of the store
- Heavy or high merchandise areas

How the Callbox works...



Typical range is 50,000 square feet, (no additional or special equipment or installation is required), and all store managers and associates will be kept abreast of the needs of customers.

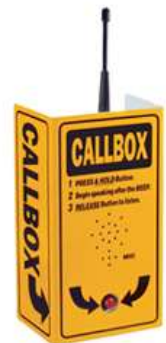
This Callbox is field programmable to work with almost any VHF band two-way radio. Also, if you have UHF two-way radios in your business, call us and we can get you a model that works with the UHF and even the GMRS band of frequencies. The Callbox is compatible with virtually any other brand of two-way radio, including Motorola and Kenwood.

Voice messages are recorded using a simple dial pulse telephone (you supply the telephone). You can also select the number of times and how often the Callbox will transmit the voice alert.

With this callbox, you never have to lose another customer again.

Wireless Elevator Call Intercom

When a tall building is being built, a construction elevator intercom system is often needed so workers on individual floors can call the car operator to request a ride on the elevator. The environment these intercoms have to operate in is often harsh and power is not always available. A wired intercom system is usually not an option due to the complexities of running the cable. So the desire is for a wireless system, but with all the concrete and steel in the building, not just any wireless system will work.



A wireless call box is the device that works well for construction elevators. The call box can communicate with other call boxes, base station intercoms, or hand-held two way radios. These callboxes are placed on the individual floors and usually the lift operator has either a base station wireless intercom or a handheld radio depending on whether AC power is available in the car. Alternatively, another callbox can be used in the elevator, but it will need to be AC powered since it must remain on all the time so the floors can contact the lift operator. The callboxes on the floors can be battery powered since they can turn off after each use.

These callboxes are built for outdoor use so they are tough enough to survive in a construction environment. They are available in both UHF or VHF frequencies so they can be used with existing business band radios. The VHF model also has five unlicensed frequencies named MURS, which is short for Multi-Use Radio System. MURS does not require an FCC license to operate.

Another option is the .the MURS Indoor Customer Service Callbox. This Callbox is normally used in stores so a customer can call for assistance. When its button is pushed, it sends out a prerecorded message to a handheld two-way radio. You can program the recorded message yourself. So each floor would have a message something like: "Floor 3".



When someone presses the button, a light on the unit lights to indicate the message has been sent. The elevator operator then goes to that floor and hits a reset button on the bottom of the unit to turn the light off.

These Callboxes are battery powered and the batteries last up to a year so this can be the perfect solution to this problem.

Event Coordinator Communication System

The day of the actual event for an event coordinator is a busy day and communication is of the utmost importance to pull the event off successfully. That's where a good communication system can help.

If the event is in a large venue then handheld two-way radios are required. Usually there is a "command central" or a base office where the coordination is orchestrated. A base station intercom such as the MURS Multi-Mile Base Intercom is a good choice for communicating with the two-way radios. The base station sits on top of a desk or table.

If radio communications need to remain silenced, then the two-way radios can be equipped with headsets. A high-quality two-way radio like the MURS 110 Two-Way Radio fits this need nicely because it has available headset options. It is also a very durable radio that will withstand the rigors of many events.

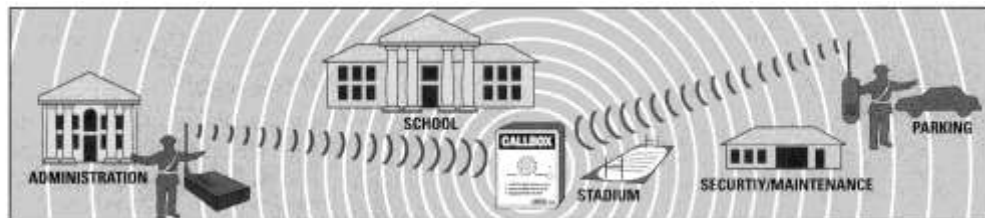
School Parking Lot Safety Improved with Emergency Call Box

Many educational facilities are improving their school parking lot safety by placing a wireless emergency call box in the parking lot that communicates with wireless base station intercoms or hand held two-way radios. These call boxes are placed at strategic points around the campus parking lots and they enable a student to call for assistance.

A wireless base station intercom is placed in a security guard station, plus security guards are given handheld two-way radios so they can still receive calls while they are roaming the campus.

These callboxes add an extra level of security in the event a student does not have a cell phone or their cell phone battery is dead.

Wireless
Communication
Solutions
for a Safer,
Secure School.



Wireless PA System For Campgrounds

A campsite needed a way to get notices out to all their campers, but they didn't want to run wires to PA speakers all over the campground. The cost would have been prohibitive.

With the MURS Wireless PA System they didn't have to since it receives its pages via a wireless signal. They can send pages using a base station intercom in the main office, or through portable two-way radios when they are roaming around the grounds.

Another way they can leverage the two-way radios is to use them to greet arriving guests. They may not have the staff needed to handle everything that needs to be done so managers find themselves handling tasks all over the campground while their guests are waiting for someone to check them in. The solution to this problem is to have a way for visitors to press a button to contact them no matter where they are on the property.

There are a couple of ways to do this. If there is good cell phone coverage over your property and a phone line in the office, then they could install a Door Intercom Controller with Call Forwarding that enables guests to press a button on a door intercom, and it dials the manager's cell phone. He or she could even press a button on their cell phone to unlock the office door to let them in. There is even a complete cell phone solution using the RoveTec Infinite-Range Wireless Cellular Network Intercom, which uses cell phone service to dial out.

If there isn't good cell phone coverage and management is willing to carry a two-way radio, guests can push a button on a wireless call box like the MURS Basic Commercial Callbox. It sends a call tone after which the manager can hear guests talk. They can then respond back to let guests know they are on the way.

If the manager needs to unlock the office or gate so guests can get in, then the MURS Callbox XT Outdoor Intercom with Gate Relay would enable them to do that when used with the right radio. These devices can work at distances of up to a mile or more using external antennas mounted up higher.

With either of these two devices, a campground guest intercom system provides excellent customer service to arriving guests.

Gas Pump Wireless Intercom

Watch the video below for details about a gas pump wireless intercom system.



Emergency Alert Notification Systems

Since the Virginia Tech tragedy, colleges in particular have been looking for emergency alert systems to increase the safety of their students. They need a way to instantly notify students of an impending danger.

Installing a wired notification system could cost thousands of dollars and require trenching that tears up the campus and cutting holes in walls of the buildings.

There are also cell phone notification systems where all students are called on their cell phones. These work well as long as the cell phone is turned on, the battery isn't dead from too much usage, and it is not in use during the time of the emergency. Also, professors usually require their students to turn off cell phones while in class and for large populations it can take a long time to call that many cell phones.

There are various two-way radio products that can be put together as an emergency mass notification system. These solutions are wireless which reduces the expense of installation and it eliminates the mess of trenching and cutting holes in walls.

The MURS Wireless PA System can quickly and easily be placed around select locations of the campus. It consists of an emergency alert radio receiver that allows you to use a base station intercom or mobile two-way radio to deliver voice messages directly to an attached PA speaker from up to 2 miles away.

You can also enable the MURS Wireless PA to receive local NOAA weather radio emergency broadcasts from the National Weather Service and play them over the loudspeaker. This will keep everyone aware of severe weather approaching. This feature requires setting the unit to your local weather alert frequency.

If you have an application that doesn't require a loud volume, the MURS Commercial Intercom may work for you. It has the capability of adding an external speaker that can be used to increase the volume of this base station intercom, especially if you add an amplified speaker. This intercom can be programmed for only one channel so students can't change it. Not only can students hear emergency messages, they can use it to report dangerous situations. Or another option is to install the intercom above the ceiling and just run a wire to a speaker.

You can also place the MURS Callbox XT Outdoor Intercom in strategic locations so that students or staff can alert campus security staff of danger that they can then report over the emergency alert system.

If you want to transmit a prerecorded message, a transmitter device with a panic button is available. One push of a button will send the notice to everyone.

All these products work on the unlicensed MURS radio frequency, but they can also be programmed to work with any existing UHF or VHF radios you may have.

Using these products enables you to quickly set up a college emergency alert system faster than any other solution.

Emergency Intercom System

To broadcast emergency messages you can place wireless public address (PA) receivers around the building and outside, so your emergency personnel can make broadcasts to warn employees of danger. If you want to broadcast recorded messages, a broadcast device can store up to two messages that can be activated when buttons are pressed. Minute-by-minute updates can be broadcast live from handheld two-way radios.



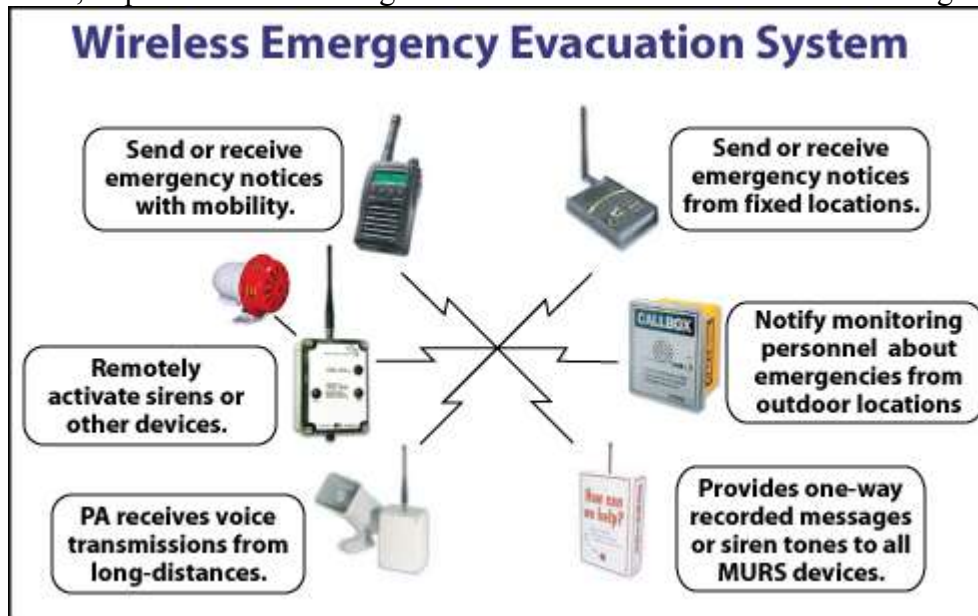
Below are some examples of instances that require an emergency evacuation system, including links to OSHA's website for more information.

- [29 CFR 1910.37](#), Maintenance, safeguards, and operational features for exit routes
- [29 CFR 1910.38](#), Emergency action plans



- [29 CFR 1910.66](#), Powered platforms for building maintenance
- [29 CFR 1910.106](#), Flammable and combustible liquids
- [29 CFR 1910.120](#), Hazardous waste operations and emergency response
- [29 CFR 1910.157](#), Portable fire extinguishers
- [29 CFR 1910.160](#), Fixed extinguishing systems, general
- [29 CFR 1910.161](#), Fixed extinguishing systems, dry chemical
- [29 CFR 1910.162](#), Fixed extinguishing systems, gaseous agent
- [29 CFR 1910.164](#), Fire detection systems

What is an emergency evacuation system? According to OSHA, "An employee alarm system can be any piece of equipment and/or device designed to inform employees that an emergency exists or to signal the presence of a hazard requiring urgent attention. National Fire Protection Association (NFPA) 72, National Fire Alarm Code, requires a fire alarm signal to be distinctive in sound from other signals and can not be used for any other purpose."



The OSHA Standard goes on to say that you can use audible alarms that "include bells, horns, sirens, voice announcement systems, and other devices that can be distinguished above and apart from the normal sound level within the workplace." They say the most effective means are voice signals or an interrupted steady sound (off and on sound).

One of OSHA's recommendations is a

"Workplace Announcement System." Here's how they define that: "Speakers can be used to play a live or recorded voice message. They are often ideally suited for large workplaces where phased or guided evacuations are needed."

See OSHA's [Employee Alarm Systems](#) web page for more information on these requirements.

In businesses that have large buildings or cover a lot of ground, installing a wired emergency evacuation system can cost tens of thousands of dollars. What you will learn here is how to do it for a fraction of the normal cost.

The heart of this system is a [Wireless PA System](#). A wireless PA system consists of a wireless receiver box connected to a horn PA speaker via a cable, and then some sort of wireless transmitting device, which could be a [two-way radio](#) or base-station intercom.

Someone who wants to make a page to the Wireless PA system just has to set the transmitter to the same channel as the wireless PA and then press the push-to-talk button on the transmitter.



The system has a range of up to a mile or more and the range can even be extended by adding an external antenna to either the Wireless PA, the transmitter, or both. If you have a wired PA system already, you can also get a Wireless PA System Interface device that will receive transmissions from radios and then broadcast those transmissions over your wired PA system.



There are several devices that can communicate with the Wireless PA system. The indoor or outdoor Customer Service Call Box is one of them. It can be used as a panic button that when pressed sends a recorded message to two-way radios, base-station intercoms, or to a wireless or wired public address system.

You can record whatever message you want, or you could simply record a siren sound that plays when the button is pressed. If you have multiple areas where you need a panic button, then you'll want to make sure you can distinguish between the recordings so you know where to send help.

There are other devices you can add to your system such as [Wireless Call Boxes](#) if you have locations outside that need to broadcast emergency messages from a fixed location.

A wireless call box is essentially a two-way radio in a heavy duty water-resistant housing. When its button is pressed, the person pressing the button can talk to other hand-held radios, base station [wireless intercoms](#), and even the Wireless PA system.

There are some situations where placing a phone call to notify an emergency response team is just not fast or reliable enough. With a wireless call box, a simple press of a button notifies everyone that needs to know. Probably the best way of using it would be to have it contact emergency personnel who then make pages over the employee alarm system.

Keeping your employees safe in any way you can should be a top priority of yours. Using all of these devices as an employee alarm system is one way to do that, while saving thousands of dollars over the cost of a wired system.



Plans for Pole Mounting a Wireless Outdoor Intercom

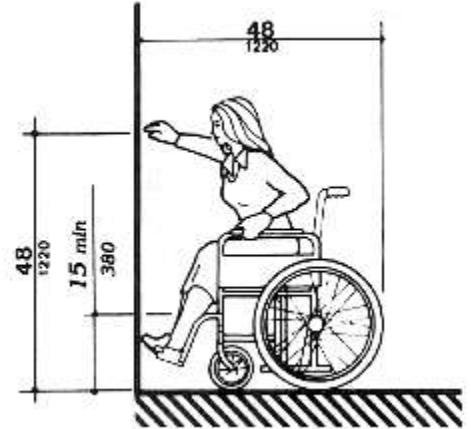
The materials you need for assembling this pole can all be readily acquired from a building supply store such as The Home Depot®. In fact, we have included a list of their part numbers below.

The pole itself is an eight foot 2 3/8" galvanized fence pole. You can even purchase a decorative end cap for the top of the pole to give the installation a more finished appearance and to keep rain out. Since eight foot is the appropriate height for the finished installation, you need some method of mounting the pole to the ground without taking away any of its height.

A 2" piece of electrical conduit happens to fit perfectly inside the fence pole so you can get a ten foot piece of that and cut it in half. Then you dig a two foot hole, pour some bags of pre-mixed fast setting concrete mix in the hole, pour water on the concrete mix, and once it hardens you slide the fence pole over the remaining three feet of conduit. You can use bolts or sheet metal screws to hold the fence pole in place on the conduit.

When mounting the callbox you want to make sure the Talk button is mounted at 48" above the ground for ADA (Americans with Disabilities Act) compliance. This enables someone in a wheelchair to easily access it.

The illustration below shows other holes you'll need to drill in the fence pole for cables and equipment mounting. When you run cables through the drilled holes you should insert some sort of bushing to ensure the cable doesn't rub against the sharp edge of the pole. If you are mounting the Multi-Mile callbox as shown, the cables already run through its supplied cable bushing which holds the cables away from the hole edges.



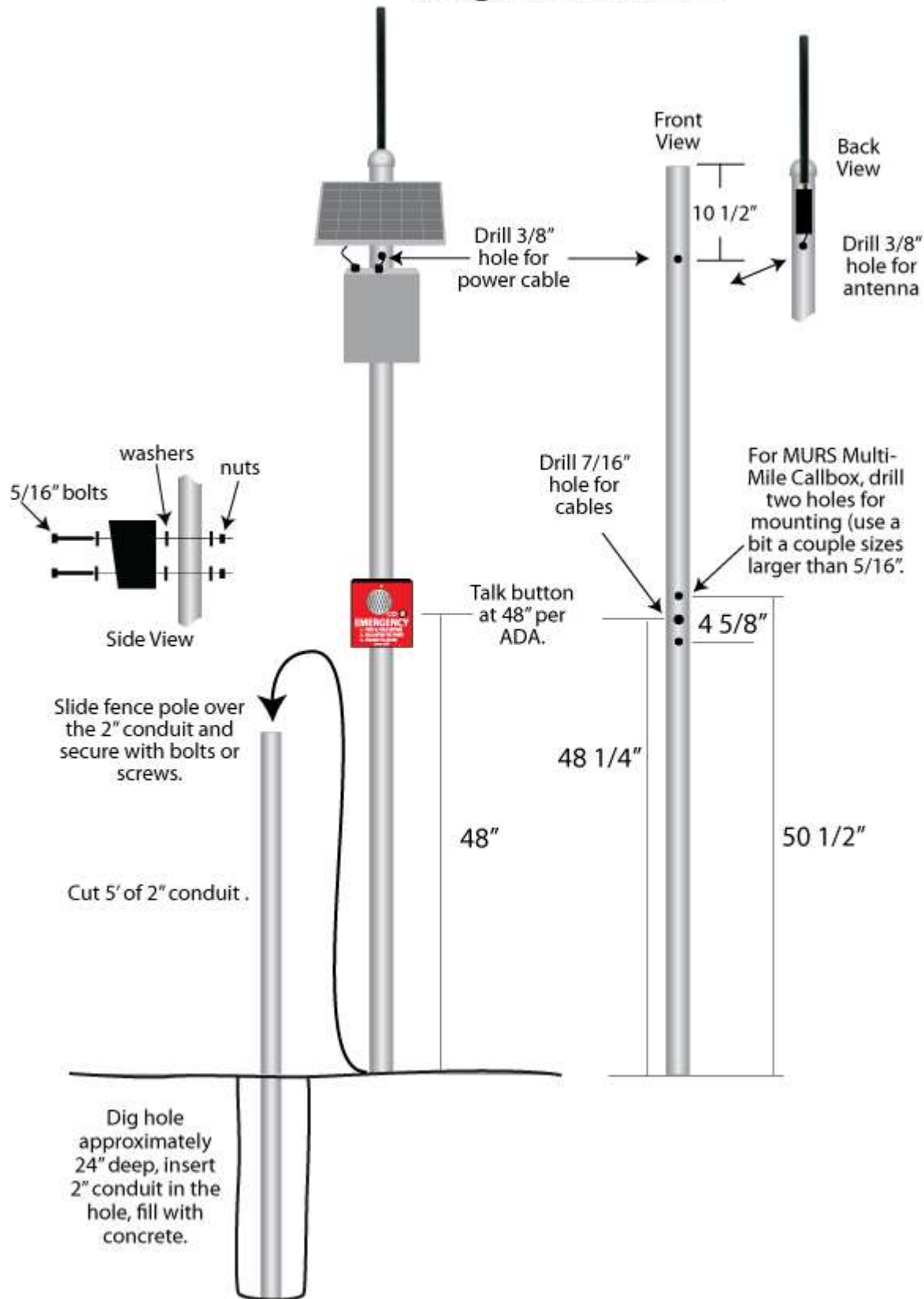
You want to mount the antenna as high as possible on the pole to ensure the pole doesn't block the signal. You'll also get the best range this way. An antenna cable extension will be required to add approximately 3 feet of cable (extensions available from IntercomsOnline.com). You will have to use a "fish tape" or stiff wire to route the cables through the holes and the center of the pole. You can use #12 x 3/4" hex head sheet metal screws to hold the antenna in place.

The Home Depot Shopping List

Store SKU #	Product Description
580-031	2" EMT Conduit x 10"
967-619	2 3/8 x 8' Terminal Post -16 GA
575-569	2 3/8" Plain Dome Cap
842-303	50 lb Fast-Setting Quikrete Concrete
117790	3/8" Anti-Short Bushing

[Download This Document as a PDF](#)

Cost of above on 6/19/12: \$47.35 (not including bolts, washers, screws, taxes)



Delivery Door/Loading Dock Intercom System



Many industrial, retail, and other businesses have delivery doors or docks where the delivery companies drop off packages, inventory, and supplies. If these doors are locked, they usually have a doorbell to alert personnel of a delivery. Or they remain unlocked so delivery people can enter.

The problem with having a doorbell, or nothing at all, is that personnel don't always hear the ringing or knocking, or by the time they can respond the impatient delivery person is already pulling away. Then the delivery waits for another day.

For those businesses that leave their delivery doors unlocked so they won't miss deliveries, they leave themselves open to a huge security risk. The loading dock or delivery door in a business, hospital, or college is a portal that exposes an organization to all sorts of risk. Anyone can walk in and have full access to the building. Adding security personnel to monitor the dock is an expensive proposition that is usually not an option.

The solution to both these problems is to lock the delivery doors and provide an intercom system for delivery people to use when making deliveries.



With a **Callbox XT Outdoor Intercom** installed by a delivery door, and at least one of the staff carrying a two-way radio, the delivery door can be secured without missing deliveries. Base station intercoms could also be placed on several desktops allowing office personnel to monitor for deliveries as well. Using these wireless intercoms, a business can still get important deliveries without compromising security.

The Callbox XT Outdoor Intercom is a metal and fiberglass box with two-way radio circuitry that enables someone to press a button to call for assistance. Two-way communication can occur so personnel can tell the delivery person they are on the way to let them in. If the delivery door needs to be remotely unlocked, a signal can be sent to the callbox to activate a door lock. Then the delivery person can bring the packages in without anyone going to the door.

The benefit of a wireless callbox is that there is no high cost of running expensive cable to the unit. There are also no air-time or telephone service fees to pay. Another benefit is that people monitoring the units can carry handheld radios to communicate with the call box. This enables monitoring personnel to be mobile.



The callbox range can be up to a mile, which can be extended by adding an external antenna.

If existing two-way radios are in use, these callboxes can be programmed to be compatible with virtually any brand of VHF or UHF business band radio.

Using a callbox at the delivery door, base station intercoms on monitoring personnel desks, and hand-held two way radios on mobile personnel, there will never be a reason to miss a delivery again.

Wireless Emergency Warning System

When an emergency occurs on a university or business campus, getting the word out quickly could save lives. While many of these campus environments may already have some type of warning system installed, they are often missing a critical element of an emergency warning system.

Campus emergency notification systems often send text or verbal messages to cell phones, but not everyone carries them, has them turned on, or is paying attention to them. So these devices can't be relied on solely.

Plus there is a time lag while a person enters the message into the system, and a delay in the time the last person receives the message. That delay could be 20 to 40 minutes or more if someone isn't checking their messages. If an off-site hosted system is used, delays can even be higher.

Sirens are also usually used to alert people of an emergency, but a siren can't tell people what type of an emergency it is. Besides that, people are so used to hearing sirens they can have trouble distinguishing a campus warning siren from one use by police, fire, ambulance or even car alarms.

The missing element of many warning systems is a verbal announcement that tells people exactly what the emergency is and what to do about it. The cost of implementing such a system is often prohibitive due to the high cost of running wires to install it.

This is where the use of a wireless public address (PA) system in conjunction with existing two-way radios can fit the need. Not only does a [wireless PA system](#) eliminate the need for expensive wiring, it also allows security personnel to make announcements no matter where they are. They can be at the scene of an emergency and give immediate updates.

A wireless PA system consists of a long-range receiver unit with antenna that receives transmissions from a mobile or desktop two-way radio, amplifies them, and then sends them to attached PA horn speakers.

The wireless PA is available in UHF and VHF frequencies and can be programmed to work with existing campus two-way radios.





These units strategically placed across a campus enable security personnel to quickly broadcast clear emergency messages and live updates. These real time messages reduce the calls to emergency response personnel who are too busy to be handling dozen of calls from people looking for more information.

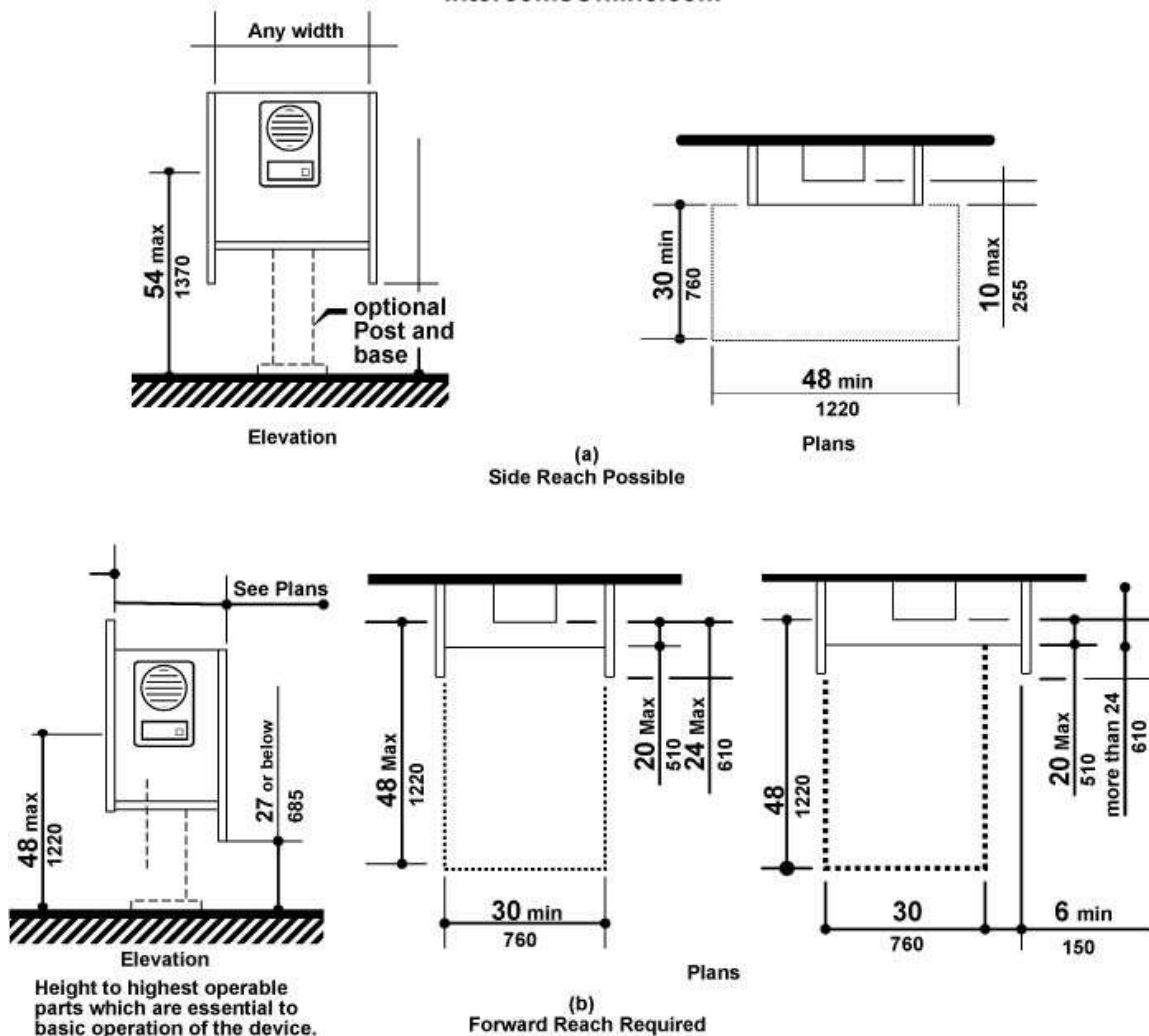
If broadcast pre-recorded messages are needed, the Wireless PA system can also be used in conjunction with a [Voice Notification Wireless Monitor](#) device, which is a wireless radio transmitter that reports changes in the status of switches connected to it. When a switch is closed, it transmits a user-recorded voice message to the PA system. It can be used for messages triggered by some device, or a button can be connected to it for manually activated pre-recorded messages.

So whether a natural or manmade disaster occurs such as a tornado or terrorist act, an inexpensive add-on wireless PA system makes sense when an immediate emergency response is needed from a large number of people.

Americans with Disabilities Act (ADA) Intercom and Telephone Mounting Requirements

When a communication system is required, one of the main ADA requirements is how it is positioned regarding its height. The highest operable part should be located no higher than 48-54 inches above the floor depending on whether the installation location requires forward reach or allows for side reach as seen in the illustrations below. Also, objects projecting from walls with their leading edges between 27 in and 80 in above the finished floor should not protrude more than 4 in into walks, halls, corridors, passageways, or aisles.

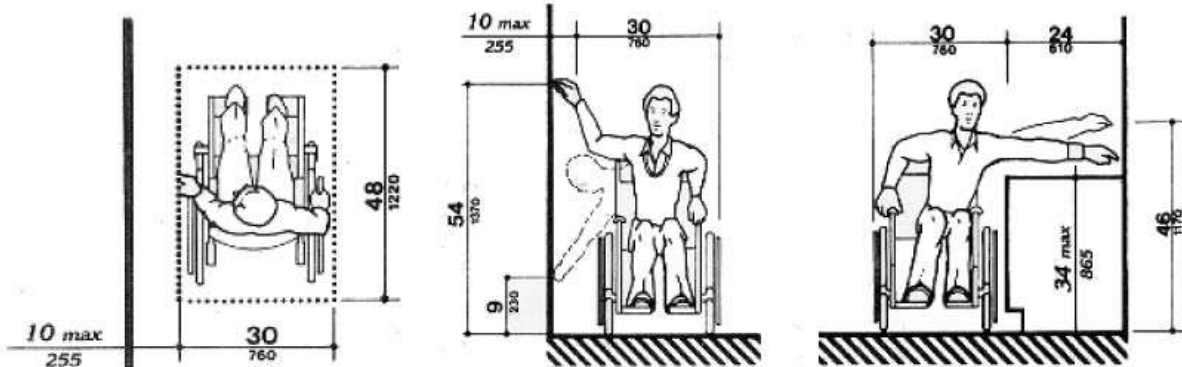
ADA Mounting Heights and Clearance for Telephones and Intercoms
IntercomsOnline.com



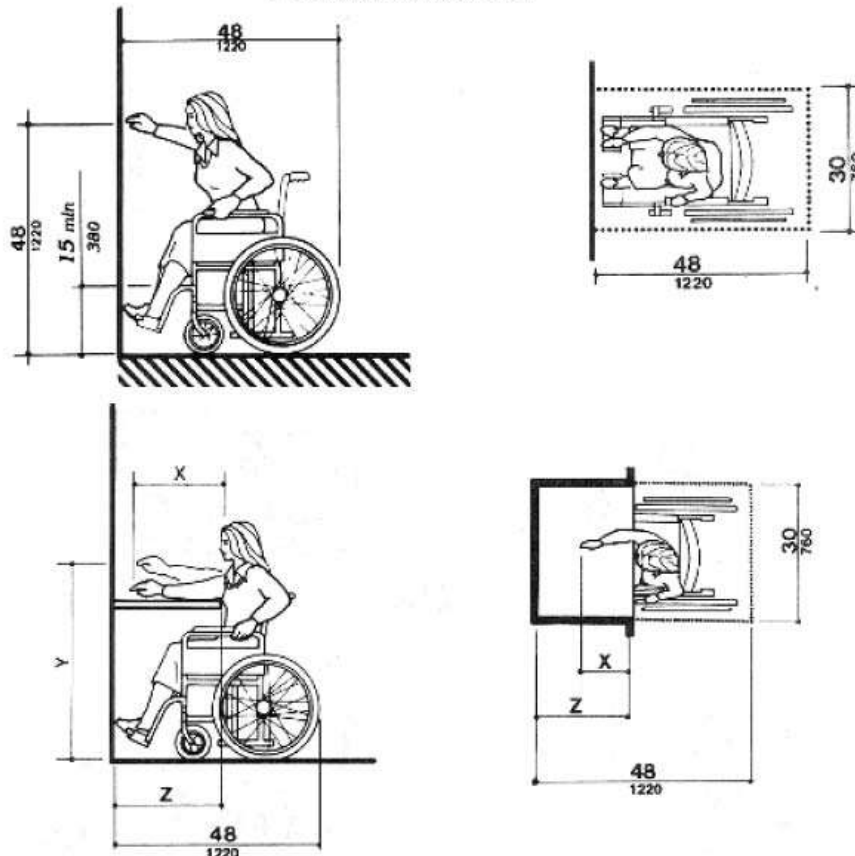
Side Reach Possible (a). If a parallel approach is provided at a device in an enclosure, the wing walls and shelf may extend beyond the face of the device a maximum of 10 inches (255 mm). The wing walls and shelf may not overlap the required clear space. Space between wing wall and shelf width are shown as "Any width." The controls shall be located no higher than 54 inches (1370 mm) above the floor and the wing walls shall extend downward to 27 inches (685 mm) or less above the floor. A clear floor space at least 48 inches (1220 mm) long by 30 inches (760 mm) wide is required with the long side parallel to the device. Device and enclosure are shown as wall-mounted or with optional post and base.

Forward Reach Required (b). If a forward approach is provided at a device with an enclosure, the shelf may extend beyond the face of the device a maximum of 20 inches (510 mm) into the required clear floor space. Wing walls may extend beyond the face of the device a maximum of 24 inches (610 mm). If wing walls extend more than 24 inches (610 mm) beyond the face of the device, an additional 6 inches (150 mm) in width of clear floor space shall be provided, creating a clear floor space of 36 in by 48 inches (910 mm by 1220 mm). Wing walls shall extend downward to 27 inches (685 mm) or less above the floor. The highest operable part shall be located no higher than 48 inches (1220 mm) above the floor. Device and enclosure are shown as wall-mounted or with optional post and base.

Side Reach



Forward Reach



NOTE: x shall be ≤ 25 in (635 mm); z shall be $\geq x$. When $x < 20$ in (510 mm), then y shall be 48 in (1220 mm) maximum. When x is 20 to 25 in (510 to 635 mm), then y shall be 44 in (1120 mm) maximum.

How to Choose a Truck Scale Intercom System

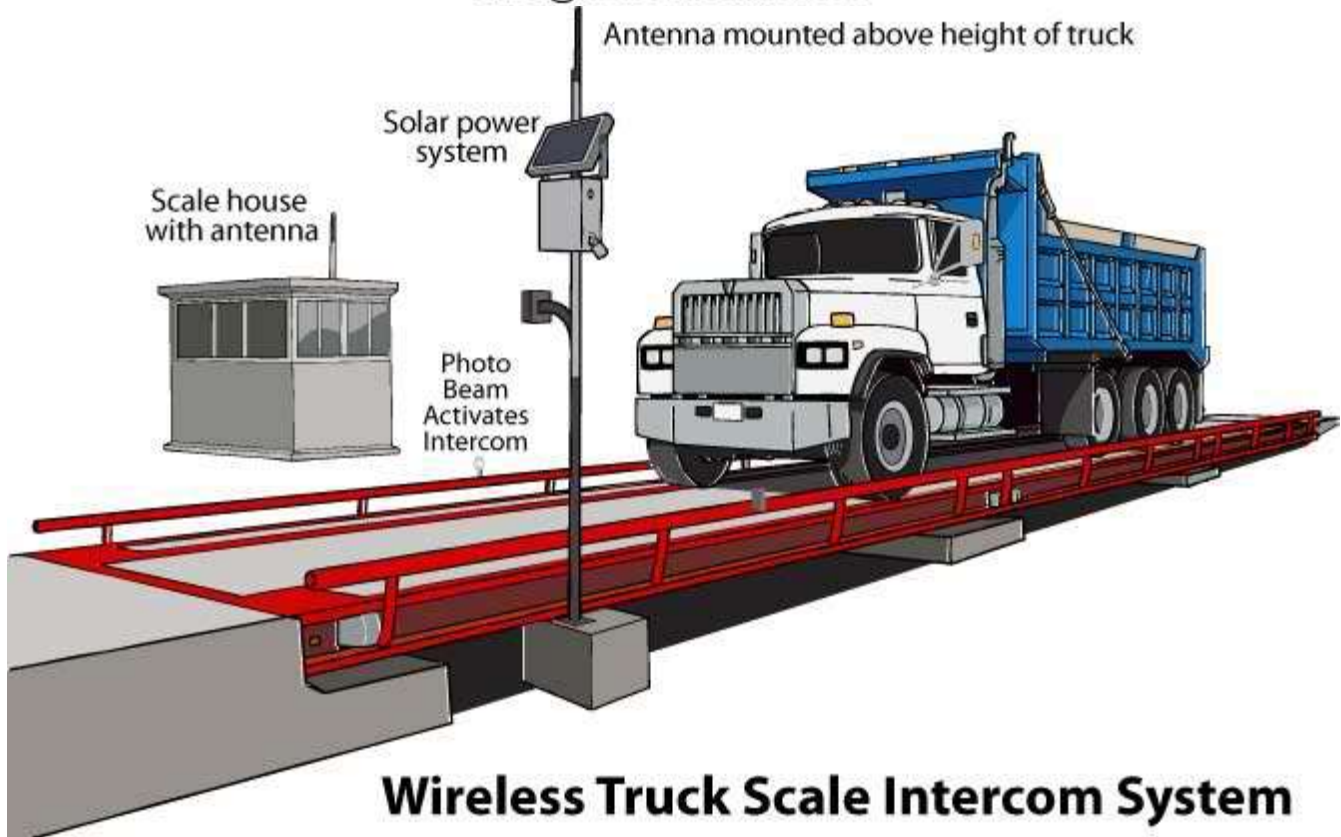
When drivers pull on to a truck scale, there often needs to be some form of communication so they know what's expected of them. There are a variety of solutions for truck scale intercoms that can be tailored to the unique installations of each of these scales. These solutions will be discussed here.

First let's cover the problems encountered that are common among many truck scales:

1. Trucker's arms aren't long enough, unless the truck is driven by a gorilla. The mirrors on most trucks stick out quite far, and since truckers don't want to hit the intercom when they are driving up, their arms aren't long enough to push a button without getting out of the cab. In some cases that's not a problem, but we will cover solutions for both instances.
2. Engines of the trucks are quite loud. If the driver stays in the truck then whatever intercom solution is chosen needs to have ample volume to overcome the engine noise.
3. Some truck scales accommodate trucks of all sizes so at what height do you put the intercom? A pickup truck driver would need the neck of a giraffe to talk into an intercom on a pole for an 18 wheeler, or vice versa.
4. There may be obstructions such as concrete, railroad tracks, or other obstacles that make running wire next to impossible. In this case, you'll have to rule out wired systems and go with a wireless truck scale intercom system. If you go with a wireless system, the truck itself may be an obstruction to the signal. There are ways and systems to overcome this.
5. If you can only install a wireless system and there's no AC power near where the intercom will be installed, then you'll need a solar power system to go with the intercom.
6. You may not always have staff watching for trucks arriving so how do you know when one pulls up? That's where some sort of notification system is needed.
7. If you have trucks of varying lengths, and they stop in different places, where do you put the intercom? This is something you may need to address with signs.
8. Of course money may be an issue too so that could limit what type of system you can choose.

There are the solutions to each of the problems above that will be discussed below.





1. Driver Arm Length

If you can install a wired system, there are intercoms that use loud horn-type speakers that also act as the microphone as well. You can install a button so the driver can call the scale house, but this isn't necessary as long as someone knows the truck is there and can call out to it. If the operator needs to be alerted of an approaching truck, then a photo eye that rings a bell could be installed. To talk to the driver, the scale house operator just presses a Push-to-Talk button on the inside intercom, and the truck driver can then talk handsfree.



Wired Intercom with Horn Speaker

If you need a wireless system and the driver can't get out of the truck, then we recommend a full-duplex wireless system that has the ability to automatically activate its transmit capability when a photo beam is broken. So when the driver pulls up, the system goes into transmit and receive mode on both sides and both parties can carry on a conversation. After the call, the system times out and waits for the next truck.



Wireless Callbox with Radio

If the driver can get out of the truck and push a button to talk, then a wireless callbox can be used to communicate with the scale operator. What's beneficial about this application is that the scale operator can use a handheld two-way radio to talk to the drivers so he or she doesn't have to be confined to one location. You could also use a basic wired intercom system as well since the driver is likely away from the noise of the truck.

If you don't need the driver to talk at all, a public address system could be used to broadcast messages. There is even a wireless PA system that would enable your scale operators to use handheld two-way radios to broadcast messages to the truckers. These systems have a range of a mile or more so the operator wouldn't need to even be anywhere near the scale. There is a wireless alert device available that could alert the operator that a truck is on the scale.

2. Noisy Engines

For a wired system this is where a loud horn speaker helps overcome the noise of the truck. For the wireless system the full-duplex intercom has noise cancellation built in, plus a speaker that gets loud enough to communicate over most engines.

3. Truck Height

If the driver doesn't have to push a button, you can mount the intercom or horn speaker somewhere in between the differing heights and you should be OK. If you use a system that does require button pushes, then there is a 72" & 42" Dual-Height, Pad-Mount Pedestal Pole where you could mount two intercoms.



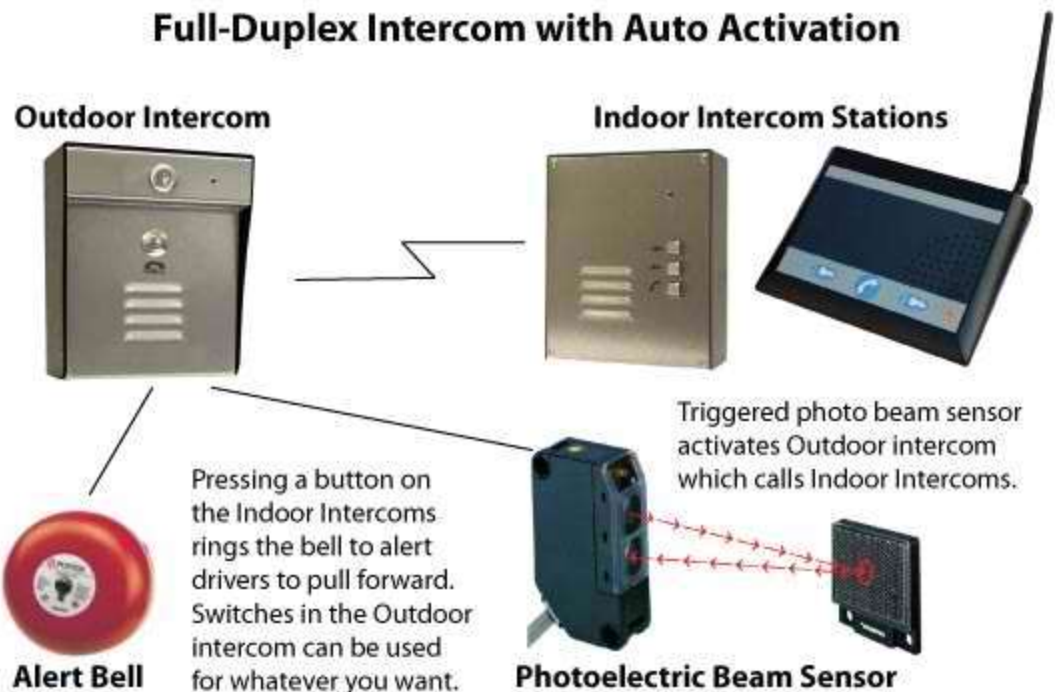
Wireless PA System

4. Obstructions

Depending on the scale installation, it may be virtually impossible, or at least far too expensive, to install cable for a wired system. Trying to bore or cut through metal, asphalt, or concrete can add thousands to the installation cost.

However, there can be obstructions for a wireless system as well. Buildings, hills, or even the truck itself are obstructions. The best signal will be obtained

with clear line of sight between the inside and outside units. It's not absolutely necessary to be able to see between points since radio signals do bounce around. But, your chances of success will be reduced, especially if you go with a full-duplex intercom that uses 900MHz as its frequency. 900MHz systems have lower power than a system that uses VHF or UHF, but the feature set is greater and may be needed. There are ways to overcome the obstructions by raising the antenna height over the truck, or by installing high gain antennas mounted as high as possible. If you want to learn more about how far wireless communications can reach, the article and video at this web address will help: www.intercomsonline.com/range



5. Solar Power

If you can't run wires, you also may not be able to get power to the location where you need the intercom. A self-contained solar power system may be your only option. What wattage solar panel you choose depends on several factors, but the greatest will be determined by the number of trucks that run through the scale daily. If you have 200-300 trucks a day, a 50-watt system will likely do it for you, while fewer trucks than that you can probably get by with a lower wattage system as long as you don't have cloudy days for days on end.



Truck Scale PA System

6. Roaming Staff

If your scale operators are roaming around, you'll need some way of notifying them that a truck has arrived. If they are far away from where they need to be, then you may want that notification to occur even before the truck has arrived so the operator can get back to the scale house. You could install a motion or photo beam sensor earlier in the path of the truck. But if you are using a full-duplex intercom that automatically turns on then you'll still need detection at the intercom system as well.

7. Truck Length

If the trucks coming on to your scale are pretty much all the same length, then where you put the intercom depends on where you want the trucks to stop. If they are varying lengths then you may need to put the intercom towards the front of the scale as long as your scale measures accurately with small trucks this way. Regardless, you may need signs to tell truckers where to stop.

8. Budget

Wired systems are the lowest cost but you have to factor in the labor cost to run wire, which can be astronomical. A full duplex wireless system is very expensive, but depending on the features you need, it may be your only choice, and it still may be less than the labor cost of installing a wired system. If you have to go with solar power that's going to add quite a bit to the cost as well. Either way, wired or wireless, installing a system may save you money in the long run through increases in productivity and efficiency.

Contact the intercom experts at www.IntercomsOnline.com and we can help you choose the right truck scale intercom system for your unique application. To download this whitepaper, click on the cover graphic to the right.

Construction Project Site Communication

Communication is key to any building construction project management. The construction project manager in the project trailer usually has ample reasons to talk to various people out on the job site.



Construction Site Intercom System

Usually hand-held portable radios fit this need nicely. Unfortunately, they fit so nicely that everyone for miles around may be using them. Since they also have a long range, you can be picking up conversations from everywhere.

That's when the WireFree Wireless Intercom System will find a use. When you go through the quick procedure after receiving these units, you'll actually set up a private network. So even if someone else nearby is using a WireFree system, they won't be able to hear your conversations.

Unlike the handheld radios, the WireFree systems use the 900MHz frequency so you won't have to listen to conversations from some kid talking to his sister about invading aliens.

You can even place an unlimited number of battery-powered, [waterproof wireless outdoor intercoms](#) at various points throughout the project so anyone within the sound of the unit can pick up your call. You can talk to whoever responds privately, or place the units in Conference mode so everyone can respond.

The WireFree wireless intercoms give you another way to make sure job site communication is successful so your building project is successful.

There is another solution for construction sites, that need greater range or additional communication options. The [MURS Wireless Intercom System](#) consists of handheld radios, base station intercoms, wireless callboxes and other wireless devices. MURS uses a set of five frequencies that are very lightly used so you shouldn't have interference problems, plus the communication range is measured in miles and not feet.



Construction Elevator Intercom System

Construction Site Wireless Intercom

As a construction site project manager you want to make sure workers can get access to assistance as soon as possible when an emergency situation occurs. Or if they need to contact you for a question about the building design or plan, the faster they can talk to you the quicker the project moves forward.

One way to do that is to place [emergency outdoor wireless intercoms](#) at strategic areas around a construction site. You have a couple of different technologies to choose from for these intercoms. One uses standard two-way radio technology to call two-way radios, and the other cellular network technology to call your cell phone or landline phone. These intercoms are housed in vandal- and weather-proof housings and they have a button workers can press to call for assistance. (See YouTube video here: <http://youtu.be/a3izuJehT1U>)

You can mount these intercoms using low-cost poles you can get at any building supply store such as The Home Depot, and they can be easily moved between job sites.

Since the system is temporary you can just mount them to standard eight foot galvanized, 2 3/8" fence pole with a decorative end cap on top. If you don't have power nearby, you can use a solar power system at the top of the pole.

Since eight foot is a good height that lets you install the antenna and solar panel up out of the reach of people, you still need a way to attach the pole to the ground without taking away any of it's length. You can also purchase a two inch piece of electrical conduit that the fence pole will easily slide over and then you can bolt the fence pole to the conduit after you set the conduit in concrete.

Mounting the equipment this way lets you quickly move the it to another construction site without having to remount the equipment to a new pole. When the project is done, you dig up the conduit and throw it away and you save the fence pole and equipment for the next event.

If you have existing licensed two-way radios, you can get models that will work with those. Otherwise you can use unlicensed MURS radios. One problem with using licensed two-way radios is that if you are moving around to different locales, that makes it harder to get a license since getting a license requires a "frequency coordinator" who checks for existing two-way radio users in an area before a frequency can be assigned to the

license. They want to make sure your radios don't interfere with existing license holders. If you are moving around that's virtually impossible to do.

The solution to this problem is to use unlicensed MURS business-class two way radios. There are five frequencies in the 150 MHz radio spectrum that are called the MURS service. MURS stands for Multi-Use Radio Service. This service was created in 2000 for use in the United States. MURS is a short range (can be several miles) service that uses the VHF (Very High Frequency) radio spectrum. The FCC does not require users of products for these bands to be licensed.

If you would rather have the [construction intercoms](#) calling your cell phone, you can get a version that works on AT&T or T-Mobile that dial out any three phone numbers you want. When someone presses the button, you'll be talking to them on your phone. This eliminates workers having to use their private cell phones to call you, or worse, having to come find you. All these units have a relay you can activate remotely that you could also use to unlock a door or gate, activate a siren, or for any application that requires a switch activation.

Either solution increases productivity and safety on the job site.

Wireless Intercom System FAQs

Below are our frequently asked questions that will help you decide which of our wireless intercoms systems is right for you.

Q: Do walls and other obstructions limit the ranges specified for the wireless intercoms?

A: Yes. The ranges specified are for the most part clear line of site ranges. So if you are in a Kansas wheat field with no obstructions between wireless intercom units, you should easily get the range listed. However, when you have walls in the way, range will go down. Brick walls reduce range more than drywall does. Metal-framed walls reduce range more than wood-framed walls. A wall filled with electrical wires every foot or so will reduce range more than one with only one or two wires in it. There is no magic way to determine whether a wireless intercom will work in your application so you just need to try it and return it if it doesn't.

Q: We have a workshop that is a metal building in our backyard, which wireless intercom will work in it?

A: The high-powered MURS Multi-Mile base intercom could possibly work without the use of an external antenna. The MURS Multi-Mile intercoms have high power to punch through both the metal walls of the building plus brick walls of a house, but they don't always work. If it doesn't work we have a magnetic mount antenna with 25 foot of cable you could put on the outside of the building and that will solve the problem.

Q: Will your intercoms interfere with my wireless network for my computers?

A: Wireless home PC networks operate in the 2.4GHz range. Our voice only wireless intercoms operate in other frequencies so they won't interfere.

Q: I need a wireless intercom that can call from one main room to call multiple rooms individually. Do you have a wireless intercom that will do this?

A: The MURS Multi-Mile wireless intercom has 5 channels, so you could theoretically place units in up to five rooms and set them to individual channels. The problem with this is people will have to switch to another channel to talk to someone, and then remember to go back to their channel when done.

Q: I need an intercom in a commercial building. Should I go with wireless or wired?

A: A wired system would likely provide the most reliable service, but it depends on your building. In most cases a commercial wireless system will do fine. But the more concrete and electrical equipment you have, the higher the chance that the wireless system won't work for you. If you can afford the expense of running the wiring, then you know the system will work. We do have a 45-day return policy, so if you want to try wireless, you have nothing to risk except shipping costs. If you go wireless, use the license-free MURS Wireless System or pick a UHF system that needs an FCC license to operate.

Full-Duplex Headset Intercom

Below is a video about headset intercoms that are used for church, video, plays, and other production purposes.



Longest Range Outdoor Wireless Intercom

The video below talks about an wireless outdoor intercom that can reach ranges measured in miles.



Telephone Entry Intercoms

This video talks about intercom systems that either use internal house phones or they can call external phones with or without a landline telephone line.



Child Daycare Intercom System

The intercom system in this video helps owners of child daycare centers meet state requirements:



Noisy Location Intercom System

This video describes wired and wireless intercom systems for noisy locations:



Industrial Wireless Intercoms

This video describes industrial or commercial quality wireless intercoms:



The Death of the Landline and Its Effect on Telephony Entry Intercom Systems.

How to Profit from Rapidly Changing Telephony Technology Trends

For decades now security system dealers, gate installers, and other companies have been installing intercom systems that use telephone lines for access control and voice communications. With the growth of the Internet and wireless phones, the days for installing analog telephone lines are numbered. Fortunately for you, this change is a revenue-producing opportunity.

According to analysis by telecom industry trade association USTelecom, traditional wire-line service dropped from 95 percent of U.S. households to 40 percent in 2011. The declining trend is continuing in 2012 as more people adopt cell phone and Voice over IP (VoIP) services.

Even telephone companies are trying to get rid of old landline technology. AT&T claims that traditional telephone lines are a “dying technology” and as the most lucrative customers leave it, the cost of subsidizing the remaining customers is becoming prohibitive.

The Federal Communications Commission (FCC) also recently held workshops to examine the transition from the public switched telephone network (PSTN) to new technologies. The Technical Advisory Council (TAC) to the FCC recommended that the FCC set a date for the end of the PSTN rather than let the service fade slowly into oblivion as it is doing now.

An October 2012 survey by the Centers for Disease Control also indicates that cord-cutting is continuing to increase. As of the second half of 2011, one in three U.S. households (34.0%) had only wireless telephones. This is up from 31.6% during the first half of 2011, and 29.7% the second half of 2010.

A “Wholesale Voice Buyer Survey” was recently done to better understand the disruptive factors and trends U.S. wholesale voice buyers think will most impact their businesses (survey sponsored by inetwork. Below are the three most disruptive factors impacting responder’s businesses:

1. Death of landline/desk phones: 74% of responders
2. 100% VoIP over long term evolution (LTE) - marketed as 4G wireless: 72% of responders (wireless carriers and VoIP service providers are becoming similar)
3. Death of plain old telephone service (POTS): 70% of responders

In the survey, you can see that 70 percent of respondents noted the death of “Plain Old Telephone Service” (POTS) as the third most disruptive factor, with providers of legacy phone services looking to gain efficiencies and offer end-users the enhanced features only available from IP-based platforms.



74 percent of respondents noted that the death of the office landline, the desk phone, will be the single most disruptive force in voice services, anticipating the continued penetration of mobile devices by business users as well.

Another key finding of the survey was that application programming interfaces (APIs) are becoming the preferred method for customers to access services. So instead of directly dialing a phone number users will be running an application on a Wi-Fi enabled smartphone or softphone, and that application will ultimately be used to place VoIP calls through a router and the Internet, but in the near term it could also be used access legacy voice communication networks.

Why are Landlines Dying?

As mentioned above the main factors for the decline of landlines are mobile phones and VoIP services. While the growth in the overall mobile phone market is expected to be low for 2012, one segment of the mobile phone market is growing rapidly. As such it will not only increase the reduction in use of landlines, but it also has the potential to greatly reduce the use of wire-provided broadband Internet in homes and businesses. This would then reduce the use of Internet-based VoIP services that are also playing a factor in landline decline. That mobile phone segment is smartphones.

A recent [Nielsen survey](#) showed that 55 percent of consumers who bought a new phone in the last three months got a smartphone over a more bare-bones feature phone, up from 34 percent a year ago.

According to research firm comScore, as of the end of May 2012, the ratio of consumer phone users in the US (aged more than 13) who use smartphones as their primary phone has reached 47%. So about half of mobile phone users have smartphones and the trend doesn’t appear to be slowing down. In March 2012 Nielsen essentially concurs with that figure in when they claimed smartphones were in use by 50.4% of consumers in the U.S.

Smartphones are only one factor in the death of the landline. The other is VoIP. Right now many products that use telephone lines for communication are using VoIP services as a replacement when standard landlines are not available. However, the rapid growth in smartphone usage could soon start to have an impact on even those replacement VoIP services. If customers no longer have wired broadband Internet installed in their home or office, and they just use their smartphones and 4G cell phone service for Internet access, we could see a decline in non-wireless VoIP usage as well.

The July 2011 report, "[Smartphone Adoption and Usage](#)" by the Pew Internet Project found that 25 percent of Americans say they are now doing most of their Internet browsing on their phones instead of a computer. "While many of these individuals still have other sources of online access at home, roughly one third of these 'cell mostly' Internet users lack a high-speed home broadband connection," said Pew in its report.

That threat does not currently appear to be something to get too worried about for the short term, but it is something to watch closely. According to International Data Corporation (IDC), "By 2015, more U.S. Internet users will access the Internet through mobile devices than through PCs or other wireline devices. As smartphones begin to outsell simpler feature phones, and as media tablet sales explode, the number of mobile Internet users will grow by a compound annual growth rate (CAGR) of 16.6% between 2010 and 2015." The IDC believes "that the impact of smartphone and, especially, media tablet adoption will be so great that the number of users accessing the Internet through PCs will first stagnate and then slowly decline."

The growth of broadband services appears to be leveling off. According to technology writer Om Malik, "There are more than 80 million broadband subscribers in the US, a sign that the market is getting saturated. It is not a surprise that the growth of new broadband subscribers has started to slow. So far this year, we have seen 200,000 fewer new additions." The big question is whether LTE service will begin to compete with this wireline broadband.

Impact on Telephone Entry Systems

The plain old analog telephone line has been used as the communication link for telephone intercom systems since their inception. With these landlines going away quickly, if you haven't already run into clients who need an alternative, you soon will.

If the client wants to keep their current telephone intercom and they have broadband Internet connectivity, then the solution is to add a VoIP service like Vonage (www.vonage.com), which requires a small monthly charge, or services like magicJack PLUS (www.magicjack.com), which has a small yearly charge. With any of these services you plug in an Ethernet cable from the client's Internet router into the phone adapter, and then plug the phone line from the current telephone intercom into the adapter as well. You can port the client's existing telephone number over to the new device, but there may be a charge for this with some companies like magicJack.

If the client doesn't have broadband Internet, or doesn't want to go the VoIP route, then you'll need a wireless solution. If the ability to call out to telephones isn't really a requirement, then a wireless intercom solution could be used. [Long range wireless intercom callboxes](#) can call either base station intercoms or handheld two way radios. Since they use wireless signals, no connection to a telephone network is required.

If the client still needs the ability for the intercom to call a telephone, then a [cell phone network intercom](#) is required. Cell phone network intercoms use GSM-based cell phone services like AT&T and T-Mobile to make calls out to the client's cell phone or landline phone no matter where they are. They can even use text messaging to open doors or gates.



These cell phone intercoms have some advanced features like the ability to:

- program telephone numbers in so the Calling Line ID of a calling phone can be used to open a door or gate (for delivery people etc.).
- send text messages to open, close, latch open, or check the status of a gate or door.
- call multiple phones when the intercom call button is pressed.
- remotely program the intercom via text messaging.



Opportunity for Increased Sales

Whenever changes like this occur it's always an opportunity to increase profits either through new service calls or new hardware sales and the installation charges that go along with them. This is an opportunity that will only increase as the years progress and more and more analog lines disappear.

How to Choose the Perfect Wired Intercom System

The wired intercom system you choose depends on whether you just want simple communication from point A to point B, or you have more advanced needs. The basic 2-wire systems we have include a master station that enables you to call one or more substations, but not between substations. The Cat-5 systems enable you to call from any station to any other station, plus they usually have more advanced features.

To simplify ordering, we have put together kits that include the basic components you'll need to get started. For systems that you can expand, all you have to do is add more intercoms to your order.

The video below will give you an overview of wired intercoms we have.



Wired Intercom Technology

This section will help clear up some of the confusion you'll experience as you search for the right intercom or door phone system for you. Here we briefly cover the underlying technology behind each system and give you the positives and negatives about each one of them.

Power Line Carrier Systems

Power Line Carrier (PLC) intercom systems communicate using a very low FM frequency over your house's existing 110 volt AC house wiring that supplies power to receptacles and light fixtures. You just plug them in anywhere you have an outlet and they're ready to go. These intercoms are typically passed off as "wireless" intercoms since you do not have to install wiring between locations.

While they sound like the ideal solution for basic applications, most users are typically not happy with these intercom systems, at least not for long.

These units are very susceptible to interference from both inside and outside the house or business. You may experience buzzing, poor audio, or they may work perfectly well for you. They are very low featured, but they are also very inexpensive. These systems are not recommended for most people and we do not offer them since they can be so unreliable. Sometimes they work fine until you plug in something like a laptop computer nearby to charge. Then you get nothing but static. Or they work until you add a high definition flat screen TV and then they fail. There are lots of devices that could interfere with these intercoms.

The other issue these intercoms have is that they don't always work in different parts of a house or business. The electricity in your house comes in as 220 volts and is split into two phases of 110 volts each. Half of your house will be on one phase and the other half on the other phase. The intercom signal traveling over one phase doesn't always make it to the other.

Master and Substation Systems

Some systems like the 2-wire system described below have one station that is considered a "master" station, which means that it allows you to make calls to multiple substations. The substations can only make a call to a master station and not to other substations. In some cases you can add more master stations that can call each other, but then you have to install cable that has more pairs of wires to accommodate multiple channels of communication. Other systems like the Cat-5 system described below have stations that would all be considered master stations enabling you to call anywhere.

2-Wire Systems

In voice communications there are half-duplex and full-duplex methods of transmission and receiving. Half-duplex communication is like push-to-talk "walkie-talkie" radios or CB radios. When you want talk to someone else with a compatible radio, you have to press a button to talk, let go, and then wait for a reply. The person on the other radio does the same to respond to you. Neither party can talk at the same time.

Full duplex communication is what a telephone uses. All parties on the call can speak at the same time.

2-wire [wired intercoms](#) are usually half-duplex only. With only one pair of wires, they have to be used for both transmit and receive. When one party is talking, the wires are being used to



transmit the voice to the other party. Then the wires are used to receive the voice from the other party, and vice-versa. Most basic intercom systems still use this method of half-duplex communication. About the only intercoms that are full duplex these days are expensive wireless intercoms.

We put together some kits of wired intercom components to make ordering easier for you. Most of these kits are two-wire, but they only allow master intercom to substation communication with no communication between the substations. To get substation-to-substation communication may require running 10-pair or more wiring. If you need all station-to-station communication then it may make more sense to purchase a telephone system or a CAT-5 intercom system.

Cat-5 Systems

Which brings us to a third type of wired system: the [Cat-5 intercom system](#). Cat-5 is short for Category 5 and it is a specific type of bundled wires. It is typically used for data networks and it consists of four twisted pairs of copper wire. It supports frequencies up to 100 MHz and speeds up to 1000 Mbps.

Intercom systems that use Cat-5 wiring may communicate digitally between stations and therefore usually offer more features. Cat-5 wire is readily available in building supply stores as home builders routinely install it for computer and telephone networks. These intercoms are mainly used for residential applications and high-end Voice over IP (VoIP) intercoms.



Installation of Wired Intercom Systems

If you decide a wireless intercom isn't the way to go and you want to install a [wired intercom system](#), then this section will help you do it. As long as you have a few tools and a basic understanding of how to use them, you should be able to install a system yourself (although having another person to help will ease the job significantly). We'll cover the tools you need, plus go over basic building construction and ways you can run the wires.

You don't need to be an electrician to run low-voltage wiring like intercoms use. There is nothing dangerous about it, as long as you exercise care when using the tools you need.

New Construction

If you're building a new house or business, then strongly consider wiring it for a wired [intercom](#) system, even if you think you want to do a wireless intercom. Somewhere in the future your wireless system could receive interference that renders it ineffective or even useless. There will never be an opportunity to run wires as cheaply or easily as there is when a building is being constructed.

Think carefully about how you will use the system. Try to consider where the most convenient place for stations will be. Will you be standing or sitting? Many hardwired systems are built in walls so for these you'll be standing. Many wireless systems and some wired systems have desktop units that allow you to be sitting.

Existing Construction

If you're planning on using a wired system for a pre-existing building, then considerable more work will be involved. Some 2-wire door phone systems claim you can just use existing door bell wiring. The problem with that is not on the door phone end of it, the problem is on the monitor side. Chances are your actual door bell is in a hall somewhere mounted near the ceiling.

If you don't want to stand on a ladder to use your door phone monitor, this obviously won't work for you. You could cut the door bell wires and connect a new wire to them, which would save you having to drill for the door phone. If you do use the doorbell wiring, you'll need to make sure you locate the power transformer for it and make sure it isn't still connected. Otherwise you could burn out your door phone.

If you don't want wires running on the surface of your walls where they are visible, then drilling and fishing the wires through the wall is required. This is not a task some people want to take on, but if you're a handyman, or handyperson, then maybe it will appeal to you. Otherwise you can hire an electrician or handyman to do it for you. Other people who could handle the job for you are heating/cooling contractors, telecommunications contractors, security system installers, and audio/visual equipment installers. Anyone who has experience in running low-voltage wires can do it.

But with a few skills we will teach you here, you can take on this project yourself.

Tools Needed

Running wires through your walls will likely require a few low cost tools you may not have. These are all basic tools you can buy from any Home Depot or building supply store, or borrow them from a friend.



First, you'll need a drill. You don't need an expensive drill. The drill needs enough power to drill through a 2x4 and a 3/4 inch layer of plywood without bogging down. If you're running wires from an attic space, the drill will have to be able to drill through 3 inches since there are two 2x4s on top of each wall.

At least that's the way it is in newer construction. Older homes only have one, but the wood has probably become hard so drilling through it will likely be about the same for the drill. If you don't use a heavy duty drill, you'll want to let it cool down during usage because they can get very hot if you have a lot of holes to drill.

Next you'll need to purchase a wood boring drill bit that's 5/8 to 3/4 inch in diameter such as the ones shown.



Next you'll need to purchase a wood boring drill bit that's 5/8 to 3/4 inch in diameter such as the ones shown.



The spiral-like auger bit shown is the best type, but they can be a little expensive. The flat bit shown will do the job and if you'll just be doing a few holes, you may as well keep it cheap and buy the flat bit.

Once you have the holes drilled, now you'll need a way to get the wires run through them. If there is no insulation in the walls, you could just drop down a string with a weight attached, tape the wire to it, and then pull it up. Inside walls have no insulation, but exterior walls do (unless you have an older house in a warm area).

You can't drop a string through a wall that has insulation in it. If you are installing a door phone it will obviously be on an exterior wall. That means you need something stiff to force your way through the insulation. That's where the fish-tape like the one shown in red comes in handy.

A fish tape is a tool used by electricians to route new wiring through walls. A fish tape is a roll of highly durable tempered 1/8" wide spring steel that can be "fished" (guided) through the confined spaces within wall cavities.

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Once the fish tape is pushed through the hole you drilled, the intercom wire is attached to the fish tape and then pulled through the wall. There is a loop at the end of the fish tape you can push the intercom wire through, and then you want to use duct or electrical tape to securely fasten the wire to the fish tape. Nothing is more frustrating than pulling the fish tape through the wall only to find the wire has fallen off.

Fish tapes have a natural curvature which helps guide the tape. You can manipulate the reel part of the fish tape to move the end to where you want it to be. This is where having a friend on the other end can really help. While you're pushing the tape through the hole, your friend can be feeling for it and grab it once he does. In a minute you'll see where your friend or you will be pulling the fish tape to.

Using a fish tape is much easier in an un-insulated wall. If the wall cavity is filled with thermal insulation, it becomes much more difficult, but you can always find that tape in the wall somewhere. If your friend has his hand in the wall he or she can feel for movement and then grab the tape before you push it way past where you want it.

If the building you want to install the wired intercom system in has the sprayed in foam insulation, you better go with a wireless system because you won't likely be able to push the fish tape through the wall.

There is one other tool you can buy or not, but you will need some way to cut a small hole in the drywall. The drywall saw shown is one way to do this. You could also use a heavy serrated kitchen knife or even a utility knife. The drywall saw produces a nice clean cut though.



The reason you have to cut a hole in the drywall is not to run the wire through, but to get your hand inside the wall to grab the fish tape. The chances of guiding the fish tape through a little hole are almost zero.

So what we do is cut a hole the size of a standard electrical outlet box, which is about 3 1/2" x 2". That's big enough to get your hand through. Then when you are done running the wire, you have three choices for the hole:

1. Patch it using drywall repair techniques
2. Install a standard retrofit electrical outlet box and cover it with a blank faceplate
3. Install the intercom station over the hole to cover it up

Of course the last two are the easiest. You can go to any building supply store and purchase an electrical box that has little flip up tabs that tighten against the back side of the wall. Then when you cover it up with a faceplate that has no holes (except for the two screw holes) it looks like it is there for some future expansion. You should always try to line it up with the other light switch or electrical outlets so it doesn't look out of place.

If you choose to install the intercom station over the hole you want to make sure the hole is right next to a wall stud. That way you have something to mount the intercom station to. To use this method, you'll need to make sure the intercom station is wide enough to mount to the center of the stud, and still cover the hole you cut.

Some intercom monitors/stations are built into the wall so you'll already need to cut a hole for these. Or you may be able to mount the station directly to the retrofit electrical box you installed.

Before you start drilling and cutting you have a decision to make. There are two ways you can run the wire: through the attic, or through the basement or crawlspace. If your house or business is sitting on a cement slab, you're obviously going to have to go through the attic or above the ceiling tiles in a business.

The two diagrams below give you detail on how the wiring will be done. The diagram with the bricks is an outside wall, but an inside wall uses the same techniques.

One thing you'll notice in the two diagrams is a cut up and straightened coat hanger. The sole purpose of the coat hanger is to help you identify where you want to drill the hole for the intercom wire. When you're crawling through an attic or crawlspace it's hard to figure out where you need to drill...and you don't want to drill through the middle of the floor or ceiling.

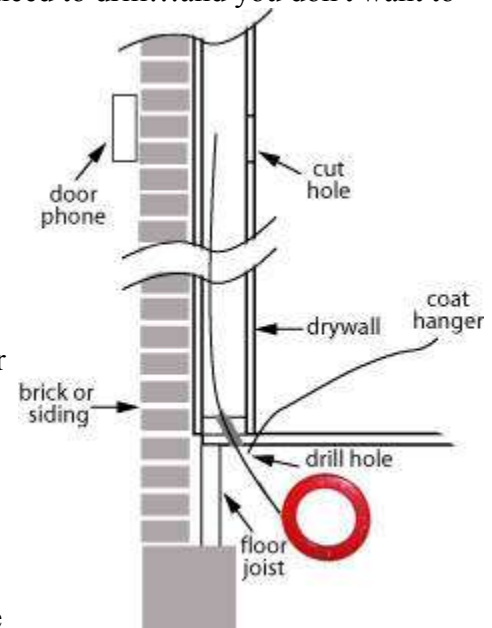
So once you locate where you want to install the stations, you either drill a small hole the size of the coat hanger through the floor or through the ceiling (you can actually just punch the coat hanger right through the ceiling if you push it with a pliers). You want the coat hanger to be directly above or below where you want the station to be so it will be easier to guide the fish tape to the desired destination.

If you're going through the ceiling, put the coat hanger through close near where the wall meets the ceiling. When you remove the coat hanger later you'll just put a little dab of spackling compound to fill the tiny hole (or even white toothpaste).

If you're going through the floor, drill the coat hanger hole right under the baseboard or as close to it as you can. If the room is carpeted, you don't have to worry about repairing the hole. If you have hardwood, just a little dab of the same color wood filler will make the hole nearly invisible. Sometimes you won't even need to do that and you still won't see it.

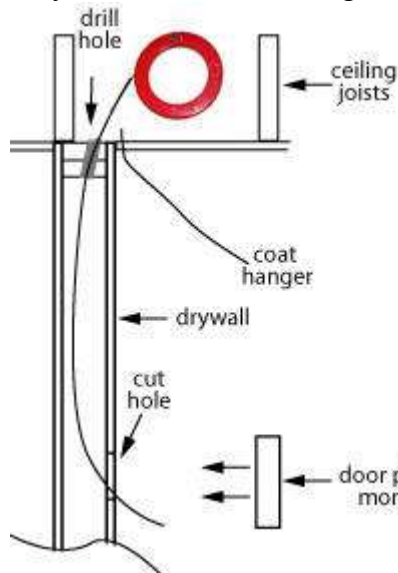
So you insert the coat hanger through the hole about a foot and then go into the attic or crawlspace to find it. Once you find it, you'll probably see some nails sticking through the floor to show you where the wall you're about to drill through is located.

Now you simply take your drill with the wood boring bit and drill about 2 inches from the coat hanger towards the wall and you'll be right inside the wall. Simple as that!



Now you get your fish tape out, push it into the wall, tape it securely to the fish tape, pull it through the wall, and then you're ready to follow the installation instructions that came with the door phone or intercom system. You'll also need some sort of wire strippers to prepare the wires to connect to the terminals on the intercom. You can use a knife, but this is not the preferred method as a kicked wire will sometimes break when bent.

So you insert the coat hanger through the hole about a foot and then go into the attic or crawlspace to find it.



Once you find it, you'll probably see some nails sticking through the floor to show you where the wall you're about to drill through is located.

If you're installing an outside door phone to a brick building, you'll also need a concrete drill bit that can go the depth of a 3 ½ inch brick plus at least ½ inch of whatever they used behind the brick. A 4 ½" long ¼" diameter drill bit should do the trick (there is still some shank left to go in the drill so the actual bit should be longer).

You don't drill through the brick itself. You want the wire to come out a mortar joint which is much easier to drill through. You'll also need some screw anchors that go in a ¼" hole so you can mount the door phone to the brick.

So while running the wires for an intercom system can be a dirty job, it's not extremely difficult once you know the little secrets you've just learned.

There's nothing like the feeling of accomplishment you get from doing a project like this yourself. In fact, once you do it you may want to take on even more low-voltage wiring projects around the house!

Two-Way Radios for Oil Rigs and Oil Fields

Two-way radios are an essential part of oil rig and oil field operations. In fact, there are typically a number of job positions that require 2-way radios due to the need for quick responses and real-time coordination essential in this high-risk environment.

For offshore oil rigs, the Offshore Installation Manager (OIM), who is the ultimate authority in the oil platform, is equipped with a portable radio so he can be in constant communication with the rest of the crew who relies on his experience and expertise to make critical decisions on operational matters. A 2-way radio provides the quickest communication available in situations where seconds can make the difference.

Other than the OIM, there are other personnel that need to be equipped with a 2-way such as the Shooter, sometimes called Blaster, who is responsible for ensuring safe and efficient use of explosives in an oil field. An Operations Team Leader (OTL) uses a 2-way radio too to keep in touch with logistics personnel such as helicopter pilots (for offshore oil platforms) and crane operators when coordinating loading and unloading of cargo or even personnel. Being an OTL also means being responsible for the entire crew. He calls the shots on the field and needs to be constantly in touch with the OIM via radio.

Given the harsh environment of oil rigs and oil fields, the 2-way radios used need to be more durable than regular radios. Water is a constant in oil rigs and oil fields either from rain or wet salty ocean air. Choosing a radio that is either submersible or one that meets military specification standards is critical.

Construction Jobsite Two-Way Radio

A construction jobsite two-way radio is used for communication between project managers and workers on the jobsite.

Usually hand-held portable radios fit this need nicely. Unfortunately, with many handheld two-way radios there are so many people on the frequency they use, you may get interference from users from miles around. Since they have such a long range, you can pick up conversations from everywhere.

Not too long ago the FCC set aside an unlicensed radio spectrum called the MURS service. MURS stands for Multi-Use Radio Service and is in the VHF (Very High Frequency) 150 MHz radio spectrum. MURS frequencies are not at all crowded.

The good news about MURS two-way radios for use the jobsite is that they have enough power to handle the largest construction sites, but not so much power that they pick up conversations from 20 miles away. They also have quiet codes that enable you to only pick up conversations from other radios programmed with the same code.

Another good thing about MURS is that not only are their job site two-way radios, but also base-station intercoms and callboxes that you can place on the jobsite. You can place the base stations on desktops in the project trailer and the callboxes at various locations where someone can make calls without having to carry a two-way radio.

IntercomsOnline.com carries a complete line of MURs radios and intercoms that help you ensure your jobsite two-way radio communication is successful...which will help your building project be successful.

Commercial Digital Two-Way Radios

Two-way radios since their inception have used analog technology to transmit your voice over the airwaves. But like every other technology, two-way radios are now starting to go digital to take advantage of all the benefits digital offers.

Digital technology brings capabilities that were not possible, at least not cost effectively, on analog radios.

The most requested feature for a two-way radio has been the ability to call a single individual instead of an entire a group. With analog two-way radios the only way to do that was to put individuals on separate channels and if someone wanted to make a call, they had to switch to the channel of the person they wanted to call. But then they had to remember to switch back to their channel or the rest of the group wouldn't know where to find them.

Not only is this setup impractical, but it also uses too many frequencies, which can be expensive to license. Another reason this doesn't work is because individuals then lose the ability to call the entire group all at once since everyone is on different channels.

Or with analog radios you could use tone decoding capability to provide direct calling (see Direct Call and SelCall feature descriptions), but an entire channel is tied up and others on that channel can interfere with the call.

Using digital technology each radio has its own unique multi-digit identification code, which is similar to a telephone number in the world of



telephones. When a user wants to call another individual, he or she simply uses the radio's navigation keys to scroll to the individual's name and select it. The call recipient's radio receives either an audible or vibrating signal, and their unit then displays the caller's ID information.

Just like a phone has a call log, so too can a digital two-way radio. Using a scroll list, users can view a recent-calls list showing the source and target of the last transmissions with time and date information. If you miss someone's call, you can always see who it was from.

In addition to individual calling, you can still call a group of people too. Plus you can define groups so if you don't want to include everyone, you don't have to. A public group enables you to call anyone on the same channel as you. A private group is set up by adding users from your contact list (and then cloning this list to other radios via cable or over airwaves). If there are four people on a channel, but you only want three of them in a group, you can set that up. The private groups enable you to have private conversations that won't be picked up by anyone else who owns the same radio, whereas the public groups can be heard by anyone on that channel.

Another benefit of digital radios is that a single "channel" allows more than one conversation unlike analog which will only allow one. With digital, each channel can be reused while an established transmission is in progress. Some digital radios use frequency-hopping spread-spectrum technology so a channel can use as many as 50 frequencies.

Spread spectrum works by "multiplexing" multiple signals and sending them along different frequencies within the allotted frequency range for a device. Or in other words it splits the spectrum into tiny slices. By spreading a signal across a range of frequencies, it's possible to carry more transmissions simultaneously. The basic notion is that if the transmission is broken into pieces, each of which is tagged with a code, a receiver that knows the code can reconstruct the message.

Digital radios provide better voice quality and more reliable coverage than a comparable analog radio. With an analog two way radio, everything in the environment that interferes with the signal directly reduces the voice quality on the receiving end. The strength of the signal falls off as the distance increases, but at the same time the background noise level remains the same. The result is a continually degrading voice quality the farther the signal broadcasts.

Digital systems remove noise and they have built-in error-correction techniques that rebuild a voice transmission to nearly its original fidelity throughout the majority of its coverage area. If the two-way radio receiver can understand the digital voice signal, it can decode it and reproduce voice clearly.

Other Digital 2-Way Radio Features:

- They can operate on a weaker signal to achieve similar range as an analog device. That means longer battery life. A digital radio uses only half the battery power of an analog system for the same wattage.
- They can send and receive short text messages such as "I'll call you back in 5 minutes" to private or group contacts. These radios usually have several pre-programmed notes that can be quickly sent. Some radios even have a mini keyboard attachment that can be used to change, add additional, or delete these messages.

- Call alerts can be sent to let the recipient know you want to talk to him or her. When you send a call alert, the recipient's radio emits a series of beeps, or vibrates, and displays your unit name or ID along with the time and date.
- Current digital radios use the 900MHz ISM unlicensed frequencies so no FCC license is required to operate them.

Antennas

The good thing about base station intercoms/two-way radios is that they allow you to extend range by using an external antenna. The base station units have what's called a BNC connector that enables you to twist off the antenna that comes with the radio and then twist on a new antenna connected to a cable.

You will get noticeably better results and more range with your radios with an external antenna, especially if you can place it high. It is the single most important factor in increasing transmitting and receiving range of a radio. You'll need to make sure you choose an antenna that is specifically designed for the frequencies and application you are using and then choose the best location possible to install it.

For MURS radios, the FCC limits antenna height to 20 feet above a structure (exclusive of the tower, mast or pole on which it is mounted), or 60 feet above ground (whichever is greater). The higher you place your antenna, the greater range you will get. If you mount an antenna on your vehicle and connect it to your mobile MURS two-way radio, the higher you place the antenna on your vehicle, the greater range you'll get.

If you are using a handheld radio and walking around with it, you can't very well use an external antenna. You may be able to extend range by installing a better antenna than the one that came with the radio, but keep in mind that the antenna that came with the radio is "tuned" specifically for that radio. If you put on an antenna that isn't properly tuned, you could lower range.

Channel Usage

Two-way radios can have multiple channels. In some cases like the MURS radios, there are only 5 channels available. Other radios typically have 10 channels or more available, or you can program them to only use one channel.

One thing about a two-way radio is that when you press the Talk button and speak, everyone on that channel will hear you. If you have individual departments in your business that you want to separate, then this isn't the ideal solution.

That's where you can use the multiple channels on the radio. If you are in a manufacturing environment for instance, you could set up Channel 2 for Shipping, Channel 3 for the Office, Channel 4 for Manufacturing, and so on.

You can use the channels sort of like an intercom system that lets call individual people or groups instead of broadcasting a message to everyone. So the Shipping people keep their radios on Channel 2, but if they need to talk to people in the office, they change to Channel 3.

Some handheld radios also have a scanning capability that also works well for this type of application. You can actually program the channels you want to scan, and the radio will only pick up conversations for the channels you have programmed.

In the example above say you add a Channel 1 as the Broadcast, Paging, or All Call channel. Now you set each radio to scan not only their department channel, but also the Paging channel as well. So if there is need to broadcast a message then anyone can change to Channel 1 and everyone hears the message. This is a great emergency notification system.

Another way to contact individual radios is through the use of a Selcall (Selective Calling) feature that some radios have. Selcall enables a voice call to a specific radio or group of radios. The caller selects the radio or group of radios from a pre-programmed “contact list” that has been programmed into the radio using the radio’s programming software.

Selcall works by generating and transmitting a series of predefined, audible tones. Both the tone frequencies, and sometimes the tone periods, must be programmed in advance into both the transmitting and the receiving radios. Each predefined tone represents a single digit. A series of tones therefore represents a series of digits that represents a number. The number encoded in a Selcall is used to address one or more receivers. If the receiver is programmed to recognize a certain number, then it will un-mute its speaker so that the transmission can be heard; an unrecognized number is ignored and therefore the receiver remains muted.

Accessories

Audio Accessories

Most two-way radios have a jack for an audio accessory like a headset or speaker microphone. When headsets are used with VOX capability the user can talk with hands free operation. Otherwise, many headsets have a push-to-talk switch located in their cord.

There are a variety of audio accessories available for two-way radios depending on your application. If you want to wear your radio on your belt, but do not want to be constantly taking it off to talk, then a speaker microphone with a clip that lets you mount it near your ear may be what you want.



Having the speaker near your ear is great for noisy environments. You see police officers using these.

Of course their shirts or jackets have a special place to clip the speaker microphone on their shoulder so this may not work for a person wearing average clothes.



If you would rather be more like the Secret Service than the police, you can get a security type earpiece with a pendant push-to-talk switch with built-in microphone and clip. You put the earphone in your ear and clip the microphone/switch to your clothes not too far from your mouth and then you just push the switch when you want to talk.

If you don’t want to have the curly cord leading up to the earpiece, you can get a headset that has an ear bud that looks more like what you would find on an iPod® or iPhone®. It still has a pendant push-to-talk switch with built-in microphone and clip.



You can also get single-ear lightweight behind-the-head headsets with boom microphones and pendant push-to-talk switches. This is more like what you would see a telephone call center agent wear. This one is great for noisy environments and is comfortable enough to wear for long periods.

If you purchase a base-station intercom to use with your two-way radios you may want to add an external speaker if you are using it in a noisy environment. You'll get a little extra volume out of the unit, plus they come with a longer cord so you can place the speaker somewhere closer to where you will be when you are not talking on the intercom. You could also use amplified horn speakers for even greater volume.

Cases, Holsters, and Belt Clips

Almost all handheld two-way radios come with a standard belt clip. You can or nylon protective cases or holsters that not only protect the radio, but also to get the radio off your belt.



also get leather make it faster

Battery Technology

Two-way radios use several types of battery technologies. Some two-way radios take standard AA batteries that allow you to use rechargeable batteries, but in event of a long power outage, you can use off the shelf AA batteries when your rechargeable batteries die. Other radios use a custom sized battery. For these you can purchase spare batteries that you can have charged and ready to go in the event your primary battery charge runs out. Two-way radios come with a charger unit to keep the primary batteries charged, and in the case of custom batteries, they usually include a slot for the backup battery too.



There are three types of batteries that are typically used for rechargeable two-way radios: nickel cadmium (NiCAD), nickel metal hydride (NiMH), and lithium ion (LiION). You can't typically choose the type of battery you use for most two-way radios. The manufacturer does that for you. Following are some of the advantages and disadvantages of each type.

	Advantages	Disadvantages
NiCAD	Good at low temperatures, resistant to overcharging, long life expectancy, low cost.	Larger and heavier, memory effect reduces effectiveness if not fully discharged,
NiMH	No memory effect, lighter than NiCAD	Shorter life expectancy, special charger required to limit overcharging.
LiION	Fast charging, no memory effect, slow loss of charge when not in use, lighter than other batteries.	Higher cost, after a number of maximum number of charges they no longer accept a charge (typically 500 to 1000).

Battery Chargers

All commercial grade two-way radios with rechargeable batteries come with a charging unit of some type. Depending on the battery type used, it may be a wall transformer that converts AC to DC and then plugs directly in to the radio, or it may be a drop in charger that the radio sets in.

The advantage of the drop-in charger type is that it provides a place for the radio to sit in an upright position instead of just laying down on a surface. The drop-in charger provides a less cluttered appearance. Some drop-in chargers also have a slot to charge a spare battery so you can quickly swap out a battery should your radio run low on power.

There are also drop-in chargers that let you charge multiple units at one time. This is good when you have staff that all carry radios that need to be



charged at the same time. If you had a separate charger for each unit, you'll need a lot of power outlets to plug all of them in. If you have a six unit multi-charger for instance, you only need one outlet to charge all your radios. This also gives a less cluttered appearance. The multi-unit charger may not have a slot for a spare battery so this is something to consider if you frequently use your two-way radios so much you run the power down.

FCC Licensing

If you are purchasing a radio for your business, most business-band radios require you to get a License from the FCC before you can use the radios. One exception to this is if you purchase radios that operate in the MURS frequencies.

Business class radios are available in the MURS unlicensed 151.8200 to 154.6000 MURS VHF range, the licensed 151.6250 to 154.6550 VHF Business Band, and the licensed 461.0375 to 469.5625 UHF Business Band range.

Unfortunately the FCC is a government agency and off course that means that getting your FCC license can be a confusing and time-consuming thing. But, since there can be fines of \$8,000 per day for unlicensed and/or improperly licensed use of a radio system, plus various other fines. That said, the majority of users of radios under 5 watts of power never do license their radios and the FCC doesn't seem to be too aggressive in pursuing fines. If you choose a frequency with little to no traffic on it and move to a different channel if someone complains, you may be fine, but of course the risk is yours.

Fortunately, you don't have to get a license for each radio. The FCC licenses the radio user, not the radio itself. You can get a license for your company in a specific geographic area. An FCC coordinator will assign frequencies you can use for all of your radios for a period of 10 years.

If you don't want to tackle getting a license by yourself, you can get help from organizations like Enterprise Wireless Alliance (www.enterprisewireless.org). They will do the process for you for a nominal fee.

If you choose to file for your own FCC license, you must first register through FCC CORES. After registration, you will be assigned a Federal Registration Number (FRN). This number uniquely identifies you in all transactions with the FCC. The use of a FRN is mandatory. If you have questions about this process, the FRN Help Desk Administrator phone number is (877) 480-3201. The FRN Help Desk staff are available from 8 a.m. to 6 p.m. Eastern Time.

After you have your FRN, then you use the Universal Licensing System (ULS) to complete your application. ULS allows you to use any PC with Internet access to research, manage, renew, and pay any applicable fees for your wireless licenses through a password-protected account. ULS frees you from having to fill out and mail a paper application, and it gives you secure, online access to your licenses and pending applications.

More information about ULS can be found online at the following address:

http://wireless.fcc.gov/uls/index.htm?job=about_getting_started

For other licensing questions, you can call the FCC Consumer Center at (888) 225-5322.

Below is the FCC's licensing process with links to their website:

1. Gathering Information

Preparing to License outlines the important information about your radio system that you gather before you contact a frequency coordinator.

2. Frequency Coordination

Frequency coordinators are FCC certified to recommend the most appropriate frequencies for applicants in the designated Part 90 radio services. Applications for new frequency assignments, changes to existing facilities or operation at temporary locations must include a showing of frequency coordination.

3. Filing Your Application

New applications and other actions which require frequency coordination are normally filed with the FCC through the recognized frequency coordinator. Other actions such as minor modifications or administrative updates may be filed with the FCC through the Universal Licensing System (ULS). For new users, you can learn more about ULS online systems through its getting started tutorials

4. Immediate Operation

There are two ways to begin immediate operation of your system. The FCC implemented a licensing procedure for conditional authority in 1995. You may begin operating your system 10 days after your application is filed with the FCC. In addition, you may apply for a Special Temporary Authority to operate during emergency or other urgent conditions without filing a license application.

5. Notification of Construction

A licensee must notify the Commission that its system is constructed and placed into operation within 12 months of the date of grant or their license will automatically cancel. (See 47 CFR 90.155(a)). Notification is made by filing FCC Form 601 through ULS (Purpose Code: NT). You may also request an extension of the construction period through Form 601 before the expiration of the construction period. This filing must be made within 15 days of the expiration of the applicable construction period. (See 47 CFR 1.946 (d)). You may also request an extension of the construction period through Form 601 (Purpose Code: EX) before the expiration of the construction period. (See 47 CFR 1.946(e)).

6. Renewal of License

You must file for renewal of your license no later than the expiration date of your license period, and no sooner than 90 days prior to expiration by filing FCC Form 601.

Two-Way Radio Feature Guide

Below are some of the more noteworthy features available on two-way radios:

Voice Activated Transmit (VOX)

The Voice Activated Transmit (VOX) feature enables you to use your radio "hands free." When VOX is turned on, the radio will automatically begin transmitting when you speak, without pressing the push-to-talk button.

On most VOX-capable radios there is a slight delay between when you start speaking and when the microphone turns on so the first part of the conversation may be clipped. Most radio users overcome this by repeating the first word.

Squelch /Auto Squelch

The squelch feature of a two-way radio keeps the speaker quiet when no signal is present. The squelch setting adjusts the threshold at which signals will open (un-mute) the audio channel. It acts to suppress the audio output of the receiver in the absence of a sufficiently strong desired input signal.

With the squelch level correctly set, you will hear sound only when actually receiving a signal. Backing off the control will turn on the audio, and the operator will hear white noise (also called squelch noise) if there is no signal present.

Two-way radios usually have several levels for squelch adjustment. You want to select a level at which the background noise is just eliminated when no signal is present. The larger the level number you select, the stronger the signal you need to receive, and the lower the receiving range.

Continuous Tone Coded Squelch System (CTCSS)

Most two-way radios have 38 CTCSS codes which stands for Continuous Tone Coded Squelch System. Many two-way radio manufacturers have different names for this feature. Here are some of the manufacturers and their names: Motorola: "Private Line (PL)," GE/Ericsson: "Channel Guard", E.F. Johnson: "Call Guard", RCA: "Quiet Channel", and some simply call it "tone squelch," "privacy codes," or "interference eliminator codes". The most proper name is CTCSS.

These codes enable a two-way radio to keep the radio squelched (quiet) if the chosen code is not received with a transmission. In other words, the speaker of the intercom is not turned on even though a transmission is received. Technically speaking, a CTCSS tone code is a sub-audible tone/code which allows your radio to ignore (not hear) calls from other parties who are using the same channel. With CTCSS it may seem like you have your own private channel but other parties can still hear your calls if they set up their radio with the same tone code or no tone code at all.

Both receiving and transmitting radios must be set to the same interference eliminator/CTCSS code or it will appear that a radio is not receiving transmissions.

While CTCSS is said to transmit sub-audible tones (can't be heard on the radio's speaker), a radio is really continuously transmitting an audible tone below 300 Hz during a conversation. Each radio contains a filter to filter out anything below 300Hz so the tone is not heard even though it is there. Encoded tones are sent by the transmitter and decoded tones by the receiver to un-mute its speaker.

There is a digital version of CTCSS called Digital Coded Squelch (DCS).

Digital Coded Squelch (DCS)

DCS is digital form of privacy codes or CTCSS (see above). The Motorola trademark name for this feature is Digital Private Line (DPL). DCS and DPL are functionally the same.

DCS is a digital squelch scheme sent by a transmitter to control the un-muting of the receiving radio's speaker. Like CTCSS it is designed to work in the "so called" sub-audible portion of the communications audio band below 300 Hz.

Instead of sending an analog tone like CTCSS does, DCS signals are digital square wave signals where the square wave signal represents '1' and '0' data bits. There are a total of 23 bits sent, and these bits are decoded by the receiving radio.

There is a loose standard set of 83 DCS codes used by most of two-way radio manufacturers.

Privacy Codes

Two-way radios have a limited number of channels available based on the frequencies assigned by the FCC, so there is always a chance someone else may be using the same channel you are using. This is the reason for privacy codes.

Privacy codes are based on the CTCSS or DCS (see above) codes capability of two-way radios. A receiving radio that has a privacy code set will not un-mute its speaker unless that code is sent along with a transmission.

So if a receiving radio is set to channel 2 and privacy code 5. The transmitting radio must be set to the same channel and code. This way you will be able to communicate between two radios without interference. You can also have a select group set to the same channel and code to effectively communicate with a group of users at the same time.

But, it should be understood that the privacy codes, as such, do not ensure privacy of your conversation. If any unknown user tunes in to the same channel and code that you are using, he or she can listen to the conversation taking place. So, the privacy codes feature should be looked at more as an interference eliminator rather than a feature that provides privacy of conversation.

One of the downsides of privacy codes is that you could assume that since you do not hear any communication on your radio, the channel is not being used. Then when you press the Talk button on your radio and start talking, you will be talking over the person who is already transmitting. If this occurs all transmissions for all radios will be garbled. Most 2-way radios have a Monitor button that disables the privacy code feature while the button is pressed so you can hear if there is any activity on the channel before you transmit.

Timeout Timer (TOT) and Penalty Timer

Handheld two-way radio devices operate on battery power so it is important to make sure their batteries last as long as possible. Most radio transmissions take on an average of 5 seconds. A transmission of a single long duration may indicate there is something faulty with the device, or perhaps the 'Talk' button has been pressed for a long time. This will exhaust the battery and also tie up the channel frequency. To avoid this situation, the Timeout Timer feature of a two-way radio comes into play.

This feature will stop the transmission of the two-way radio if the radio is transmitting for a long duration. In some models, if the Push-To-Talk button is pressed for 60 continuous seconds, the radio device emits a warning tone and stops transmitting.

Some radios may also have a Penalty Timer which starts after the Time-Out Timer is over. The Penalty Timer keeps the unit from transmitting for an additional length of time.

Noise Filtering

A two-way radio can be susceptible to interference from electrical noise generated by some nearby electrical equipment. This noise may interfere with the regular operation of mobile radios. If the radio signal is strong, the noise component may not affect communication, but if the signal is weak, noise levels can create a hindrance in communication and hence noise reduction becomes very important.

Some radios have a noise filtering feature that can reduce unwanted noise and help in effective communication.

Call Tones - Unique Call Tones

The Call Tones feature of a two-way radio provides the user with a facility to choose from a range of available call tones and set one as a default call tone for a particular group or person. It helps the other members of the group identify the caller uniquely.

Call Tones allows the user to broadcast a tone to other members in the group to alert them that someone from the group wants to communicate with them. It helps get their attention.

This feature is analogous to the set call tone for a particular caller in mobile phones which helps us to identify the caller by the unique ring.

Voice Scramble

The voice scramble feature of a two-way radio provides the user with more private and secure conversations within a group. When using voice scrambling, a radio will encrypt the signal it is transmitting. The receiving radio will intercept the signal and will have to decrypt it to make any sense of the signal's actual message.

Anyone with a regular radio on the same channel will only hear noise or garbled transmission instead of the actual message in the signal. If the user wishes to use this feature in a group, then, all the members in the group must have radios supporting voice scramble or they will just hear garbled voice.

But, it should be noted, that this feature does not ensure complete privacy. Anyone with the same brand and model of radio as yours will be able to intercept and decrypt the signal and hear the conversation clearly.

Encryption

When communicating over a two-way radio, it is important to understand that anyone can listen to the messages communicated over the channels if they are on the same channel. This is may not be acceptable when the device is used by security agencies and other private users who wish to keep their conversations private and inaccessible to unauthorized persons.

This problem can be eliminated by electronically encrypting conversations before transmitting them and then decrypting the conversations at the receiver's end, therefore ensuring their privacy. This encryption capability is provided in many high-end commercially available radios.

Generally, a group of two-way radios to be used together are subjected to a configuration set up wherein the encryption and decryption codes to be used during transmission and receiving of the data are programmed into the devices. This may involve putting the radios in a programming mode so they can "talk" to each other to learn the codes needed to decrypt a message.

Anyone intercepting a decrypted message on a radios not programmed will hear garbled voice so they won't be able to understand the conversation.

There are different encryption levels such – low, medium and high and the implementation of these levels are dependent on the commercial use of the devices. One of the more secure encryption techniques is called P25, which is a suite of wireless communications protocols used in the US and elsewhere for two-way voice radio systems. The protocols include security options in which voice and data traffic can be cryptographically protected from eavesdropping. Lower level radios may simply have voice scrambling that could easily be picked up with someone who has the same radio from the same manufacturer.

Direct Call

The direct call feature of a two-way radio enables users to make a private call to a particular person or a group of people. While a conversation can take place between two or more people in a group, if you are on an analog radio it could still be heard by people outside your group plus it still ties up the channel everyone is on.

This feature uses the CTCSS or DCS codes (see above) of the radios to provide "simulated" privacy. These codes are transmitted sub-audibly along with the conversation and if a radio is set to receive a different code, its speaker will remain quiet. Only people whose radios are programmed to receive the code will hear the conversation. The exception is a radio that is programmed with no CTCSS or DCS codes. It will hear all conversations.

Some radios let you choose from a list of either names or CTCSS or DCS codes from a menu selection and that allows you select from people or groups you want to talk to.

Digital radios can have actual direct call that is private and does not tie up a channel.

Selcall (Selective Calling)

Selcall enables a voice call to a specific radio or group of radios. The caller selects the radio or group of radios from a pre-programmed "contact list" that has been programmed into the radio using the radio's programming software.

Selcall works by generating and transmitting a series of predefined, audible tones. Both the tone frequencies, and sometimes the tone periods, must be programmed in advance into both the transmitting and the receiving radios. Each predefined tone represents a single digit. A series of tones represents a series of digits that represents a number. The number encoded in a Selcall is used to address one or more receivers. If the receiver is programmed to recognize a certain number, then it will un-mute its speaker so that the transmission can be heard; an unrecognized number is ignored and therefore the receiver remains muted.

DTMF

DTMF stands for Dual Tone Multi Frequency, which is the oldest and the most widely used data format on two way radios. This format was invented by Bell Telephone for telephones. DTMF is actually the generic term for Touch-Tone which is a registered trademark of AT&T. A telephone has a DTMF generator that produces the tones as you dial the numbers.

DTMF is used in 2-way radio for station identification and for other control functions. In a two way radio, DTMF can be used to send an individual ID code every time a user pushes the PTT. This code informs receiving radios which user is calling them. In a low range, weak signal or noisy environments, it is sometimes difficult to recognize a radio caller. In such situations, these DTMF signals can be used to distinctly identify the calling radio.

This function has various uses such as selective calling individual radios, radio disabling, and for short messages to be transmitted and received in situations of emergency.

2-Tone and 5-Tone Codes

2-tone and 5-tone codes are method of signaling in radios and other devices. 2-tone sends a single tone followed by 50 to 1,000 milliseconds of silence, and then a second tone. 5-tone does the same thing but only with five tones as the name implies. These signals are "encoded" by the sending radio and "decoded" by the receiving radio. What happens after that is usually set in programming for the radio.

When a tone code is decoded by a radio, it could unmute a speaker, turn on a light, sound a signal, page a group, control a repeater, or in the case of a wireless call box, it may activate a gate or door relay, which then opens a gate or door.

While radios from different manufacturers may both have the 2-tone feature, they are not necessarily compatible unless the timing between tones can be adjusted. The frequencies of the tones must also match.

The feature SelCall feature (offers privacy on radio) often relies on 5-tone coding. Every tone frequency has a fixed or specific value to it, depending on the implemented system. Thus SelCall transmits a burst of five in-band audio tones to initiate a private conversation.

Scan Channel Delete/Nuisance Channel Delete

This two-way radio feature allows the user to skip a channel they know is not required during the radio's channel scanning. Therefore when the radio is scanning the available channels, it will jump over the channels that the user has selected to be skipped.

This feature is useful in instances when there are channels that may be used for other groups and they do not need to be monitored, or if there is a channel that has frequent activity that you do not want to hear. This feature is also called as the 'Nuisance Channel Delete'.

Priority Channel Scan

The two way radio Priority Channel Scan feature allows users to prioritize certain channels over others during the scanning operation. This enables a more frequent checking of the preferred channels over other channels and reduces the likelihood of missing important messages or conversations over the preferred channels.

For example, if the radio has 8 set channels, the normal scan operation scans the channels in the following way – Ch1 >> Ch2 >> Ch3 >> Ch4 >> Ch5 >> Ch6 >> Ch7 >> Ch8 >> Ch1 >> Ch2 >> Ch3...

But, if the user set the priority of Channel 3 as 1, then the scan operation will scan the channels in the following order – Ch3 >> Ch1 >> Ch3 >> Ch2 >> Ch3 >> Ch4 >> Ch3 >> Ch5 >> Ch3 >> Ch6 >> Ch3 >> Ch7 >> Ch3 >> Ch8 >> Ch3 >> Ch1...

If the user set the priority of Channel 3 as 1, and of Channel 5 as 2 then the scan operation will scan the channels in the following order – Ch3 >> Ch1 >> Ch5 >> Ch2 >> Ch3 >> Ch4 >> Ch5 >> Ch3 >> Ch6 >> Ch5 >> Ch7 >> Ch3 >> Ch8 >> Ch5 >> Ch1...

If the radio is on a non-priority channel, some models keep checking for activities on the priority channels, and if activity is detected on any of the priority channels, the radio switches to the priority channels.

Power Output

One important factor in the distance a two-way radio will communicate is its power output. This power output is measured in "watts." You've likely heard an FM radio station say they are broadcasting at 50,000 or 100,000 watts. Well, a handheld business-type two-way radio usually broadcasts at 1-5 watts. A vehicle mobile radio may broadcast anywhere from 5 to 100 watts. The more watts a radio has, the farther it can transmit as described in the 2-Way Radio Range section above.

Certain models of two-way radios provide a feature of selecting the power output of the device. The different modes offered to the user are – high power, medium power and low power modes. Most radios include only the high and low power mode. This feature is also known as the Power Selectable feature.

When a 2-way radio is used in for short-range communication, it's always best to use the low power mode. Always try to use the lowest power setting. Running the device in low power mode conserves battery power therefore giving more time between charges.

Another reason to use the lower power setting is that your radios won't transmit as far, therefore limiting the number of people outside your group that can hear your conversations.

The high-power mode should be reserved for long-range communication, or for when there are lots of obstacles to penetrate.

Power Selectable

The power selectable feature found in some two-way radios permits users to switch easily between low and high power modes. Low power mode lowers communication range, while high power mode increases range or helps overcome obstructions that are in the way.

Some radios may have three power modes, i.e. low, medium and high. However most radios just include low and high power modes, which may be 1 watt and 5 watts. These settings may be determined in programming or via a programmed button that toggles between them. If the radio has a display, an indicator usually states what mode the radio is in. Some radios also enable you to have different power levels on different channels.

The feature is used to conserve battery power when needed and to limit range when long distances are not needed. (See the 2-Way Radio Range section for more details).

Military Specification Standards

In an effort to achieve standardization objectives for purchases of products used by the military and other government organizations, the U.S. Department of Defense created standards that these products must meet. You will see these standards called military standard, "MIL-STD", or "MIL-SPEC." These standards ensure products meet certain requirements, commonality, reliability, compatibility, and similar defense-related objectives.

The Department of Defense developed mil-spec standards for two-way radios that meet levels for such criteria as vibration, rain, salt air, sand/dust, shock (dropping), humidity, temperature as well as other factors. Buying a radio that meets mil-spec standards means you are buying a quality product that is built to withstand tougher use.

Ingress Protection (IP)

Radios with an "IP" designation are similar to those who meet military standards. IP stands for Ingress Protection and it is an international standard that specifies the sealing effectiveness of the enclosure of a product. It is a two digit code that tells you how effective the enclosure is to penetration from fingers, dust, and moisture.

For instance, for a radio that meets IP 55, the first 5 means it is protected from the amount of dust that would interfere with its operation. The second 5 means that it is protected from water that shoots from a nozzle.



1 st Number	Degree of Protection	2 nd Number	Degree of Protection
0	No protection against contact or entry of solids	0	No protection
1	Protection against: Accidental contact by hand, but not deliberate contact. Large objects (> 50mm)	1	Protection against drops of condensed water. Condensed water falling on housing shall have no effect.
2	Protection against: Contact by fingers Medium-sized objects (>12mm)	2	Protection against drops of liquid. Drops of falling liquid shall have no effect when housing is tilted to 15 degrees from vertical.
3	Protection against: Contact by tools, wire etc Small objects (>2.5mm)	3	Protection against rain. No harmful effect from rain at angle less than 60 degrees from vertical.
4	Protection against: Contact by small tools and wires Small objects (>1mm)	4	Protection against splashing from any direction.
5	Protection against: Contact with live or moving parts Harmful deposits of dust	5	Protection against water jets from any direction.
6	Protection against: Live or moving parts Penetration of dust	6	Protection against conditions on a ship's deck. Water from heavy seas will not enter
		7	Protection against immersion in water. Water will not enter under stated conditions of pressure and time.
		8	Protection against indefinite immersion in water under a specified pressure.

Radio manufacturers often define what exactly what the second number means. For one manufacturer, a radio that meets the IP57 ingress protection standard can be submersed in water at a depth of 3 feet for up to 30 minutes and it will not harm the radio. As you can see in the table below, there is no time or depth defined for second digit 7. You will need to check with the manufacturer to see exactly what the digits mean.

Submersible Two Way Radio

Though the submersible feature is not found in regular or standard two way radios, there are many manufacturers who sell handhelds that have it as their key feature.

A submersible two way radio meets Ingress Protection Rating (IP) IPX7 or IPX8 standards. The IPX7 standard means the radio is waterproof to 1 meter (3.3 feet) of water for about 30 minutes. That means if your two way radio falls into a shallow pool of water, it is not going to get damaged. IPX8 means the radio is suitable for continuous immersion in water under conditions which are specified by the manufacturer.

Submersible radios are great for people working as coastguards or in the marine field. However, they can also be purchased by others who want their radio to be very durable. This is because these radios are usually built rugged and can work efficiently day in and day out whether there is a windy spray, whitecap splash, a tidal wave or it has fallen in about 30 feet of water. Submersible may be accompanied by a floating design so if you drop it in a pond, it floats to the top.

Intrinsically Safe

An intrinsically safe radio is a one that is safe to operate in explosive environments. In normal conditions most communications devices can cause tiny internal sparks in connectors and switches and these sparks can ignite the flammable substances that are present in the surroundings. The concept of intrinsic safety was developed for safe operation of communication devices in hazardous situations especially on gas platforms, grain elevators, and any other explosive environment. These radios are very expensive and often bulky.

Two-Way Radio Battery Saver Mode

Since two-way radios are mobile devices, obviously they operate on battery power. The batteries used in most of the models are rechargeable type, with some devices working on AA or AAA non-rechargeable, throwaway batteries.

The battery saver feature of the two-way radio, also called low power mode or the sleep mode, helps extend the life of the batteries. If the user has left the radio unused for a certain period of time, the feature switches the device to low-power mode to conserve power. The radio automatically switches to battery saver mode if there are no transmissions from it for more than 10 seconds. This time is adjustable in certain models.

Low Battery Alert

The low battery alert feature of a two-way radio alerts the user when battery power is low. The user is informed either with the help of a low battery signal using some audible tone, or with an icon displayed on the device screen indicating the low battery sign.

This feature helps the user to know in advance when to recharge or change the two-way radio batteries before it dies during some operation.

Push-to-Talk (PTT)

Push-to-talk (PTT or P2T) is also alternately known as Press-to-Transmit. PTT is a means of communication in half-duplex mode. When using a 2-way radio, the device can either transmit or receive a signal, but transmitting and receiving cannot happen at the same time. This is possible by the use of a switch wherein on pressing the switch on the device activates the transmitter and changes from the receiving mode to transmitting mode. In half duplex mode, since the users can only either transmit or receive at any point of time, each party must wait for their turn to speak.

One variation of the PTT is the Push to Talk over Cellular (PoC). Cellular phones service providers can provide this service which allows the user to use their phone as a walkie-talkie with unlimited range (however, this feature seems to be being phased out).

Two-Way Radio Keypad Lock

The keypad lock feature of a two-way radio, when activated allows the user to lock the buttons so that in case the user presses them by mistake, it does not result in some unwanted action.

This feature is useful when the user carries the radio in a pocket or in a bag wherein there are chances that the buttons could get pressed, or channels could get changed, by accident.

Once keypad lock is activated by the user, it will have to be deactivated before channels or any features can be changed.

Silent or Audible Ring Alerts

Many two-way radios provide the ability to set the device on silent or vibrating modes. This feature is sometimes called ring alert and helps the user to select audible, vibrating, or silent mode for the radio.

If the radio is set to audible mode, the radio rings with the set call tone for the incoming transmissions.

If the mode is set to vibrating, the radio only vibrates and the user feels the vibrations and the screen blinks when there is an incoming transmission.

In the silent ring alert mode, the radio disables all the beeps and tones. In this mode, the radio will indicate an incoming transmission without making an audible alert of any type and only the display will flash several times. This feature is very helpful for the people whose work cannot be disrupted by noise e.g. soldiers, hunters, etc.

Lone Worker Mode

Lone Worker Mode is a very useful feature for people working in remote difficult terrains, mines, forests, or dangerous conditions. This feature uses a built-in timer in the two-way radio. The timer has a pre-set interval, after which the user must reset the timer again for the next interval. If the user fails to reset the timer, the two-way radio will automatically switch to the Emergency mode and start transmitting distress signal tones.

Lone Worker can prove to be a life-saver. If the user has met with an unfortunate accident and has not reset the timer, the help signal will send someone to look for him or her.

Emergency Alert

When the Emergency Alert button pressed, this button sends out a distress call to other radios within range. This feature allows the user to quickly send out a distress signal in case of an accident or other emergency. Also, emergency alert calls generally have a priority over all other calls.

To activate the Emergency Alert feature, the user holds the button down for a configured number of seconds and a distress tone is sent to all other radios. In some models, the radio also automatically changes to the hands-free mode to enable the user to transmit a voice message to the receiving radios.

Stun/Kill/Revive

Some two-way radios have a 3 unique functions called ‘stun’, ‘kill’ and ‘revive’ which are used in situations where the radio has been lost temporarily or stolen. These functions can disable and enable the device remotely and are used to prevent the unauthorized use of the device by unscrupulous persons.

If a 2-way radio has been lost, the user can send remote ‘stun’ signals from a second radio to the lost radio to inhibit all the functions of the device making it practically unusable. The two way radio can neither receive nor transmit any messages over any of the channels if it has received a ‘stun’ signal.

Once the lost radio has been re-located, the device can be enabled again by sending the ‘revive’ signal from another device to lost radio, re-activating all its functions.

If a two-way radio is deemed to have been permanently lost, then the user can send ‘kill’ signals from another device to the lost radio permanently disabling all its functions. Such a ‘killed’ radio, if recovered at a later time, can only be re-activated after re-programming its internal circuitry.

The Stun-Kill-Revive functions provide a safety feature to prevent its unauthorized use.

Companding

The word ‘companding’ is actually the combination or blending of the two words – ‘compressing’ and ‘expanding’.

This two-way radio feature is used when the device itself has a smaller dynamic range capacity and is required to transmit a large dynamic range. In this technique, the sound waves before transmission are compressed and then transmitted. Thus this allows a large bandwidth transmission over a narrow range device.

At the receiver's end the sound waves are expanded enabling a full sounding signal. The Radios have a compandor built in to facilitate this function. Both radios must have the same compandor circuitry for this feature to work between two radios.

Companding also has other benefits like noise reduction which improves the sound clarity and reduces the static hissing sound between two transmitted words. Crosstalk levels at the receiver are eliminated and there is an overall enhancement in the transmission quality.

900MHz

The International Telecommunication Union divided the world into three regions and the U.S., Canada, and Mexico falls in ITU Region 2. In ITU Region 2 the 900 MHz frequency range allocated to amateur radios ranges from 902 MHz to 928 MHz. The ITU also defines 900 MHz to be in the industrial, scientific and medical radio bands (ISM Band). Two-way radios, cordless phones and wireless intercoms designed for ITU Region 2 can be used in North America, Australia, and Israel (Australia and Israel adopted the region 2).

When these products first came to market they communicated using analog technology. One problem with analog 900MHz products is that they allowed other people to hear your conversations if they had a device that is using the same frequency. Now most 900MHz products use digital spread spectrum which divides digital transmission across a range of frequencies so other devices can't eavesdrop on your conversations. Spread spectrum also enables multiple channels of communication at the same time with the same network of intercoms (see section on Spread Spectrum for more details).

The 900 MHz frequency range has been in use since 1985 when the Federal Communications Commission allocated the frequency range to unlicensed devices. The Federal Communications Commission allocated this frequency range on a secondary basis to the amateur radio service which means that the amateur radio users could use the frequency range as long as they were willing to accept interference from the primary users and did not cause any interference in the communications of the primary users.

The 900 MHz frequency range is usually used for local and short distance communications in comparison to bands that are lower in frequency. However two-way radios with higher antennas and better adjustable gain features have shown that the 900 MHz frequency range can prove to be very useful even for long-range communications.

One advantage of using two-way radios operating on 900 MHz is that both businesses and individuals can operate the communications device on this frequency range without having to obtain a license from FCC.

Frequency-hopping spread spectrum (FHSS)

Frequency hopping means the radio hops from one frequency to another many times a second. This is actually the same as thing as the spread spectrum feature above. FHSS is a feature of digital two-way and radios having it continuously switching their frequencies. Radios in a group are programmed to hop frequencies together so they can talk to each other.

The benefit of frequency hopping is that users can make more secure and private calls. Conversations cannot be overheard or intercepted by other persons using other types of radios or any type of commercially available scanners.

Besides offering privacy, another great advantage of this feature is that they require no FCC license (See Spread Spectrum below for more info).

Spread Spectrum

Spread spectrum works by “multiplexing” multiple signals by sending them along different frequencies within the allotted frequency range for a wireless intercom. Or in other words it splits the spectrum into tiny slices of time.

Hollywood actress Hedy Lamarr and musician George Antheil filed for a patent on a spread spectrum communications system in 1942, though real-world deployment occurred later. A spread spectrum system inverts the static model of transmitting with high power on a narrow channel.

Using low power and spreading the signal across a range of frequencies, it’s possible to carry more transmissions simultaneously. The basic notion is that if the transmission is broken into pieces, each of which is tagged with a code, a receiver that knows the code can reconstruct the message. The wider the spreading, the more space there is in between the coded packets to send other signals at the same time (see Figure 7).

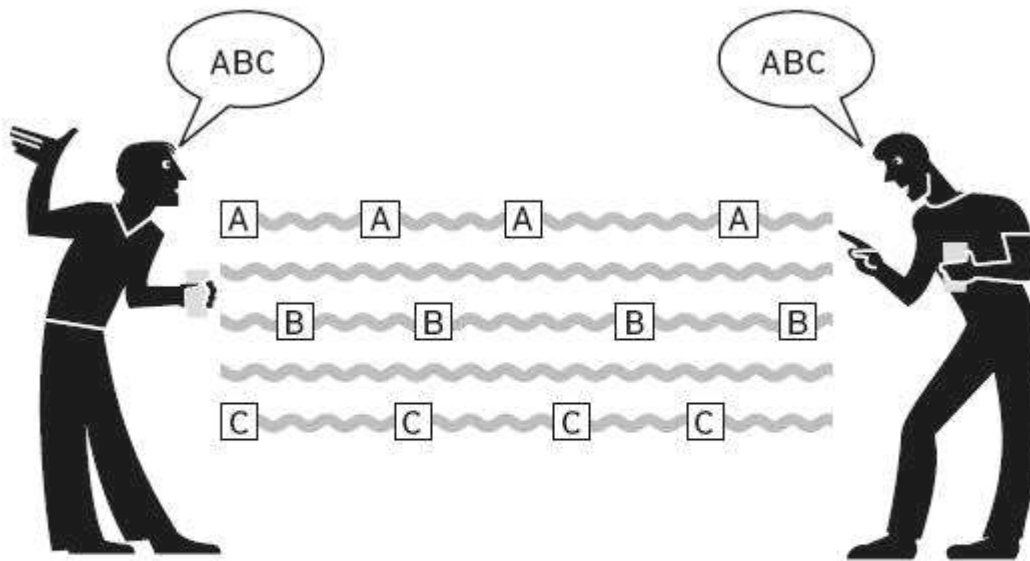


FIGURE 7 – SPREAD SPECTRUM: In spread-spectrum communications, low-power radio transmitters divide their signals into coded packets across a range of frequencies and receivers reconstruct the message.

Taking spread spectrum to its logical conclusion, if the signal is spread wide enough, the power density can be so low that the signal becomes effectively invisible to other systems in the same bands.

Radio frequencies are never totally empty of noise. Radiation-emitting devices such as hair dryers and microwave ovens, as well as cosmic background radiation, create a “noise floor” that all systems must contend with. Static systems do so by using high-enough power that it’s easy to distinguish the high-power signal from the low-level noise.

With enough smarts, a spread spectrum system can transmit and receive very faint signals without ever raising above the noise-floor threshold.

For a wireless intercom, spread spectrum has several benefits. One is that it uses lower power so battery life is extended. Two is that it eliminates the noise that wireless intercoms with other technologies would experience. And three is that it makes it much more difficult for other devices to hear a conversation since the conversation is broken into tiny fragments over a wide range of frequencies.

GMRS and FRS Two-Way Radios

General Mobile Radio Service (GMRS) shares the frequency band of the Family Radio Service (FRS), between 462 to 467 MHz. GMRS offers 23 channels within this frequency band, but 7 of them are shared with FRS.

GMRS channel usage requires an FCC license and fee and only people above 18 can apply for a license.

Devices marketed as "FRS/GMRS" or "dual-service devices" are available from many manufacturers and many retail or discount stores. If you operate a device that has been approved exclusively under the rules that apply to FRS, you are not required to have a license. FRS devices have a maximum power of ½ watt (500 milli-watt) effective radiated power and integral (non-detachable) antennas. If you operate a device under the rules that apply to GMRS, you must have a GMRS license. GMRS devices generally transmit at higher power levels (1 to 5 watts is typical) and may have detachable antennas.

Since there are so many of these radios sold in discount stores, the frequencies are often very crowded.

Vibrate Alert

Vibrate alert is used on radios to notify a user of an incoming call in a noisy environment. It can also be used when the user wishes to receive a discreet notification about any incoming call. The vibration is often produced by a small electric motor that is connected to an eccentric or unbalanced weight to produce the vibration that alerts the user.

Adjustable Gain

Adjustable gain enables radio users to adjust the sensitivity of the radio's microphone for the voice activation (VOX) hands-free feature. Turning the microphone sensitivity down minimizes the possibility of accidental transmission due to background noises. The adjustable gain feature can also be used to enhance the ability of the VOX feature to pick up quiet voices.

Audio Accessory Connector

Most commercial grade radios have an audio accessory connector that is essentially a port that allows the user to connect an external device to the two-way radio. The actual devices supported depend on the model of the communications device.

Some of the most popular external devices connected are speakers and microphones. Most microphones available can be connected to almost any two-way radio model because they have a universal 3.5mm standard jack. You will often see radios that have two jacks, one input for a microphone and one output for a speaker. The microphone jack may be a 2.5mm while the speaker is 3.5mm.

GRMS	FRS
462.5500	462.5625
462.5625	462.5875
462.5750	462.6125
462.5875	462.6375
462.6000	462.6625
462.6125	462.6875
462.6250	462.7125
462.6375	467.5625
462.6500	467.5875
462.6625	467.6125
462.6750	467.6375
462.6875	467.6625
462.7000	
462.7125	
462.7250	
467.5500	
467.5750	
467.6000	
467.6250	
467.6500	
467.6750	
467.7000	
467.7250	
Seven frequencies are shared between FRS and GRMS	

Some radios have a method of attaching the microphone cable with a screw so it doesn't easily pull out when the radio is dropped, and so water and dust do not penetrate the opening. See Audio Accessories section above for more detail.

Cloning Capable

The cloning capable feature enables an already programmed radio to easily load its configuration to a different radio. Whenever new radios are being added, this makes programming quick and easy.

This feature is often built into multi-unit charging stations, or it may just use a simple interface cable. The interface cable connects the radios, and using different program settings, the configuration of one radio is loaded onto another.

Channel Announcement

The channel announcement feature enables a user to change the radio's channel without having to look at the channel knob. Therefore, the channel announcement feature is extremely handy during hands-free operation. This feature audibly voices the number of the channel the radio is currently tuned to. In many radios the channel announcement feature is provided to the user in numerous languages. You can usually switch the feature off in the programming settings, or assign a button that turns it off and on.

NOAA Weather Alerts

Two-way radios that support weather alerts by NOAA (National Oceanic and Atmospheric Administration) can automatically alert the user whenever a weather alert is being broadcasted.

The NOAA Weather Radio All Hazards is a radio station network that broadcasts weather information on a continuous basis after receiving direct information from the National Weather Service office. The broadcasts by the NOAA include weather watches and warnings, and emergencies such as natural disasters, environmental emergencies, national security and public safety.

The NOAA National Weather Service is a public service and since mid-2009 has been using over 1000 transmitters which has been providing weather alert service to 95% of the population of the United States. The broadcasting service is available in all 50 states of the country as well as in the adjacent coastal waters, US Virgin Islands, Puerto Rico, Guam, Saipan and American Samoa.

Only VHF two-way radios are capable of receiving NOAA transmissions since the signals are in the VHF frequency range.

Weather Alert Radio

Some two-way radios in the VHF band allow you to receive weather broadcasts from the NOAA Weather Radio service if you are in a broadcast area. With this feature you'll know instantly of approaching bad weather so you can alert others. See above for more detail.

Contacts List

A two-way radio contacts list is a list of individuals or groups the radio can call. The user scrolls to a particular contact name and then initiates a direct call to that contact.

The contacts list is normally entered into the radio using a programming kit on a PC. It can then be cloned to other radios. The list usually consists of details such as the name of the contact as well as the frequency and any associated codes on which the individual or group can be contacted.

Many two-way radios also provide speed dialing capability along with the contacts list feature. Using it the user can assign speed dialing to certain contacts. Depending on the features of the radio, the user can also categorize contacts so they can list certain contacts in the emergency contacts list and other contacts in the regular contacts list. The user can also change the display of the contacts list according to different details such as level of importance, category, first name, last name and channel frequency.

Out-of-Range Alert

The out-of-range alert feature lets users know when two radios having this feature are within range. With this feature enabled your radio automatically sends a code to other radios in your group at fixed intervals. If that code is received, the receiving radio sends a confirmation code back to acknowledge that it was received. If the sending radio does not receive a confirmation code, then the radio will sound the out-of-range alert.

In short, if you travel beyond the working range of your group, then it automatically alerts you. Thus the out-of-range alert feature in two-way radios is extremely helpful in keeping a group in touch.

PC Configurable in Two Way Radio

Most business-class two-way radios have an available software application and cable used to program the radio from a personal computer. This software application makes it more manageable to adjust the radio settings or alter user selectable frequencies. PC-compatible software enables the user to benefit from the full functionality of a computer (including the keyboard and the mouse) to configure a two-way radio settings, along with storing relevant and required data with ease.

Programmable Buttons in Two Way Radio

Programmable buttons are physical buttons on a two way radio that can easily be programmed with the radio's available features. The number of buttons available depends on the model and brand. A single programmable button may accommodate more than one feature, thereby helping the user use more features.

Users can choose their settings from the list of programmable features, depending on how frequent they need them. Besides the fixed programmable features, some models also include customizable features.

Assigning features to a programmable buttons is usually done via a PC programming tool.

Text Messaging

Text messaging is one of the key features of a normal cellular phone, however now it can also be found in some digital two way radios. Just like a mobile phones, text messaging in two way radios, enables the user to send and receive text messages to individuals or other people in a group.

Using the two way radio's keypad, a user can send short text messages to an individual or to an entire group. A user can write a text message or select from the list of pre-programmed messages (as applicable) and send it to a group or select the recipient from the contacts of their radio contact list. Most radios that support this feature have a big backlit alpha-numeric text display that enables the user to read the text messages even in the dark.

Repeater Capable Two Way Radio

A repeater capable two-way radio is one that is capable of transmitting and receiving on separate frequencies for a single channel. This permits a two way radio to communicate through a repeater, which strengthens the radio signal and considerably increases its range. Repeaters receive a signal on one frequency (RX), and then

re-transmit this signal on another frequency (TX) with a greater strength (see Repeater section for more detail).

Two-Way Radio Repeaters: How to Choose and Install

A two-way radio repeater takes weak and low-performing signals and retransmits them at a higher power so they can cover longer distances, ranges, and terrains without degradation. Repeaters eliminate unwanted noise and interference, helping to clarify messages as they are strengthened and re-transmitted. When properly installed, radio repeaters provide reliable communication signals from one radio to another, almost completely eliminating dead zones.

By definition, a repeater is both a radio receiver and a radio transmitter, a device that receives an analog or digital signal and amplifies and transmits it further than it would otherwise be able to go. Repeaters are commonly used by emergency responders, commercial organizations and amateur radio operators (known as HAM radio operators) to extend frequency ranges from one receiver to another. The most basic repeater consists of a receiver on one frequency and a transmitter on another frequency, usually in the same radio band (i.e. UHF or VHF), as well as one or more antennas. They may also require amplifiers, isolators and other accessories.

A Brief History on Radio Repeaters

Military communication units have been using radio repeaters for many years to allow command posts to transmit both encrypted voice and data signals across hundreds of miles, while allowing for a forward moving regime. It was this type of technology that inspired the radio repeaters on the market today, which are far smaller, more durable and less expensive.

Military radio repeaters require vehicles to haul bulky and heavy equipment and provide a heavy-duty power source. They involve the installation of very tall antennas constructed by entire communication teams. Using a 50-ft. antenna, military radios can carry a signal for a maximum of 35 miles. At least a dozen repeater sites would be required to carry a message 500 miles.

Modern radio repeaters, on the contrary, are compact, user friendly, and easy to install. Many of them are smaller than a briefcase, weighing just a couple of pounds. Tough-to-cover areas are no longer a problem with a radio repeater because range and coverage limitations are eliminated. Some repeaters promise coverage for a hundred miles or more with the proper installation.

Types of Radio Repeaters

There are different types of radio repeaters, each designed for specific uses and situations. Repeaters strengthen and sustain both UHF (Ultra High Frequency) and VHF (Very High Frequency) signals, especially in rugged terrain and over water. Most repeaters available for businesses today use UHF frequencies.

A repeater uses two frequencies, a transmit frequency and a receive frequency. It receives signals on one frequency and re-broadcasts them on another frequency. For a two-way radio to work with a repeater, it requires a radio that enables the programming of separate transmit and receive frequencies that match the repeater.



Low-power repeaters are used for onsite communications, with antennas placed at a low level. These are generally used for areas as large as a small town or for a campus or building. These systems may only have 2 to 5 watts of transmitting power.

High-power repeaters are placed atop tall towers or hilltops to maximize coverage areas. These systems allow users with low-powered, two-way radios to communicate with each other across many miles. These systems may contain as much as 100 watts of transmitting power.

In a digital communication system, a repeater takes a transmitted signal, regenerates it and sends it along to the next receiver station. A series of repeater sites make the extension of a signal over an incredibly long distance a possibility. Digital repeaters are able to eliminate the unwanted signal, a digital signal, even if it is faint or unclear, can be completely restored. Analog signals, however, are strengthened with amplifiers, which, unfortunately, often amplify noise as well as the audio information.

In communications systems, a repeater consists of a radio receiver, a transmitter, an amplifier, one or two antennas, and an isolator. The transmitter produces a signal on a different frequency than the received signal. This is called a offset, which is required to prevent the transmitted signal from disabling the receiver.

For more complex installations, an isolator in line with the antenna cable provides additional protection. An isolator is a one-way band-pass filter that reduces the ease of signals from nearby transmitters going up the antenna line and into the base station transmitter. This prevents the unwanted mixing of signals inside the base station transmitter which can generate interference. An isolator also reduces the transmission of undesired signals. Isolator circuitry may be built right into the lower power repeaters.

A repeater, when strategically located on top of a high building or a mountain, can greatly enhance the performance of a wireless network by allowing communications over distances that would otherwise be impossible to cover.

Some organizations now use all digital systems. Unlike analog signals, digital signals need to be more frequently repeated. Because digital signals scatter more quickly than analog signals, amplifiers are often needed. While analog repeaters are spaced at about 18,000 meter intervals, digital repeaters are usually placed in 3,000 to 6,000 meter intervals.

Installing a Radio Repeater

Installation of two-way radios can range from somewhat complex to incredibly easy, depending on the configuration. High-power repeaters usually require two antennas, one for receiving and one for transmitting. Installation of this type of repeater is complicated and not recommended for the average, untrained user. The typical repeater for shorter distances, however, requires only one repeater antenna, which transmits and receives to two-way radios, usually hand-held devices. These are relatively simple.

In two antenna installations, placement of the antennas is critical to prevent the receiving antenna from taking in energy from the transmitting antenna. The antennas are placed at different heights to minimize this interference.

To make installation easier, some repeaters have what's called a built-in or add-



on duplexer that allows the unit to transmit and receive on the same antenna at the same time. Essentially, the duplexer contains circuits that isolate the transmitter from the receiver. This way, the transmitter's radio frequency doesn't damage the receiver.

Regardless of the use of one or two antennas, a high-performance antenna is usually positioned at the coverage area's tallest point with the repeater. When strategically located at the most elevated point of a communication site, height greatly enhances the overall operation and performance of a repeater's signals. Antennas are preferably mounted with line-of-sight to all repeaters or other two-way radio users.

Before installing a repeater, a site survey and radio coverage test are vital to its proper performance. This type of testing and level of planning becomes helpful as it saves time, money and resources. Investing in these recommended practices on the front end can essentially eliminate poor equipment performance and ineffective communication later, and possibly when it matters most.

Repeater Site Survey

Conducting a radio coverage site survey and finding the right installation location is one of the most important steps in setting up a radio repeater. Positioning of the antenna is critical to the overall success of the radio communication that is depending on the repeater. Finding a prime spot is essential.

Choosing a place for a repeater should be relatively easy. Line of sight is very important in radio communication. Trees, electrical towers, hillsides and other dense structures or objects can impede signal transmission. That's not to say you must have line of sight. Just know that if you don't your range will be reduced.

Once a general area for the repeater has been identified, several options should be considered as potential antenna locations. This allows for revision to any plan negatively affected by unforeseen obstacles that might ultimately hinder signal performance.

Keep these criteria in mind when selecting the site for your repeater antenna:

- The antenna should be as centered as much as possible within the coverage area so the strength of the signal is at the same level as, and able to transmit to, all points within the configuration.
- If you must install the repeater inside of a building, rather than on top of it, which is ideal, try to look for a height that is also vertically centered on the area you wish to cover. This reduces the distance the radio signal must travel by about half. If attempting to cover a high rise building with 16 floors or more, go to a location half way up –the seventh floor, for example.
- To ensure safety, be sure the repeater device and antenna always maintain the minimum distance recommended by the manufacturer from people and objects.
- If you are planning to permanently install a repeater, be sure to reference environmental and electrical requirements to ensure your repeater meets state and federal standards.
- If you are planning to use the repeater to cover a large area with many buildings, it is highly recommended that you use a larger antenna. Try to install the repeater antenna at the highest point to allow as much line of sight as possible.
- Every site is different. Concrete walls, fire panels and other construction elements can block the penetration of radio signals. This is also true of other obstructions and these things should all be considered when conducting the survey and subsequent installation.
- Gradually lower and raise the height of the antenna during the site survey to see if coverage improves.
- Expect coverage to be somewhat enhanced when the repeater is permanently installed.

Radio Coverage Test

Once a site has been decided upon, conducting an RF (radio frequency) coverage test is the next logical step in the repeater installation process. An RF coverage test eliminates the possibility of settling on a poor installation location and identifies adverse environmental conditions that might affect the repeater's performance.

A coverage field test should be conducted at whatever site is selected as a repeater location. The objective of the field test is to replicate the quality and coverage of signals transmitted by the repeater from a given location. This should be completed before any permanent installations are implemented. It is always good to try several options to find the best location for an antenna to ensure maximum performance of the repeated signal.

Following these quick and easy steps for a standard coverage test:

1. Go to the planned repeater area with two people and pair of fully-charged handheld two-way radios. Before the test, make sure the radios are programmed exactly to the same specifications –bandwidths, frequencies, codes, etc..
2. If you're planning to have an external antenna installation, you should try to duplicate, as much as possible, the antenna's positioning to best replicate the antenna's planned height. Typically, the higher the antenna the better, but this is not always the case. If needed, position a person on a ladder or raised element to more accurately replicate the height you intend to mount the antenna. Remember, you may have to try several heights and/or locations before finding the one that works best.
3. The antenna (not the repeater) will be in the center of the desired coverage area. One person should take one radio and go to the most likely antenna location. This person's communication will represent the type of coverage you can expect if the repeater antenna were installed in that location. If coverage is inadequate, relocate to a different location and repeat the process until the desired range and coverage are optimized.
4. One person should remain at the repeater while the other person walks around the area intended for radio coverage, covering the perimeter when possible.
5. Both parties should be continuously transmitting and receiving while communicating across the signal. If the quality of communication between the two-way radios is good, this means the repeater transmissions will most likely reproduce a strong, quality signal.
6. It is best to only change one variable at a time during the coverage test. For example, adjust just the antenna height or only location, then repeat the survey process and compare results.

Every communication configuration is different, and therefore, no specific set of instructions applies when it comes to determining where to locate an antenna for optimal coverage. In general, however, remember that the antenna acts as a pivot point for all radio communication operating on a given channel. The antenna must be at the area's greatest vantage point, which will reduce potential obstructions and enhance the distance a radio signal can travel. This allows the signal to go from any place in the desired coverage area to the antenna.

When evaluating sites where coverage is needed in multiple buildings, external mounting of the antenna may be required. If you are planning to use the repeater to cover such an area, a larger external antenna mounted as high as possible is recommended. This is usually true when setting up repeaters in office complexes, shopping centers and law enforcement compounds.

Before considering an external installation of any antenna, a site survey should be conducted and then a coverage test. In this instance, one person should be positioned inside a centrally located building in the desired coverage area the highest possible elevation. The second person should walk the site, communicating from inside every building and at all outside areas where radio coverage is desired.

Always remember when handling radio equipment – safety is paramount. Use caution when installing and operating two-way radio repeaters.

Cell Phones versus Two-Way Radios

In many cases people are using cell phones in place of two-way radios. While in applications where calls are infrequent, this may be an acceptable solution. However, there are still advantages of using a two-way radio. Here are several:

1. When you want to call someone on a cell phone at a minimum you have to press a speed dial button and wait for the connection. Between the dialing and the time delay of the person on the other end answering, thirty seconds can go by (if they answer at all). With a two-way radio you simply press a button and start talking. In emergency situations this speed could be critical.
2. If you want to broadcast a message to a group, you can't do that with a cell phone. You would have to call everyone individually. When you start getting over three people in a group, the time it takes becomes very significant, not only in the time it takes to dial and connect with people, but also in the idle chatter that goes along with phone calls. In an emergency, a cell phone would waste critical time.
3. Two-way radios can connect with accessory products that cell phones can't. You can set up wireless public address systems that can receive broadcasts from two-way radios. So no matter where you are you can make an announcement. You can also set up customer assist call boxes throughout your store that customers can use to contact you wirelessly. There are wireless outdoor call boxes that can communicate with two-way radios so you can put these devices wherever emergency assistance may be needed.
4. You can get two-way radios that pick up weather alerts from NOAA weather radio so you'll be instantly notified when bad weather is approaching.
5. The Emergency Call or "man down" feature enable the radio user to immediately notify all other radios on the same channel. For example, if the radio user should become injured, trapped or is in danger, a simple push of a button will call everyone and the microphone on the radio is automatically activated for a brief period so the user can call out a message. The user may not be able to even dial a phone number on a cell phone.
6. Two-way radios continue working in natural disasters or even snowstorms. Even if cell phones do work, the cell phone towers are overloaded with everyone trying to make calls so your call may not go through.
7. Some two-way radios are built to military standards, which means they will work in wet environments or even after they are dropped on concrete. Most cell phones are delicate devices.
8. There may be places at your business where cell phones don't work. Two-way radios can reach all areas of your business, especially when repeaters are installed.
9. There is no monthly contract with two-way radios. You never have to worry about exceeding your allotted minutes with a two-way radio like you do with a cell phone

Why is there Such a Price Difference in Two-Way Radio Models?

When you're shopping for a two-way radio you'll find that there's a very wide difference in prices. Some radios are priced under \$50 while others cost several hundred. Why is this? What's the difference between them? Which one should you choose?

There are several factors to consider when buying a two-way radio. But it all comes down to how you plan to use your radio. The first question to ask is if you planning on using it for business or personal use. Answering that question determines several things starting with the frequencies you can use.

Frequencies: For two-way radios, there are essentially five groups of frequencies available: Business-Band UHF, Business Band VHF, GRMS, FRS, and MURS. Discount radios are usually only available in FRS and GRMS.

Power Output: The more expensive commercial radios usually have a higher power output. The higher the power, the farther the radios can transmit.

Battery Life: The more expensive radios use more expensive batteries such as lithium ion batteries. These batteries have fast charging, no memory effect, slow loss of charge when not in use, and are lighter than other batteries. If you need your radio for long periods, you'll want a lithium ion battery.

Durability: A professional radio is much more durable and is built to "MIL-SPEC" or "IP" standards. These standards ensure products meet more stringent requirements so are built to withstand tougher use.

Headsets and Accessories: If you need a specific type of headset you'll be much more likely to find it with a commercial radio. Most radios have a variety of headset options ranging from Secret Service, call center agent, to police lapel-type speakers and headsets. If you also want to charge multiple radios in one charger unit, which save space and power, multi-unit chargers are only available with commercial two-way radios.



Restaurant Two-Way Radios

If you are looking for the ideal two way radio for restaurants, this video below covers the perfect one.

