Radio For Scouting

V1.5

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GWS Radio Science and Technology

Index

1.0 Part 1 Introduction

Welcome to Radio for scouting in these notes we will cover basic radio oppression. These notes are meant to expand your knowledge of radio and how to use it for scouting activity a number of other types of radios are around but will not be included because they are not used by scouting or require special training or licensing, there is a lot more depth to the subject than will be discussed in the notes if you wish to continue into Radio studies there are other courses external to scouts that may interest you. Some are

Amateur Radio (HAM)
Level 1: Foundation Licence
Level 2: Standard Licence
Level 3: Advance Licence

Marine
VHF-MF/HF (MROCP)
VHF (MROVCP)

Emergency Communications
Certificate II in Public safety SES Oppressions (must have level 2 or 3 Amateur)

SIS10
PUAOPE002A

Fell fee to ask GWS radio science and technology activity team about thesis courses if you are interested.

2.0 Part 2 Basic Electronics

2.1 Electrical safety 

The human body's communications system works on electrical impulses transmitted along the nerve system and electro-chemical stimuli. Sometimes these stimuli are used to contract muscle tissue, like your hart. Your heartbeat, which is regulated by these tiny electrical impulses sent from your brain, is easily interrupted by quite small amounts of electricity flowing through your body. In fact only 12 milliamps of electric current can cause heart failure, arrhythmia or fibrillation, all conditions, which can quickly cause death.

If your equipment runs from a battery supply or an approved low voltage power supply it is relatively safe but can be dangerous under some situation particularly when using large capacity batteries. It is important that you never remove the covers on your equipment and if you ever suspect that a piece of equipment is faulty or broken do not use it until it is replaced or repaired.

Electricity is like water and will always take the shortest path, so if going throw you is the quickest path it will. The effects of electricity on the human body can very depending on were the electricity is flowing. The most dangerous path is one that goes throw your hart. When someone is being electrocuted it is some times impossible for them to move. It is often also accompanied by the person shaking a little.

If you ever suspect someone is being electrocuted keep well away and try and turn the power off, if you cannot use a wooden broom or like to hit them out of the way. This is one of the few times it is ok to hit someone.

Electricity burns just like Fire dose, the only defiance is that it only burns were the electricity has passed throw. You treat an electrical burn just like a normal burn the important thing to remember about elocution is that the last thing you need is to be hurt as well.

So have you ever thought what would happen if you were to place I bit of metal across the terminals of a battery? Or a power point? we are not saying you should try. But it is quite spectacular. Basically the wire that is used for shorting gets very, very hot so hot that it chaces on fire and begins to burn. Not very good is it, it is a very good way to burn down a house or the hall, and that is why we ***don't do it.***

Electricity also has a very nasty habet of being stored in place. Some devices can hold electricity in them for weeks after they have been switched off, Older TV's are a good example of this.

Power points while being very use full can also be very dangerous, **never ever plug some thing that was not deigned for a power point into one**, never pull a power plug by it cord and make shore you turn the switch off before you remove the plug.

Extension cords are also a very dangerous item, people drag them around over rocks throw door ways and so on, they get cuts and damage to them and can even lead to exposed wires, if you ever see damage to a lead **do not uses it and get rid if it**.

The point I am trying to get across is be safe around electricity not just at scouts but wear ever you are

2.2 Power Supply's

Believe it or not all things electrical need power from some were, the two most common places are from batteries or from a power point in the wall. Battery's are in some cases much safer but become expensive if you have to keep replacing them, and can be heavy and have limited oppression time.

2.3 Fuses

Fuses are used to protect electric circuits from high currents. A fuse is designed to melt at a certain current (I) in Amps and break the electric circuit, thereby stopping the Power

Many fuses are mounted externally of radios so that the user can replace them. If you do replace a fuse it is most important that you replace it with one of the same type and rating. If you use an incorrect fuse rating the fuse may not blow when it should and cause a fire, never use things like fencing wire, nails screws and other bits of metal in a fuse holder

The problem with fuses is that they require a large current to blow. Fuses are designed to prevent electrical fires and ***will not protect you against electrocution*** if you happen to touch a live wire or part

2.4 Battery's

Batteries can be some of the most dangerous pieces of equipment under some concisions' they are normally safer than the mains but be aware they pack a lot of energy for their size and contain hazardous chemicals

Large batteries and some high energy small ones like alkaline, Nickel cadmium, Nickel Metal Hydride, and lithium batteries can supply very high current. A short circuit placed across a battery can easily cause a fire, or even an explosion of the battery itself due to internal heating and gas build-up

For this reason all battery powered equipment other than simple torches Etc. must have a protective fuse

Battery's also contain very corrosive and poisons chemicals. Any chemical leak from a battery can cause skin irritation and some, especially car batteries, can cause severe acid burns or blindness Mercury batteries also extremely poisonous

- Never short Circuit a Battery
- Never Dispose of a battery in a fire
- Always use a protective fuse with batteries
- Yong Children should never play with batteries

Large batteries can also be very heavy and can easily corse injury if not handled correctly. Large batteries should always be on the ground or as low to the ground as you can to prevent it falling on you.

When recharging a lead acid (Car battery or wet cell) battery make shore it is well-ventilated and away from sparks and flame.

Always use the recommended batteries in handheld devices. All batteries have a negative normally marked as a "-" and a positive normally marked as a "+" positive wires are normally red and negative are normally Black but check the manual before trying to wire up a radio, batteries have a voltage rating based on the number of cells in side them, common battery voltages are 1.5V 6V 9V 12V 24V. It is important that you use the correct voltage battery for the equipment you will be using. Most equipment will have stamped on the unit or on the manual what sort of batteries they use. If you use a battery that is to big it will damage the equipment to low and the equipment will not work. Also be aware that battery can only be recharged if they are so marked trying to recharge a non rechargeable battery can result in a explosion. Below is a list of common batteries and there voltages

	Type	Voltage
	AAA Used in small low powered devices often a number of them are used in one device	1.5V (Rechargeable/Non Rechargeable types)
	AA Used in medium power demand devices such as cameras and head lamps. Often a number are used in one device	1.5V (Rechargeable/Non Rechargeable types)
	C Used in sum torches and medium to high power device. Often a number used in one device	1.5V (Rechargeable/Non Rechargeable types)
	D Used in high power devices. Often a number used in one device	1.5V (Rechargeable/Non Rechargeable types)
	6V Sometimes called a latten battery, used in some torches and lighting devices	6V (Rechargeable/Non Rechargeable types)
	9V Very often used in toys smoke alarms and small communication devices	9V (Rechargeable/Non Rechargeable types)
	12V Used to power cars boats motorbikes very high current, very heavy, and contains strong acid	12V (Rechargeable only types)

(Table 1) Battery common sizes

2.4.1 Battery Hazards

- There are two hazards associated with Large batteries that operators should be aware of:
    1. The **risk of explosion**
    2. The **risk of chemical burns**.
- As a result of the chemical process occurring within the cells of a battery during charging, **gas is produced.** When mixed with air, this can form highly explosive mixture, which can be ignited by a naked flame, a lighted cigarette, or a spark. The spark caused by breaking or making an electrical connection in the vicinity of the charging battery may be sufficient to ignite the Gas-air mixture.
- If using metal tools to work on battery connections, extreme care must be taken to ensure that terminals are not short-circuited. Insulated terminal covers are recommended.
- The **electrolyte in battery cells is sulphuric acid**. It is sufficiently concentrated, particularly just after charging it can damage eyes, skin or clothes if spilt or splashed. Immediate and prolonged application of running water is recommended to rinse the affected skin or clothing.
- It is recommended that **eye protection** be worn when a person is carrying out maintenance on batteries. Batteries **should not be topped-up whilst on charge.**

2.5 Mains

The Australian Power system runs at 240Volts AC 50Hz and can be fatal if touched. If you connect this to your radio directly it will blow it up and may even set it on fire. So we need a device to turn this power into some thing that will work with the equipment. We use a device called a transformer or mains power supply. Most handheld devices come with a transformer for charging always use them and never try and use a transformer that was not made for the equipment

For the mains supplies it is best you refer to your equipments manual and get a supply that will work with your equipment, if you ever suspect a fault with these bits of equipment replace them or get a licensed electrician to check them for you

Notes

3.0 Part 3 Radio Basics

What is a Frequency?
A Frequency is what we call the number of time a energy wave completes a cycle per second, the wave can be sound, light, radio, radiation and so on. Frequency is measured in Hertz shown as (Hz). so say we have a wave going up and down once per second in Frequency we say that is 1 Hertz or 1Hz of we have a wave going a 1000 times a second we say that is 1Kiolhertz or 1KHz. K Times by 1000. If we have 1000000 cycles per second we call that a 1 Mega hertz or 1MHz, meaning times by 1000000

3.1 Audio Frequency's (AF)

Audio Frequencies are wave we can hear, a young person (that has not listened to much loud music) has the hearing range on average 20Hz to 1KHz. As we age we lose the higher frequency's, things like loud music, industry noise can increases the decay of our hearing. Below 20Hz we call sub audio this is what some animals use for long distance communications such as elephants, just above Audio frequency's is ultra Sonics this is what dog and cats can hear when you uses one of throws special dog calls you can not hear, bats also use these frequency's for navigation

3.2 RF Frequency's & Bands

3.2.1 Radio Frequency (RF)

Radio Frequency radiation or (RF) is a form of electromagnetic radiation with a frequency of 3 KHz to 300 GHz. This range of electromagnetic radiation constitutes the **radio spectrum** and corresponds to the frequency of alternating electrical signals used to produce and detect radio waves. RF can refer to electromagnetic oscillations in either electrical circuits or radiation through air and space. RF travels at the speed of light.

3.2.2 Bands

Radio Frequency's are divided into the below bands

VLF: Very low Frequency's 3 KHz – 30 KHz
LF: Low Frequency's: 30 KHz – 300 KHz
MF: Medium Frequency's, 300 KHz – 3 MHz
HF: High Frequency's, 3 MHz – 30 MHz
VHF: Very High Frequency's, 30 MHz – 300 MHz
UHF: Ultra High Frequency's, 300 MHz – 3 GHz
SHF: Super high Frequency's 3 GHz – 30 GHz

EHF: Extremely high Frequency's 30 GHz – 300 GHz

3.3 Radio Frequency Radiation Safety

High levels of electromagnetic radiation can be very dangerous (the sign pictured above is the Australian standard sign for areas that may contain high levels of RF radiation do not enter theses areas unless permission from the site owner is obtained)

The major radiation risk is from that part of the system, which is designed to radiate – the antenna. The greater the power, and the higher the frequency of a radio transmission the higher the risk of the antenna being a radiation hazard

It is currently believed that low powered handheld radio equipment with inbuilt antennas, or any equipment operating at low power dose not poses a significant radiation risk

However, you may only be running a small amount of power but some antennas focus the power into a narrow beam. A directional antenna (also called a high gain antenna) concentrates the power in a specific direction there can be many times the normal power level.

Antennas also carry very high Voltages and touching an antenna while it is transmitting can Cause an "RF Burn" this is similar to a normal burn except for the fact that it is caused by radiation running through your skin and is often quite deep, severe, and slow to heal a RF burn can be a 2nd or 3rd degree burn. If you have any doubts about this just remember your microwave oven it uses RF Radiation to cook your food

In all cases, for your own and others safety it's best to be prudent. The radiation risk falls off quickly with distance from the antenna, so place antennas well away from where people are likely to gather and, if you are using handheld equipment, attach a speaker-microphone so the transceiver and its antenna can be held a short distance from your body when transmitting.

The basic rule for RF safety is every time you double the distance the radiation reduces by 50%

So a let's take a Transmitter running at 50Watts or 50W 1 meter is say 50W (Watts)
At 2 meters it is 25.0W (Watts)
At 4 meters it is 12.5W (Watts)
At 8 meters it is 6.25W (Watts)

And so on

When using a hand held device it is important to minimise the amount of radiation you receive to your head, so try and maximize the distance between your head and the transmitter, for fixed setups a taped or roped off area is a good idea. In a Car placing the aerial above you on a roof rack is much better than placing it on the bull bar if you are going to be transmitting allot. Also when using a Car radio make shore that no one touches the antenna.

Transmitter power W (watts)	Closest Someone Can be for a short time meters (m)	Distance for Long term Meters (m)
3	**0.08**	**0.19**
6	**0.17**	**0.38**
25	**0.35**	**0.75**
50	**0.7**	**1.55**
100	1.4	3.1
500	3.1	7.0
1000	4.4	9.9
1500	5.4	12.2

(Table 2) This is a glide to safe distances as compared to power level

The antenna (Sometimes called an aerial) couples the signal from your radio into the space around the antenna, from where it radiates out as an electromagnetic radio wave. When used as a receiving antenna, radio waves are converted into electrical signals, which are fed to your radio

Antennas work the same both ways, that is, on transmit and receive. If an antenna is designed to transmit well, then it will also receive well

The performance of any antennas is very much affected by its height above ground and its proximity to nearby objects such as building or trees.

The best idea is try to get the antenna as high as possible and well away from structures

3.4 VSWR

Voltage standing wave ratio
Each antenna has an impedance which is measured in Ohms which is typically something like 50 Ohms (Ω) or 75 ohms (Ω) for TV's, This impedance must 'match' the 'impedance' of the radio, cable and antenna, when the radio, cable and antenna are the same the radio is said to be 'matched

‘ If all the Parts are not matched properly the antenna system will not be efficient as a large percentage of the signal will be reflected back and forth along the cable. In this event it is also possible to damage the radio. To measure this we use a device called a VSWR or SWR meter.

A VSWR meter works by comparing the max power and the power returning down the cable. It is said that A reeding of <1.5 is good you can get away with it being higher but the higher you go the less efficient and the more possible damage may happen to your radio.

To test your Radios VSWR follow the below steps

- 1 Adjust your radio to be close to the centre channel in the band you will be working in
- 2 set your radio to its lowest power
- 3 Lessen to make shore no one is using the channel
- 4 If the channel is clear press the Push to talk button (PTT)
- 5 Switch the VSWR meter to the set position – this is marked FWD, FORWARD or CAL
- 6 While pressing the PTT adjust the “Calibrate control’ so that the needle moves all the way across to the SET or CAL position. This should take just a few seconds
- 7 Switch the VSWR meter to the SWR position and read your antenna’s directly off the meter Scale
- 8 An VSWR of 1.5 or less is considered to be good

3.5 Modulation:

Modulation is the term we use to describe the way we put information on a radio wave. A radio wave it selth produces only a tone or no sound what so ever with out some form of modulation. Common Modes or Modulation is Morse code, AM, FM, SSB. You may notice that a standard car radio or stereo there is a switch that has AM/FM on it, this is two different modulation styles that is used by radio stations as well as many other radio uses

3.5.1 Carrier:

A frequency that the radio is using measured in Hertz

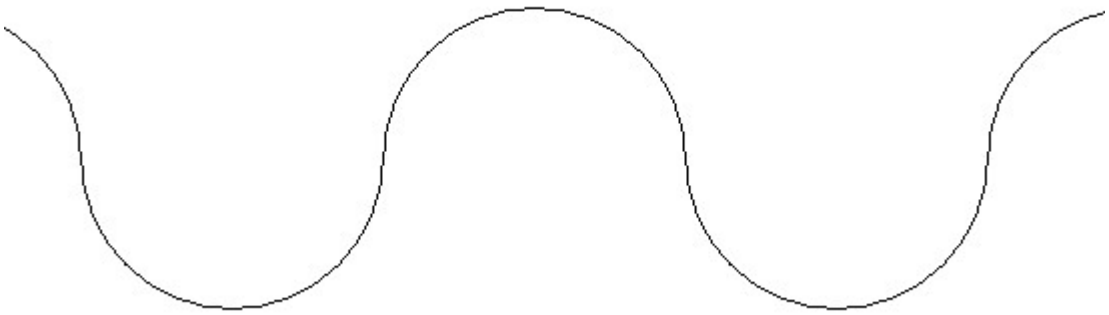


Fig1 A carrier wave

3.5.2 Morse code (CW)

Is a type of character encoding that transmits Text information using rhythm. Morse code uses a standardized sequence of short and long Beeps to represent the letters, numerals, punctuation and special characters of a given message. The short and long elements can be formed by sounds, marks, or pulses, in on off keying and are commonly known as "dots" and "dashes" or "dits" and "dahs". The speed of Morse code is measured in words per minute (WPM) or characters per minute (CPM).

Originally created for Samuel F. B. Morse's electric telegraph in the early 1840s, Morse code was also extensively used for early radio communication beginning in the 1890s. In the early part of the twentieth century, the majority of high-speed international communication was conducted in Morse code, using telegraph lines, undersea cables, and radio circuits. However, the variable length of the Morse characters made it hard to adapt to automated circuits

The most popular current use of Morse code is by amateur radio operators, although it is no longer a requirement for amateur licensing in many countries. In the professional field, pilots and air traffic controllers are usually familiar with Morse code and require a basic understanding. Navigational aids in the field of aviation. Morse code is designed to be read by humans without a decoding device, making it useful for sending automated digital data in voice channels. For emergency signals, Morse code can be sent by way of improvised sources that can be easily "keyed" on and off, making Morse code one of the most versatile methods of telecommunication in existence.

3.5.3 Amplitude modulation (AM)

A technique used in electronic communication, most commonly for transmitting information via a radio carrier wave. AM works by varying the strength of the transmitted signal in relation to the information being sent. For example, changes in

the signal strength can be used to reflect the sounds to be reproduced by a speaker, or to specify the light intensity of television pixels.

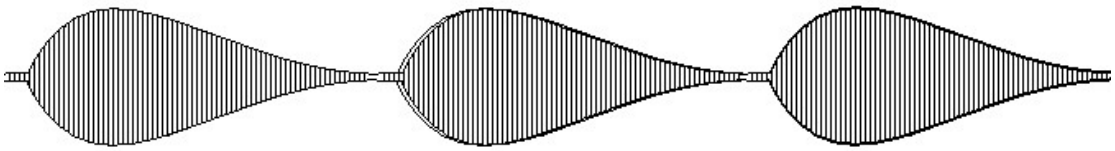


Fig2.AM Signal

3.5.4 Single-sideband modulation (SSB)

A refinement of amplitude modulation that more efficiently uses electrical power.

Amplitude modulation produces a modulated output signal that takes up a large area of the band. Single-sideband modulation ½ this space and reduces power wasted on a carrier, at the cost of somewhat increased device complexity.

The first U.S. patent for SSB modulation was applied for on December 1, 1915 by John Renshaw Carson. The U.S. Navy experimented with SSB over its radio circuits before World War I.SSB first entered commercial service in January 7, 1927 on the longwave transatlantic public radiotelephone circuit between New York and London. The high power SSB transmitters were located at Rocky Point, New York and Rugby, England. The receivers were in very quiet locations in Houlton, Maine and Cupar Scotland.

SSB was also used over long distance telephone lines, as part of a technique known as frequency-division multiplexing (FDM). FDM was pioneered by telephone companies in the 1930s. This enabled many voice channels to be sent down a single physical circuit.

Amateur radio operators began serious experimentation with SSB after World War II. The Strategic Air Command established SSB as the radio standard for its aircraft in 1957. It has become a de facto standard for long-distance voice radio transmissions since then.

USB: Upper side band, one of the two forms of SSB
LSB: Lower Side band, one of the two forms of SSB

3.5.5 Frequency modulation (FM)

conveys information over a carrier wave by varying its frequency. In analog applications, the frequency of the carrier is directly proportional to the value of the input signal. So the louder you talk the higher the frequency

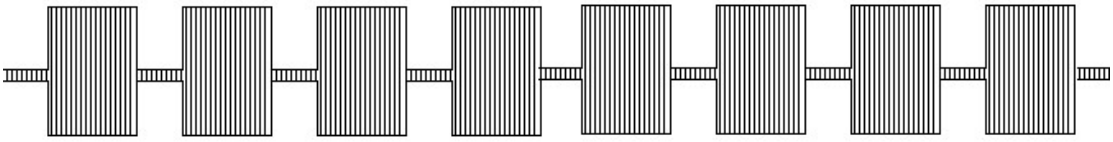


Fig3.FM Signal

3.6 Propagation

Each band of frequency behaves differently to the others this is why we use some bands for long distance communications and others for short distance

3.6.1 MF/HF (0.300Mhz to 30Mhz)

Frequencies in theses bands have a tendency to bounce off the ionosphere and bounce around the world it is quite possible to talk around the world on very little power with this system. This is why this is used by international shipping, aircraft and some out back stations. MF/HF frequency's are also quite dependent on the sun and time of year, the more active the sun the grate the distance travailed, by the signal. It also very common that a station 100's of kilometres away can hear you but a station down the road will not, this is another reason MF/HF is used for long distance communications this is also called Skip

3.6.2 VHF (30Mhz to 300Mhz)

Frequencies in this band are use for medium distance communications and will pass over and around small obstacles such as hills but not mountains. There is affect called ducking on VHF which is when a form of radio tunnel forms in the atmosphere that will carry the signal for 100's of kilometres, theses manly occur in summer on a sunny day, VHF is used by marine, aircraft, and FM radio along with some companies and public safety groups.

3.6.3 UHF (300Mhz to 3Ghz)

Frequencies in this band are directional the rule with UHF is you must to be able to see the other station to communicate with them, so the signal will not go around mountains round bends in valleys, UHF is manly used for short distance communications up to 50Km's, Ducting is also possible in this band, UHF can also be stoped by wet foliage, rain, wind and smoke, the high end of UHF is where Mobile Phones, wireless net works and microwave ovens work. UHF is very popular due to the small size of units and good quality of signal, there is a never ending demand for it

3.6.4 SHF (3Ghz to 30Ghz)

Frequency's in the SHF range are extremely direction and can be stopped by almost anything. Most applications of SHF are for Satellite and point to point systems like

high speed computer or voice links between buildings and towns. These frequencies are used for this because of their ability to carry high speed digital information better than most other frequency's

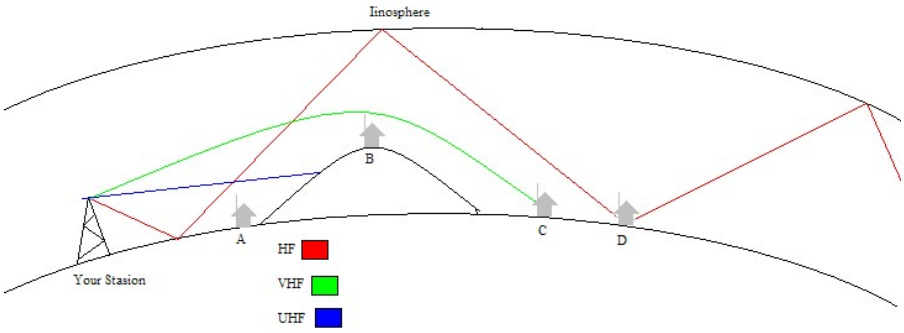


Fig4.radio Propagation
You are transmitting form the radio tower on HF VHF AND UHF as pictured above
Station A can hear you on UHF and VHF
Station B can hear you on UHF and VHF
Station C can only hear your signal on VHF
Station D can only hear your signal on HF

Notes

4.0 Part 4 Types and uses of radios (Presentation Pre work)

Examples of radio users you may wish to use for topics for pre work for communications badge for scouts

- VKS
- Flying Doctor
- Ham (Amateur)
- Marine HF/MF
- Marine VHF
- Public Safety
    - Fire
    - SES
    - Police
    - Ambulance
    - Other
- Commercial
- Air Band
- Defence
- Others

Notes

5.0 Part 5Radio procedures

5.1 Call Signs

Call signs are a way of identifying your station. On some types of radio it is a legal requirement that the user has a registered call sign with the ACMA or alike. On most of the radio you will be using you do not require a registered Call sign.

When choosing a call sign (if one is not allocated) you should avoid using your first name. A call sign should also give some information about were or what you are doing for example if you were a First aid team the call sign of (First aid) would be ok, or if you are manning the start line of a race (Start) could be used.

If you are on a hike, you can use your troop name. Like (1st black stump). If you have a number of radios in your group you could give each member a number or letter, giving you cal sings like (1st Black stump 1) or (1st Black stump A) you can also change the A to the Phonetic Alphabet (as listed below) and use Alpha instead of A giving you (1st Black Stump Alpha). Using it in this way allows other members of the grope to no that you are from 1st Black Stump scouts and you are one of up to 28 people with a radio, while still protecting your name from people who may be listening. You also could use your patrol name giving you some thing like (1st Black Stump Scorpions). In some situations a status massage may be a good idea,
hear are some of the common one's

Portable:	Using a hand Held radio
Mobile:	In a Car
Maritime:	On a stationery Boat
Maritime Mobile:	On a moving Boat
Maritime Portable:	On a Boat with a hand held radio
Mobile stationary:	Stuck in traffic in the car
Remote base:	At a short-term radio base (Like a camp site)
Air born:	In a plane/helicopter

Using this give others a idea were you are and what you are doing if you were walking around the camp site with a radio you could use some thing like (1st Black Stump Alpha Portable)

The trick is not to make it to hard for others to understand or so long you cannot remember it. It just needs to be quick and easy way if identifying your self while protecting your identity.

5.2 Edict

Whist on the radio you need to make shore you conduit your self in a proper way. The first thing a lot of people to when they get on a radio is act like a fool thinking no one knows who they are and can not find them, this is wrong lots of people have the

ability to track and search for people that misuses the radio (like the police, military and Ham operators), in extreme cases the federal government or the police may come knocking at the door. I have Hurd many stores of what is called an importuned Foxhunt; this is when a number of angary radio operators start looking for the signal and tracks it to Someone's house, this results in a mob of angary people out side the door. The best thing to do is stick to the guidelines so the mob dose not visit you, believe it or not it is offence to falsely alarm or offend another radio user under the Australian Radio Telecommunications Act 1992

5.2.1 Language

Imagine you are at school in class every one is quiet and it is your turn to stand up and talk to the class, What do you think will happen if you start yelling, swearing or using colourful language? That's right you will be at the principals office faster than your feet can touch the ground. The main reason for this is it is just not socially ok to do this. The only difference with radio is there is no teacher. But if it gets to out of hand the radio police (the ACMA) step in. it is also not on to abuse bully or threaten Someone else over the radio this can very quickly lead to a visit from the police. If you ever hear such behaviour do not try and stop them just ignore them and they will hopefully stop if they have no one to talk to if it gets very bad record the conversation and things like time date and channel/Frequency as well as your location and signal strength of the offending person and pass it on to ACMA or Police.

5.2.2 Topics of decision

You are allowed to talk about what ever you like on the radio with a few exceptions. Things that should never be spoken over the radio are

1. Financial information (Bank details, Pin Numbers so on)
2. Your address or Address of others. (Unless in an emergency)
3. Religious augments.
4. Political augments.
5. Medical or private information of yours or others (Unless in an emergency)

If your conversation starts to drift towards one of theses topics change the subject or stop talking to the person.

5.2.3 Pause Between Over's

A radio frequency is a public resource and is owned by the federal government, no one can claim that a channel is owned by them, so understanding that it is important you take turns and share this resource. When

having a talk with Someone or a group of people each person must take turn to speak and make shore the other person is finished before you speak.

5.2.4 Radio Prowords

When havening a conversation on the radio there are a few common terms you need to understand and use they make it easer for every one.

Send: Go ahead

Standby/Wait: Pause for a few seconds

Wait Out: I will Call you again- a Pause for longer than a few seconds, you can also use "Wait out unless urgent", when means wait until I call you unless there is something urgent, this is used a fare bit with emergencies.

Out to you: This the end of my transmission to you and a call to another station follows immediately

Nothing Heard: Indication that no signals have been heard form a particular station

Radio Check: Request a report on reception of the transmission at your location

Over/Back: Over is used to tell every one you have finished what you are going to say and they are welcome to all so use "Back" or "Back to you" they also means the same thing

Stop: full stop on message

Say again: repeat last message (do not ever use Repeat, this is a hangover form military radio, for military repeat means fire another volley of shells)

Clear/Going Clear/Out: this means that you are fished and are stoping talking unless Someone else wants to talk with you (do not use "over and out" as this is bad procedure)

Closing down: this means that you are turning off your radio and or packing up. this indicates will be unable to be contacted by radio very often used at the end of an event or day. Some time you can say something like "Closing down until 9:00" this means that your radio will be off until 9:00 at which time you will be turning it back on.

Lessening: You are on the air and available to talk

All stations: Everyone lessening attention

Breaker: This term mainly is said between Overs by a person who wants or needs to interrupt or join the Conversation. Leaving a Pause between Overs allows time for

others to put in 'beaker'. If you hear a Breaker, you are required to acknowledge the Breaker and ask what is needed. The breaker may require urgent assistance and you could be blocking them

CQ: Calling all stations

Negative: No

Affirmative: Yes

Side / On the Side / Standing By: Means you are about to stop Sending or Transmitting but will still be listening so you can rejoin, or someone else can call you

Romeo: A common Acknowledgement or Confirmation meaning Yes, Agree or Understood (do not use Roger or Roger Roger as this is bad procedure from CB operators)

5.3 Calling

When you first turn on a radio it is good practises to lessen for 30 seconds before talking just in case Someone else is using the channel

5.3.1 Calling a random station:

To call a random station you uses the term CQ. And your call sign for the example we will says we are 1st Black stump Alpha. To call you would say

"CQ CQ this is 1st Black stump Alpha OVER"

And then listen for 10 to 15 seconds before trying again. If Someone hears you and wants to talk you will hear them reply back to you

5.3.2 Calling all stations

This call is used when you have a group of stations that you whish to send a massage to such as tea is ready on so on

"All stations all stations, this is 1st black stump Alpha Tea is ready OVER"

And then listen the other station may wish to talk back to you

5.3.3 Calling another Station

This is procedure is used to call another station you no is on air, we are 1st Black stump Alpha the station being called is 2nd North Seal Bravo

"2nd North seal Bravo from 1st Black stump alpha OVER"

If 2nd north seal Bravo is listening they will reply to you

5.3.4 Being Called

From time to time someone may wish to contact you so always keep an ear on your radio just in case it should sound some thing like this

"1st Black stump alpha from 2nd north seal Bravo OVER"

We would then reply

"2nd North seal Bravo from 1st black stump alpha go a head OVER"

Then standby for there reply

5.4 Holding a Conversation

Having a conversation on the air is a very easy procedures you can talk back and forth or as part of a group for hours on end if your battery last that long. The important thing to remember is that only one person can talk at a time and every time you finish what you have to say put Over at the end. Like below

"Hi my name is XXXX I am a scout from 1st Black Stump were are you from? OVER"

The other station would then respond with the answer followed by Over

5.4.1 Talking speed and rhythm

When talking on the radio it is best to not talk to fast or in such a way as out of rhythm if this is not correct the others station may not be able to understand you the best speed to talk as if you are writing what you are saying down on paper as you are saying it. It is a good idea to practice this from time to time as people tend to speed up when they are existed or something so going wrong, talking to fast may result in something important being missed.

5.5 Completing a Conversation

Once you are finished thank the other person for the talk and then say your call sign and Clear"

"Thanks. 1st Black stump Alpha Clear Over"

If you are then going to turn your radio off you would instead says
"Thanks 1st Black stump Alpha Clear and closing down Over"

Or if you are whishing to announce you are still going to be around

Thanks 1st Black stump Alpha Clear and Listening Over"

5.6 Announcing you are on air

Some times it is a good idea to announce you are around being when you turn on the radio or maybe every hour. The preferred way to do this is to use the term listening which means that you are available for a contact. A listening call would look like

"1st Black Stump Alpha listening OVER"

5.7 Braking in to a conversation

Some times you may wish to brake into a conversion that is going on to do this we use the Breaker or Brake command. It is important to lessen for a brake in conversation and then say Brake or Breaker.

Then hold off until Someone comes back with some thing like "Go ahead breaker" then you say your call sign and start your talk. If you hear a brake or breaker the polite thing to do is to stop talking and let them have there say by saying "go ahead breaker" or you can finish what you are saying and the call them in with the above Statement.

5.8 Radio Nets

Depending on what situation you find yourself in you may encounter a Radio Network or (Net) for short, a radio net classified as more than 2 stations wishing to communicate with each over. A number of protocols are used to control the conversation this is also sometime called Radio Traffic,

5.8.1 Net Control Station (NCS)

Net Control Stations (NCS) are a very special station used to control some types of Nets. The Stations normally requires a dedicated person manning it at all times to make shore things operate correctly. If the NCS is operating correctly messages should flow throw the Net like a well oiled machine if the NCS is not operating correctly the Net can be a mess and be dangerous in some situations.

The job of a NCS operator can be a thankless job but very important, it can also become very stressful and it not to be undertaken lightly it is not something to just have a go at, in some cases the NCS operator is directly responsible for peoples safety.

5.8.2 Net Types

5.8.2.1 Uncontrolled Nets (Ratites rules)

Uncontrolled nets are the simplest nets that occur they spring up all the time and are sometime very short in duration. The basics of the net is first come first serve so if you are fast on the microphone or have more transmit power you will get in first and get your message across. This nets work well if you just have something quick to say and there are not a large number of station involved, Uncontrolled nets are often used as working nets or tactical nets, I.E to get a truck to move up or coordinate on the ground Tactical moments, The draw back of an uncontrolled net is they can often descend into chaos when every one wants to talk at once like in an emergency or a difference of opinion is voiced, the best example of a Uncontrolled net is a CB radio channel

5.8.2.2 Round Robin Nets

Round Robin Nets are a bit more complicated than an uncontrolled Net in Round robin nets each person takes turns to talk while everyone else lessens and holds their comets and questions until it is their turn it is unlikely that that people will talk over each over in Round Robin net, but they become very slow to pass messages when there is a lot of stations involved. In some cases a "Control Station" or NCS will run the Net they may start the net by calling for check in's, in which stations wishing to participate announce their call signs which are then logged by the NCS and are then called in turn by the NCS to have their say, This type of net is mainly redistricted to people just having a chat they are unsuitable for reactive (Fast response) type situations, good ensamples of a Round Robin net is a Amateur radio clubs weekly radio Net

5.8.2.3 Calling Nets

Calling nets are a net that works by every one meeting on a designated channel called the "Call Channel" and they then try to make contact with the station they wish to talk to. Once they make contact the two stations move a allocated channel or frequency chosen by ever the person in charge of the net called the "Control station" / NCS or chosen by the two stations that are going to talk. The two stations then change channel to the new channel leavening the call channel free for the next person. It is very important this happens as if the stations do not move it stops the whole net stops operating. Once the stations on the other channels have fished their talk they return to the Call channel and

lessen for a call or call for another station when the channel is free. This type of net is good for keeping confusion down between stations and give a dedicated line to the stations for critical instructions, the disadvantage is that other stations cannot hear others this makes it hard to get a full picture of the situation or offer assistance, another problem is that if there is lot of users the number of available channels or frequency's can run out very quickly, a good example of a Calling net is air traffic control at airports or Amateur HF Radio as well as VHF marine radio

5.8.2.4 Controlled Nets

Controlled Nets always have a "Control Station" or NCS that works like a traffic control, the Net can be on one Channel or frequency or a number of linked radio systems. In an controlled net all Traffic is between the Station calling and the NCS, The NCS will recorded the message and then make shore that the Message gets throw to the correct Station or Stations, The NCS also can act as central control and issue instructions and pretty much run the event over the radio, in practise to work with this type of net you call up the NCS as a normal call and then tell them the message, if the NCS is busy you may have to wait until the channel is free and then call, the uses of priority codes such as Red, Blue, Yalow and so on are some time used to indicate the importance of the message, the NCS will always take the high priority messages first. Some people can become frustrated with Controlled nets and upset with the procedure (this can some time come down to the person running the NCS), not understanding that the amount of work the NCS is doing.

In a Controlled net a station can request the NCS to allow them to talk direct to another station; the NCS will allow it if possible. If you get permission to Talk direct be as short as possible as this blocks up the Net for every one else. Controlled nets are very good for fast changing situations and can handle large numbers of users. Controlled nets do have a few drawback I.E people do not have instant communications and errors can happen when repeating a message

Some examples of Controlled nets are Emergency services and Large Event

5.8.3 Priority Codes

Emergency: Message that involves grave or immanent danger to life Safety requires a response this second
Immediate: Message that involves life safety requires a response within one hour of receipt of message.
Priority: Message that requires a timely operational response within 4-6 hours of receipt, in order to address the specified emergency.
Routine or no Code: Message that reflects routine data transfer for administrative, logistical or operational means, which requires no response or a response within 12-18 hours.

Colour codes: in some nets colour codes are used for Priority codes the colours meanings are decided by the Net Control Station before the event

5.9 Logs

In some cases Logs of the radio traffic may be required this can range from recording the times of transmissions all the way to writhing every word down you hear on the radio. Most of the time in scouts we will not need to do logs but in the event that a major incident happens for your own peace of mind keep a log, why I hear you say well if the unthinkable happens and you end up having to engage legal advise, your logs may get you off, if your defence relies on your word it would be harder to prove your innocence, so what do you put in a log.

1. Time and date
2. Who the message was from and going to
3. The contents of the message exactly as spoken or herd by you

Sometimes a recorder can be used as well so that way it frees you up a bit, but even in this case write down critical information, so what can be log as a log?

1. Voice recordings
2. Hand written/ typed notes
3. Maps
4. White boards/peg boards
5. Computer files

5.10 Confirming Messages

Very often it is a good idea to confirm messages you receive over the radio particularly if it is of importance I.e (safety instructions, directions and so on), if there is any doubt about what you have received request the message be resent, another good way of Confirming to read back the message to the sender and get them to confirm it is correct.

5.11 Channel Types

On some radios each channel is given a specific function these functions need to be obeyed at all times to maintain the radio system for every on. Below are listed some of the types of Channels

5.11.1 Conversations/ Calling & working/ Ship to ship and ship to shore/ Ship to ship Channels:

Are set aside for general chat between radio uses they have no specific prepose other that talking on

5.11.2 Highway Channels:

Are set aside for station travailing on highways they quite often contain information about road conditions or locations of hazards on the Highway as seen by other high

way users, you may use the channels if you are on the highway, this is quite often were you will find interstate trucks

5.11.3 Emergency / Distress Channels:

Are set aside for emergency traffic only theses channels are to be used only if you require urgent help, using them for non emergency transmissions can result in a large fine

5.11.4 Calling Channels:

Are set aside as locations for people to gather to make contacts, the procedure is that once you have made contact with a station you move to a Conversation channel or repeater channel to continue the conversion freeing it up so someone else can make contact, once you finish the conversation you may return to the calling channels to find someone else, sometimes used as part of calling nets (See 5.8.2.3 Page 30)

5.11.5 Activity Channels:

Are set aside for groups conducting special activity's channels like this include ones marked as 4WD Drivers / Commercial Operations / Professional Fishing / Rescue organizations / Club events, unless you are involved in that activity you are not to use throws channels

5.11.6 Convoy Channels:

are used by groups travelling as a convoy to a destination, the users often give directions to the members of the convoy to keep it together, it is important you do not interfere with them

5.11.7 Repeater Output Channels:

These channels are normally used as the output of a repeater system; it is very common to hear a lot of stations on theses as the stations are trying to get long range communications. In areas were a repeater is present on the channel you are required to use your radios repeater functions or DUP button on the channel, in areas were there is not a Repeater you can use the channel like a Conversations channel

5.11.8 Repeater Input Channels:

These channels are normally used as the Input of a repeater system, it is very common to hear a lot of stations on theses as the stations are trying to get long range communications. In areas were a repeater is present on the channel you are required to turn your radio to the Repeater output channel and use your radios repeater functions or DUP button on the channel, in areas where there is not a Repeater you can use the channel like a Conversations channel

5.11.9 Digital Channels:

These Channels are set aside for digital signals such as selcall, telemetry and digital voice. Unless you are using theses do not use the digital channels

5.11.10 Broadcasts Channels:

These channels are used in some areas to advice of road conditions, flooding, storms, fire, and community news, these channels can normally be used as a Conversations channel except when there is a Broadcast going on, it is best practises to keep clear of them

5.12 Emergency Situations

In an Emergency radio can and has been used to save lives and propriety. If you ever hear a emergency called while you are talking stop immediately and lessen, you are not to talk unless you do not hear Someone else assist the station, emergency calls can come on almost any channel and have right of way emergency are indicated by words like “fire” “Help” Mayday” “Pan Pan”, “urgent” and “emergency”

5.12.1 Calling for Help

If you are the one in trouble turn to the emergency channel and put a call out. Give as much detail as you can include Location, what is wrong how many people there are affected, latitude and longitude or grid reference if available even if it appears no one is coming back you people may hear you but cannot get a signal back so you so repeat the message 3 times minimum before trying another channel

5.12.2 If you hear a call for help

If you are listening to the radio and hear an emergency call you are obligated to respond if no one else answers if another station answers do not talk until the emergency is over. If you answer the station take down as much information as you can do not give medical advice under any circumstances unless instructed to by a doctor or paramedic. As soon as you can get the information to the Emergency services on 000,112 or other means and in NSW request police. keep contact with the station even if the station calling emergency seems to have not heard you pass the information on. If a better-equipped station come on air you are to hand the station on to them and follow their instructions to the letter. Stations like theses include

NSW Police


Fire and Rescue NSW's


NSW Ambulance

NSW SES (State Emergency Service)

WICEN

CREST

Emergency Monitor’s


RFS (Rural Fire service)

Maritime Services

Coast guard


VRA (Volunteer rescue association)

Civil aviation (Air Craft safety)

RAAF (Royal Australian Air Force)


RAA (Royal Australian Army)

RAN (Royal Australian Navy)

Federal Police

NSW Government Station

Australian Government Australian Government Station

Emergency Monitor Information

Emergency Monitors cannot offer first aid or medical advice over the radio under any circumstances. If absolutely necessary, they will contact the Ambulance Service or a Doctor and relay any advice they may have.

There may be times when an Emergency Monitor is not available, or cannot hear you. Atmospheric conditions can do very strange things to radio signals, and a local Monitor may not be able to hear your call above the level of interference being received at his/her location. If no one answers your call on the emergency channel, try other channels, especially other local repeaters.

Emergency Monitors are volunteers often using their own radio equipment to listen for people needing help. It is impossible for any volunteer group to guarantee 100% coverage 24/7.

All Information Regarding Emergency Calls Are Treated Confidential. Phone Numbers And Names And Motor Registration And Other Misc Information Are Kept Confidential.

Australian Communications Media Authority(ACMA)

For misuse of the emergency channels such as using for non-emergency purposes, the operator can be prosecuted under the Australian Telecommunications Act 1992. Maximum penalty is 2 years imprisonment, or a fine of up to $165,000. Alternatively

the Police or the ACMA can issue an infringement notice for an amount of $220 for minor offences.

For interference to an emergency call in progress then section 193 of the Radio communications Act 1992 provides for a maximum penalty of 5 years imprisonment or $550,000. This offence can only be dealt with via court.

5.13.0 Licences

All radios equipment that transmits in Australia requires a licence as detailed in the Radio communications Act 1992. There are a number of licences that the ACMA uses and you need to be aware of them

5.13.1 Class Licence

A class Licence is issued to a type of Equipment that the Frequency's and Functions are fixed from production , there for making the equipment ok to use for any one. CB's Mobile phones small FM transmitters, garage door openers, wifi units and so on fall in this category. Class licensed equipment looks to have no license or is termed license free as the user douse not have to apply to the ACMA for authority to transmit as the company that made the equipment has already done the work

5.13.2 Apparatus Licence

Apparatus Licence are issued for equipment that can operate on a range of frequency's. With apparatus licences a person or company is authorised to operate the equipment on assigned Frequency's and within any restriction's the ACMA may impose. A holder of a Apparatus Licence must be in control of the radio at all times. People who have Apparatus licences are Amateur radio, commercial companies, ocean going ships and all aircraft

5.13.3 Apparatus Type approved Licence

A Apparatus Type approved Licence is sort of a mix of a Apparatus and Class, in this case the equipment is built in such a way so the user can not operate the equipment outside the rules, but the user still is Required to register with the ACMA and hold a Licence, examples of this is Flying doctor, VHF marine and HF services such as VKS737

5.13.4 Broadcasting Licence

These licenses are issued for the use of broadcasting for profit, many used for TV, AM/FM radio and DAB+ Radio (Digital radio)

5.13.5 PSN Licence

These licenses are issued to company like Telstra and like to provide public access communications services such as mobile phones

5.13.6 Fixed link Licence

These are issued for fixed microwave links between towers and building mainly used by Telstra and a like but my be used for companies between sites and buildings

5.14.0 Unlicensed oppression of transmitting equipment

As the title suggests this is a very bad thing if you are found to be or have been transmitting signals without the correct Licence you can be fined have your equipment confiscated and face criminal proceedings, Like wise owning equipment capable of transmitting without the correct Licence attracts the same penalty

5.15.0 Modified equipment

Modified equipment is a gray area if you modify any radio to transmit on a frequency that you do not hold a license for it is an offence, also modifying Class license equipment to transmit on Frequency you have a licenses for is also out. In the case of Amateur radio a license holder can build and modify radios to their frequencies but they are the only ones who can do such things in Australia

5.16.0 Things you cannot do to class licensed equipment (CB's, FM transmitters, garage door openers and so on)

1. Amplifiers you cannot amplify the signals of Class equipment in any way so Amplifies are out
2. Repeaters, you cannot build a fixed repeater system except for WIFI
3. Modify radios for secret messages
4. Connect to the public phone system unless in the case of factory made cordless phones

5.17 Codes and Jargon

Below are some examples of codes and jargon you may or may not have heard of. They are used to speed up or make information clear you are not required to use this unless it is specified by law or you have been instructed to.

5.17.1 Phonetic Alphabet

Sometimes when talking on the radio, it is difficult to understand the other person. Sometimes there is interference or perhaps you just can't quite 'read' the other

persons accent. In theses instances it helps to spell important words, the trouble is that many letters sound the same – Like ‘C; ‘B’ ‘D’ and ‘V’.

To make things clearer, we use whole words to stand for each letter this is called the Phonetic Alphabet.

A	Alpha	N	November
B	Bravo	O	Oscar
C	Charlie	P	Papa
D	Delta	Q	Quebec
E	Echo	R	Romeo
F	Foxtrot	S	Sierra
G	Golf	T	Tango
H	Hotel	U	Uniform
I	India	V	Victor
J	Juliet	W	Whiskey
K	Kilo	X	X-ray
L	Lima	Y	Yankee
M	Mike	Z	Zulu

(Table 3) Phonetic Alphabet

5.17.2 10 Code

10 code is a code often used by CB operators to speed up conversations, it is particularly popular with interstate truck drivers

10-1 = Receiving poorly
10-2 = Receiving well
10-3 = Stop transmitting
10-4 = Message received
10-5 = Relay message to _____
10-6 = Busy, please stand by
10-7 = Out of service, leaving the air
10-8 = In service, subject to call
10-9 = Repeat message
10-10 = Transmission completed, standing by
10-11 = Talking too rapidly
10-12 = Visitors present
10-13 = Advise Weather/Road conditions
10-14 =
10-15 =
10-16 = Make pick up at _____
10-17 = Urgent business
10-18 = Anything for us?
10-19 = Nothing for you, return to base

10-20 = My location is _____
10-21 = Call by telephone
10-22 = Report in person to
10-23 = Stand by
10-24 = Completed last assignment
10-25 = Can you contact _____
10-26 = Disregard last information
10-27 = I am moving to channel _____
10-28 = Identify your station
10-29 = Time is up for contact
10-30 = Does not conform to ACMA rules
10-31 =
10-32 = I will give you a radio check
10-33 = Emergency Traffic
10-34 = Trouble at this station
10-35 = Confidential information
10-36 = Correct time is
10-37 = Wrecker needed at
10-38 = Ambulance needed at
10-39 = Your message delivered
10-40 = Medical needed at ____
10-41 = Please turn to channel
10-42 = Traffic accident at
10-43 = Traffic tie up at
10-44 = I have a message for you
10-45 =
10-46 =
10-47 =
10-48 =
10-49 =
10-50 = Break channel
10-51 =
10-52 =
10-53 =
10-54 =
10-55 =
10-56 =
10-57 =
10-58 =
10-59 =
10-60 = What is next message number?
10-61 =

10-62 =	Unable to copy, use phone
10-63 =	Net directed to
10-64 =	Net clear
10-65 =	Awaiting your next message/assignment
10-66 =	
10-67 =	All units comply
10-68 =	
10-69 =	
10-70 =	Fire at _____
10-71 =	Proceed with transmission in sequence
10-72 =	
10-73 =	
10-74 =	
10-75 =	
10-76 =	
10-77 =	Negative contact
10-78 =	
10-79 =	
10-80 =	
10-81 =	Reserve hotel room for _____
10-82 =	Reserve room for _____
10-84 =	
10-85 =	
10-86 =	
10-87 =	
10-88 =	
10-89 =	
10-90 =	
10-91 =	Talk closer to the microphone
10-93 =	Check my frequency on this channel
10-94 =	Please give me a long count (1-10)
10-95 =	
10-96 =	
10-97 =	Mission Stop, Unit Deactivated
10-98 =	Mission start, unit Activate
10-99 =	Mission completed, all units secure
10-200 =	Police needed at _____

5.17.3 Morse code (CW)

Morse code or CW is a code used when all other means of commissions fail, it will work throw really bad interference, a good operator can use Morse almost as if they are speaking into the microphone but it takes years of practice to get that good

A	*-
B	-***
C	-*-*
D	-**
E	*
F	**-*
G	--*
H	***-
I	*-
J	*---
K	-*-
L	*-*-
M	--
N	-*
O	---
P	*--*
Q	--*-
R	*-*
S	***
T	-
U	**-
V	***-
W	*--
X	-**-
Y	-*--
Z	--**
0	--**
1	*----
2	**---
3	***--
4	****-
5	*****
6	-****
7	--***
8	---**
9	----*
Full stop	*-*-*-
?	**--**
Error	******

5.18 The Microphone

All radios that are capable of transmitting will have a microphone of sum type most radio microphones are as below pictured.

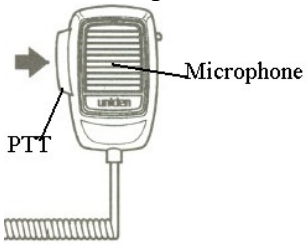


Fig5. Radio Microphone

All radio Microphones have a PTT or Push to Talk button pressing this button you enable the transmitter of the radio. It is always good to leave a second before talking as to allow the radio to power up. If you leave the gaps between pressing the button and talking to short you can cut off your voice. It is not necessary to eat the microphone or yell into it the microphones on modern radios are quiet sensitive and yelling into them only distorts your signal making it harder to under stand you. Like wise eating the microphone will muffle your voice the best placement is 2 to 3 cm from your mouth directly in front of your mouth. The same is said for hand held's, hold the radio or extension microphone 2 to 3 cm from your mouth

Always let go of the PTT 1 second after you are finished so as to not cut of the end of your signal, it is important to leave a 3 to 4 second gap from when the station you are talking to finishes there over and when you start yours, this will allow breakers to get a chance to get a word in.

5.19 Activity idea: Ambulance Dispatch

You and your group will play ever drive or direct a Ambulance to a accident site as quickly as you can using Radio microphones the teams will take turns of driving or Directing. Directors can only give instructions such as forward to Next Street left or right at Next Street. The drives must follow the dispatcher's direction and can tell the dispatcher if they encounter traffic along the way. This Activity is to assess your ability to uses the microphone and radio edict correctly

Notes

6.0 Part 6 Use of radios

6.1 Care of Antennas

Below are some points that need to be checked on antennas

6.1.1 Ultra-violet radiation

This will cause fibre-glassed whip antennas and Feed lines to degrade after many years of service to a point where moisture can penetrate the layers. This will seriously affect radiation efficiency and replacement or re-fibre-glassing will be necessary.

6.1.2 Corrosion:

This can be a major problem to a antenna system it can happen on the antenna its self or plugs and connectors ever 6 mouths or so antenna and plugs should be checked to make shore they are not rusting or cording if you see rusting or corroding treat it or replace the affected part

6.1.3 Mechanical Damage

It is always possible for your antennas to be damaged by strong winds, hail, Someone miss judging the roof of a car park, as well as birds and other wild life hanging off them (Like Scouts/Cubs and some Leaders). It is a good idea every week or so to have a visual check of your antennas to make shore nothing is broken or missing, there has been many cases of birds pulling cables out or people not realising or the antenna has fallen off and is a few kilometre back down the road, not picking up on damage to the antenna can lead to allot of damage to radio equipment connected to it

6.2 Care of Transceivers

Some Radio equipment are manufactured for uses in harsh environmental conditions. However, transceivers should always be **protected from rain and spray dirt dust extrema heat and cold,** By being positioned inside a car or building. They should be fine most of the time but hand held are very susceptible to damage if you suspect that your transceiver my be exposed to harsh environments take steps to minimise the risk to the equipment like keeping it in a sealed plastic when on the water or dusty

environments only removing it when required and such. In a car they should be **securely fastened** to the prevent damage to them and you on bumpy roads.

After use, a **microphone** associated with a transceiver should always be replaced in its holder or bracket. For a variety of reasons, one of which is that it can result in the transmitter being activated through inadvertent pressure on the microphone press-to-talk switch and without the knowledge of the operator. As a consequence, all background noises, including conversations made in the vicinity of the transceiver, are transmitted. Use of the frequency by other nearby stations cannot take place until the station responsible has been located and the problem corrected.

It is normal practice to locate **fuses** in the leads connecting the transceiver to the battery supplying the power. The purpose of these fuses is to "blow" should the transceiver malfunction and start to draw a current in excess of the fuse rating. By doing this, the fuses protect the wiring system from serious damage and the possibility of fire.

6.3 Care and Maintenance of Lead Acid Batteries

6.3.1 Essential Battery Maintenance

The functioning of radio equipment is dependent on power supplied. If it is to provide adequate performance in the event of an emergency, regular and careful maintenance is required.

- A battery's service life also depends on the manner in which it is treated. To ensure the best performance from a battery it is important that a battery:
- Is kept **clean, dry and free from terminal corrosion**;
- Has the **electrolyte kept at the correct level**; and
- Is **kept correctly charged**.

6.3.2 Battery Cleanliness

- A battery should be kept clean. A dirty battery may hold spilt electrolyte on its surface thereby providing a path for the electrical current to leak away. It is important to keep the outside surfaces of a battery dry and free of contamination.
- Corrosion forming on terminal clamps may seriously affect, or even prevent, the ability of the battery to supply current. Corrosion will be evident by the formation of a white-green powder between the battery terminals and the terminal clamps. In this situation, the terminal clamp should be removed and both it and the terminal post cleaned.
- To minimise the likelihood of corrosion, terminal posts and clamps should be lightly smeared with petroleum jelly or neutral silicone sealant.

6.3.3 Correct Charging

- To provide the best service, a battery must be correctly charged. Both overcharging and undercharging can seriously affect its performance.
- On Car or boat the usual means of charging the radio battery will be an alternator or generator attached to the engine. An associated regulator, which reduces the charging current as necessary, should prevent overcharging.
- Batteries that are not fitted to a car or energy source may need to be charged from a power point using a device called a charger if a battery is used relatively infrequently (say, once every few weeks), it is likely that during storage even a battery that starts as fully charged, will self-discharge and go flat.
- For safety reasons, it is important that the owner is able to determine the general condition of a battery and its ability to supply current over a period of time (its capacity). An indication of the level of charge in a battery may be obtained: **on-load terminal Voltage**

6.3.4 Measuring the On-Load Terminal Voltage

- Measurement of the on-load (that is, when the battery is supplying current terminal voltage will also provide an indication of the amount of charge in a battery.
- For a 12-volt battery, the on-load terminal voltage should not fall below approximately 11.4 volts **while transmitting**. If the voltage does fall significantly below this figure, the battery requires charging. If after charging, the on-load terminal voltage still falls significantly below 11.4 volts, it is an indication of a faulty cell and the battery should be replaced.
- Measuring of the off-load (that is, when the battery is idle) terminal voltage of a battery is a poor indication of its condition.

6.3.5 Loss of Capacity

- A battery will suffer a gradual loss of capacity during its life. This is inevitable and the battery should be replaced when the capacity loss becomes significant.
- Many lead-acid batteries have a commercial life of only two to three years.
- However, the useful life of a battery can be considerably shortened by:
    1. Operating a battery in a low state of charge for long periods;
    2. Allowing a battery to stand in a discharged state for long periods;
    3. Leaving a charged battery for long periods without periodic charging; and over charging.

6.3.6 Location of Batteries

- The location of a battery supplying radio equipment should be chosen to ensure that, as far as practicable, the battery is:
    1. **Protected** from the elements;

2. Readily **accessible** for routine maintenance;
3. Located reasonably **close to the transceiver**;
4. Well **ventilated** to dissipate the hydrogen gas that may be produced (if located within a compartment, venting to the outside may be necessary);
5. Not located with other items of equipment that could fall across the battery and cause short-circuiting.
6. Not located in the same compartment as a different type of battery, for example, alkaline cells.

6.4 Common Radio Controls

6.4.1 Power:

This may be a push button rocker switch, or a rotary switch. It will usually be marked 'Power', 'PWR', or 'ON/OFF', and is often part of the volume control

6.4.2 AF Volume:

The AF volume control or Volume, control adjusts the loudness of the received signal. This control is often labelled 'Vol'; AF gain _ which means audio frequency amplification and it works on that part of the circuit that amplifies audio frequencies

6.4.3 Squelch or Mute:

The squelch or mute control silences background noise in the absence of incoming signal. You normally set the squelch control to just eliminate background noise when no signal is present

Setting the squelch to high could cause weak signals to be missed, so the level is usually set to "just cut off the noise". It is recommended to listen and ensure that channel is not in use before transmitting. This may require, particularly on 27Mhz radios 'Opening the squelch' to check for the presence of very weak signals before transmitting

6.4.4 RF Gain:

The RF gain control is a little like the AF Volume control in that it will adjust the volume of the received signal. The difference is that where the volume control adjusts the amplification of the receiver in the audio frequency circuitry, the RF gain control adjusts the amplification in the radio frequency circuitry, the RF gain controls the 'sensitivity' of the receiver, which is the measure of the ability of a receive to detect weak signals

6.4.5 Channel selector:

The channel selector is ever a set of up and down buttons or a large knob. By using the buttons or knob you can select every channel the radio is able to use

6.4.6 Clarifier:

This control allows you to make small adjustments to your receive frequency in order to make a received SSB signal sound more natural and properly tuned-in, without changing the transmitter frequency.

6.4.7 Microphone Gain

This control adjusts the audio (speech) Level out of the Microphone amplifier. On SSB this control determines the Max transmitted power, setting the microphone gain too high will cause your signal to be distorted and you will cause interference to other stations operating near your channel

6.5 Receiving

Receiving or RX is one of the more important aspects of radio oppression in this session we will describe how to set up your radio of optimum Receiving capabilities

6.5.1 Setting the Squelch

Turn the unit ON
Adjust volume or AF gain to a comfortable level.
Note: *You must select* a *channel which is not in use before setting the SQUELCH control on your radio.*

2. Think of the Squelch control as a gate. If you turn SQUELCH fully on it raises the "Squelch Gate" so high that no signals get through.

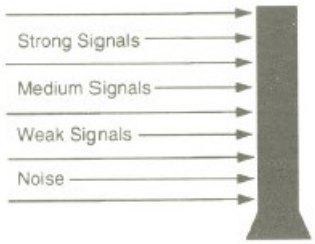


Fig6. High Squelch

3. If you turn the SQUELCH fully off it lowers the "Squelch Gate" so that everything gets through - noise, weak signals, and strong signals.

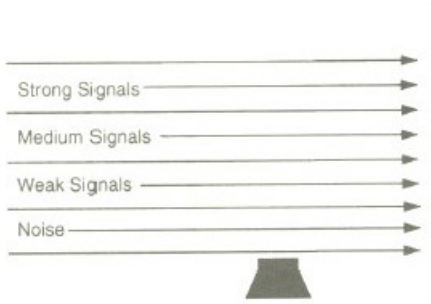


Fig7. Low Squelch

4. To set the "Squelch Gate" to the desired level, turn SQUELCH Control
Until you hear noise. Then turn the SQUELCH Back just until the noise stops.
Now only strong signals get through.

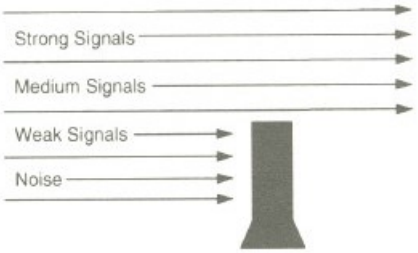


Fig8. Squelch set Right

6.5.2 RF Gain

Normal this control is turned right up so you can hear every thing around, if noise becomes a problem and the Squelch will not take it out reduce the RF gain. When receiving signals set the RF gain so that almost all of the background noise very low or no existent.

6.5.3 Clarifier

Some times you the signal you hear will sound like aliens talking, being high pinched or very low this shows that they are a little off frequency, to correct this turn the Clarifier left and right until the voice sounds normal

6.6 Transmitting

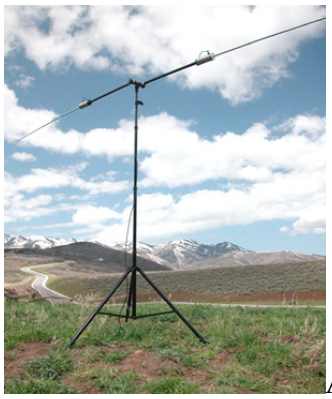
Transmitting is normal activated by means of a PTT or push to talk Switch on some radio there is a control called Microphone Gain this amplifies the signal out of the microphone so that someone with a soft voice can be Herd and Someone with a loud voice can be turned down. Most of the time transmitting requires very little work just press the microphone and go but do not transmit to long some radio have talk timers

that will stop the transmission if it is left on to long, also repeated and pronged conversations drain batteries and make the radio very hot in some cases so hot you can not touch it. It is also important to remember to listen before you transmit so as not to talk over Someone else

6.7 Antennas

There are many types and sizes of antennas on the market for radios, but all antennas must be made for a band of frequency's, it size depends on the frequency the lower the frequency the larger the antenna the higher the shorter, below are listed some of the common types of antennas there are a lot more but it is beyond the scope of this manual

6.7.1 Dipole



A **dipole antenna** is a radio antenna that can be made of a simple wire, with a center-fed driven element. It consists of two metal conductors of rod or wire, oriented parallel and collinear with each other (in line with each other), with a small space between them. The radio frequency voltage is applied to the antenna at the center, between the two conductors. These antennas are the simplest practical antennas from a theoretical point of view. They are used alone as antennas, notably in traditional "rabbit ears" television antennas, and as the driven element in many other types of antennas, such as the Yagi. Dipole antennas were invented by German physicist Heinrich Hertz around 1886 in his pioneering experiments with radio waves.

6.7.2 Yagi

A **Yagi-Uda array**, commonly known simply as a **Yagi antenna**, is a directional antenna consisting of a driven element (typically a dipole or folded dipole) and additional elements (usually a so-called *reflector* and one or more *directors*). The reflector element is slightly longer (typically 5% longer) than the driven dipole, whereas the so-called directors are a little bit shorter. This design achieves a very substantial increase in the antenna's directionality and gain compared to a simple dipole.

Highly directional antennas such as the Yagi are commonly referred to as "beam antennas" due to their high gain. However the Yagi design only achieves this high gain over a rather narrow band, making it more useful for various communications bands (including amateur radio) but less suitable for traditional radio and television broadcast bands. Amateur radio operators ("hams") frequently employ these for communication on HF, VHF, and UHF bands, often constructing such antennas themselves ("homebrewing"), leading to a quantity of technical papers and software.

6.7.3 Whip/vertical/Monopole

A **whip antenna** is the most common type of antenna, an antenna with a single driven element consisting of a straight flexible wire or rod, often mounted above some type of conducting surface called a ground plane. They are designed to be flexible so that they won't break off, and the name is derived from their whip-like motion when disturbed. Often whip antennas for portable radios are made of a series of interlocking telescoping metal tubes, so they can be retracted when not in use.

The whip antenna can be considered half of a dipole antenna, it has an omnidirectional(all directions) radiation pattern. The length of the whip antenna is determined by the frequency of the radio waves used. The most common length is one-quarter of the length of the frequency, called a quarter-wave whip, although the length of this type of antenna is often shortened by the use of a loading coil. Half-wave whip antennas are also common. These antennas are widely used for hand-held radios such as cell phones, walkie-talkies, FM radios, boom boxes, Wifi enabled devices, and GPS receivers, and also attached to vehicles as the antennas for car radios and two way radios for police, fire and aircraft.

6.7.4 Inverted Vee

An **inverted vee antenna** is a modified dipole antenna supported in the center with the ends lower than the center. Viewed from the side, it looks like the English letter "V" turned upside down, hence the name. Inverted vee antennas are commonly used by many amateur radio stations, and aboard sailing vessels requiring better HF performance than available with a short whip antenna.

6.8 Activity idea: Setting up a station

You and your group must safely assemble a radio base with tower in 20 minuets to send and receive a set of important instructions to disarm an Explosive device

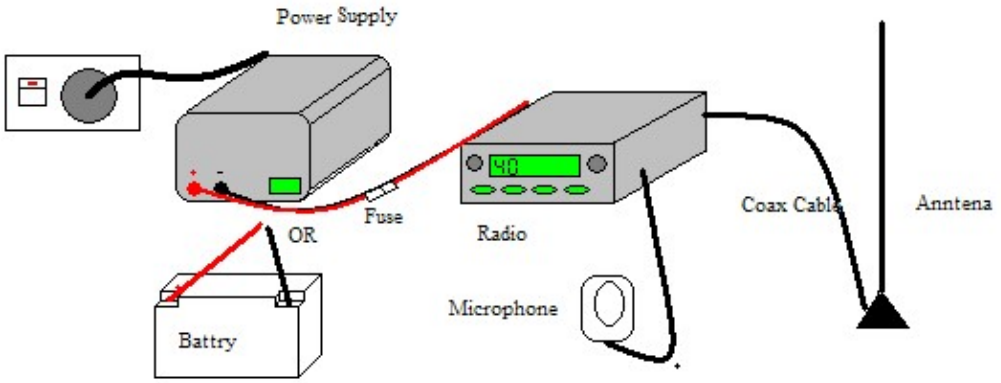


Fig9. Radio set up

Notes

7.0 Part 7 CB radios

7.1 27 MHz CB

27 MHz is capable of both local and interstate communication. However the latter cannot be relied upon. What 27 MHz can do depends on the transmission mode (AM or SSB), with SSB providing better results when signals are weak and/or over long distances.

Locally, expect communication distances of between 5 and 15 kilometers on AM. Actual range achieved will depend on antenna efficiency, terrain and interference levels. Well-equipped home stations will do better than a mobile station. On SSB, distances of between 15 and 30 kilometers are common, with 3000 km sometimes possible under favorable conditions. Good conditions are often called 'skip', so-called because the signal bounces ('skips') off the ionosphere on its way to the other station. Long-distance propagation is most common in December/January each year and throughout the year during times of high sunspot activity.

In the last decade or so 27 MHz AM activity has declined enormously. These days, you'll have no problem finding a vacant channel; even in major cities it is common to flick through them all and hear nothing. Major retailers have stopped selling 27 MHz radios, so you will need to find one of the few specialised communications shops, haunt the pawnshops or peruse the local classifieds to find equipment for sale. Nevertheless AM remains suitable for groups desiring cheap car-to-car communications amongst themselves. If your interest is more recreational, you'll do much better if you get a set with SSB (i.e. LSB and USB settings) as well as AM. SSB maintains a significant 'hobby' following, with many operators erecting large beam antennas to allow interstate communications. CB is a public medium so be prepared to hear all types on the air!

Pros	Cons
Licence Free	Public Service
Will work in Valleys and dense bush	Rage over 50Km cannot be relayed on
Can talk long distances under some circumstances	Hard to find equipment

Low cost	Large Antennas needed
	Can be interfered with by Power lines and storms
	Hard to use for untrained persons

Table 4 Pros and Cons of 27Mhz CB Radio

7.1.2 27Mhz CB Channels

Channel	Uses	Modulation
1	Conversations	AM
2	Conversations	AM
3	Conversations	AM
4	Conversations	AM
5	Conversations	AM
6	Conversations	AM
7	Conversations	AM
8	Highway	AM
9	Emergency	AM/USB
10	4WDrivers	AM
11	Calling	AM
12	Conversations	AM
13	Conversations	AM
14	Conversations	AM
15	Conversations	USB/LSB
16	Calling	LSB
17	Conversations	USB/LSB
18	Conversations	USB/LSB
19	Conversations	USB/LSB
20	Conversations	USB/LSB
21	Conversations	USB/LSB
22	Convoy Channel	AM/USB/LSB
23	Conversations	USB/LSB
24	Conversations	USB/LSB
25	Conversations	USB/LSB
26	Conversations	USB/LSB
27	Conversations	USB/LSB
28	Conversations	USB/LSB
29	Conversations	USB/LSB
30	Conversations	USB/LSB
31	Conversations	USB/LSB
32	Conversations	USB/LSB
33	Conversations	USB/LSB
34	Conversations	USB/LSB
35	Calling	LSB
36	Conversations	USB/LSB
37	Conversations	USB/LSB

38	Conversations	USB/LSB
39	Conversations	USB/LSB
40	Conversations	USB/LSB

Table 5 27Mhz CB Channel Chart

7.1.3 Emergency Situations

To call for help simply follow this procedure:
1. Select the emergency channel on your CB - channel 9 AM or SSB.
Be aware some emergency Monitors may monitor other local channels in addition to, or instead of, the emergency channels. If no response is received, try other local channels.

2. Call "Any emergency monitor", this is "call sign or first name" calling any emergency monitor"

3. Give the Monitor time to answer if no response is received call again.

4. Respond with the nature of the incident, exact location and other information. The Monitor will ask you for the information that he/she needs in order to notify the required services.
Remember To Stay Calm!

7.2 UHF CB

UHF CB uses the FM transmission mode. UHF gives clear, crisp local communication without the long-distance interference sometimes heard on 27 MHz. UHF is also less susceptible to power line noise than 27 MHz. Its main disadvantage is that it performs poorly in hilly and forested areas due to its 'line of sight' characteristics. Typical direct (simplex) car-to-car ranges of UHF vary between about 5 kilometers in urban areas to 20 kilometers or more in open countryside. However if located on a hilltop, distances of 50 kilometers are common, even with low-powered handheld equipment.

UHF really comes into its own when repeater stations are used. Repeaters are installed on hilltops and retransmit signals received on one channel onto another channel. They are set up by community groups or commercial organisations but can freely be used by everyone. Distances of 50 to 100 kilometres are commonly achieved via repeaters, even if mobile or handheld transceivers are used. Most urban and rural areas are served by at least one repeater. To listen for the repeaters in your area, search for signals between channels 1 to 8 and 41 to 48. Those channels are busy most of the time are likely to be repeaters.

Note: as of June 2011 the ACMA has changed to rules for UHF CB to Allow 80 channel instead of the old 40 CH system, A 40 Channel CB will still work but audio from a 80 Channel will sound distorted on it, it is recommended that you use 80 channels were ever possible.

7.2.1 Repeaters

A Repeater Station picks up your signal on one Channel and retransmits it on another. Repeaters are located in very high positions and normally transmit high power. They typically have excellent radio range and can therefore greatly extend the radio coverage to their users, especially low power and mobile stations.

Repeaters have a ‘time out’ to protect the repeater transmitter from damage should a fault or interference to its receiver lock it on. The time out varies typically from 3 minutes to 10 minutes. You should be aware of the timeout of repeater you are using as if you operate beyond the timeout period; the repeater will power down and the rest of your transmission will be lost. The timeout does not mean you cannot use the repeater for a longer period, it just your ‘over’, however it is good practice to keep you ‘overs’ short. You also need to leave a short break between ‘overs’ to reset the timer.

Repeaters are a shared resource among radio operators; as usual you should always listen to see if a repeater is in use before you make a call. If you want to participate with a group currently using the repeater just wait for a pause in transmission and announce you wish to join in (using brake or breaker). Remember to leave breaks between ‘overs’ to allow other stations to call in

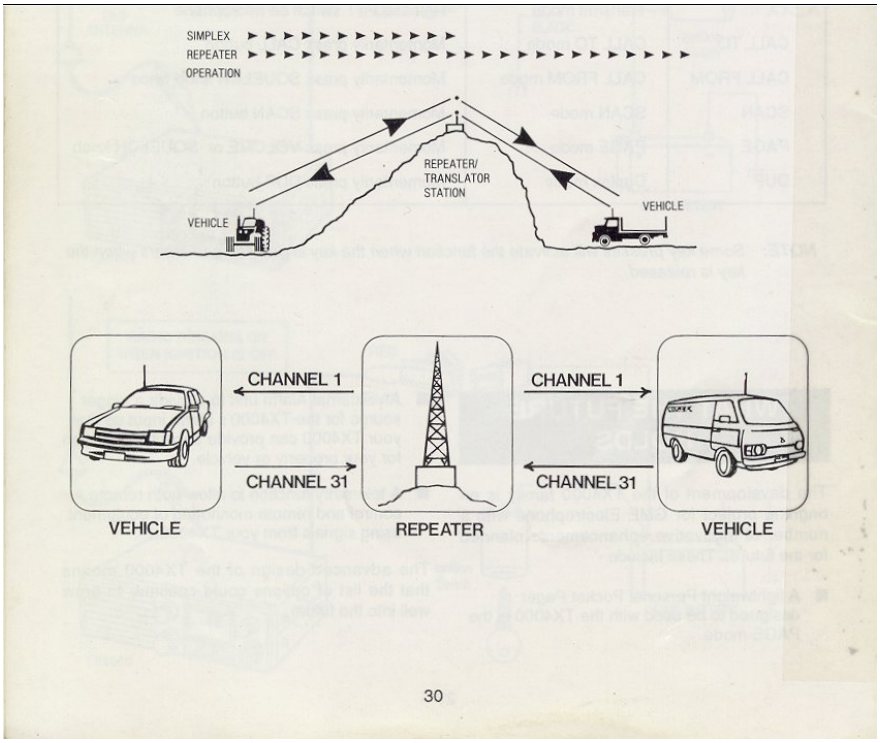


Fig10.Repeter oppression

7.2.2 Sellcall

Sellcall is a system that operates like a telephone; the radio is programmed with its own unique Selcall identification number. If this number is called by another radio your radio will beep to alert you.

If you do not whish to hear any other activity while waiting on a channel, you can activate a quiet mode; the radio will then remain quiet to all incoming signals until your Selcall number is called this system can be used as a paging system or a way minimise traffic on a channel the down side of this is that all Sellcall numbers must be known to the user and every one using it must no ho to operate their radios correctly.

Sellcall is a digital mode and can be used on channels 22 and 21, try and avoid calling mutable times as the digital traffic can be irritating to other users.

The main use for Sellcall is for remote control systems it is very popular with farmers as a way to turn water pumps on and off, open close gates and so on farms

7.2.3 CTCSS

CTCSS (Continuous Tone Coded Squelch System) is a Squelch quieting system that allows several groups of users to share the same channel without disturbing each other. It uses one of 50 preset sub-audible (very low frequency) tones to open and close the squelch on your radio. The system applies a continuous low-level tone decoder to your receiver’s squelch. With CTCSS enabled, the channel remains quiet

to all incoming signals unless they carry the correct tone. When a transmission with the correct tone is received, the squelch opens and remains open for as long as the signal is present. When the channel becomes quiet again transmissions that do not use the correct tone will not be heard

Pros	Cons
Licence Free	Public Service
Repeaters Available	Rage over 20 Km not possible without repeater
Low level Security functions	Will not work throw heavy bush or in valleys
Low cost	Can become congested in city's
Easy to find	

Table 6 Pros and Cons of UHF CB Radio

7.2.4 UHF CB Channels

Channels 1 to 40 are the same on both 40 and 80 channel radios

Channel	Uses
1	Repeater 1 Output
2	Repeater 2 Output
3	Repeater 3 Output
4	Repeater 4 Output
5	Emergency /Emergency Repeater out put
6	Repeater 6 Output
7	Repeater 7 Output
8	Repeater 8 Output
9	Conversations
10	4Wdrivers
11	Calling
12	Conversations
13	Conversations
14	Conversations
15	Conversations
16	Conversations
17	Conversations
18	Caravan's, campers
19	Conversations
20	Conversations
21	Digital (Telemetry and Selcall)
22	Digital (Telemetry and Selcall)
23	Conversations
24	Conversations
25	Conversations
26	Conversations
27	Conversations
28	Conversations
29	Conversations
30	Broadcasts

31	Repeater 1 Input
32	Repeater 2 Input
33	Repeater 3 Input
34	Repeater 4 Input
35	Emergency /Emergency Repeater input
36	Repeater 6 Input
37	Repeater 7 Input
38	Repeater 8 input
39	Conversations
40	Highway Communicans
41	Repeater 41 Output
42	Repeater 42 Output
43	Repeater 43 Output
44	Repeater 44 Output
45	Repeater 45 Output
46	Repeater 46 Output
47	Repeater 47 Output
48	Repeater 48 Output
49	Conversations
50	Conversations
51	Conversations
52	Conversations
53	Conversations
54	Conversations
55	Conversations
56	Conversations
57	Conversations
58	Conversations
59	Conversations
60	Conversations
64	Conversations
65	Conversations
66	Conversations
67	Conversations
68	Conversations
69	Conversations
70	Conversations
71	Repeater 41 Input
72	Repeater 42 Input
73	Repeater 43 Input
74	Repeater 44 Input
75	Repeater 45 Input
76	Repeater 46 Input
77	Repeater 47 Input
78	Repeater 48 Input
79	Conversations

80	Conversations

Table 7 UHF CB Channel Chart

7.2.5 Emergency Situations

To call for help simply follow this procedure:

1. Select the emergency channel on your CB - Channel 5 (same on 40 & 80 Channel radios) (select 'Duplex' or 'Repeater' mode if in range of a channel 5/35 emergency repeater, otherwise use 'Simplex' mode - i.e. turn your Repeater or Duplex button OFF).
Be aware some emergency Monitors may monitor other local UHF repeaters in addition to, or instead of, the emergency repeater. If no response is received, try other local channels.

2. Call "Any emergency monitor", this is "call sign or first name" calling any emergency monitor"

3. Give the Monitor time to answer if no response is received call again.

4. Respond with the nature of the incident, exact location and other information. The Monitor will ask you for the information that he/she needs in order to notify the required services.
Remember To Stay Calm!

7.3 27Mhz Marine CB

27 MHz marine radios, commonly called 27 'meg', are popular for use on recreational boats and provide short-range communications, but not the range or performance of a Marine VHF radio (Requires license).

They would be suitable for operating in protected and semi-protected waters or in unprotected waters within the range of a coast station. No operator's licensee is required to use a 27 MHz Marine radio.

27 MHz Marine may be monitored by other recreational vessels or at various locations and hours of operation by Volunteer Marine Rescue radio bases.

Pros	Cons
Licence Free	Public Service
Will work in Valleys and dense bush	Rage over 50Km cannot be relayed on
Monitored Emergency channel	Large Antennas needed
Low cost	Can be interfered with by Power lines and storms
	Can only be used for boating

Table 8 Pros and Cons of 27Mhz Marine CB Radio

7.3.1 27 MHz Marine Channels

Channel	Uses
68	Commercial Operations
72	Professional Fishing
82	Professional Fishing
86	Secondary Distress Channel
88	Primary Distress Channel
90	Calling & working ship to shore
91	Calling & working ship to shore
94	Ship to ship and ship to shore
96	Ship to ship
98	Rescue organizations

Table 9 27Mhz Marine CB Channel Chart

7.3.2 Emergency Situations

Distress Calls

The distress call 'mayday' may be used only if the boat is threatened by grave and imminent danger and immediate assistance is required. For example, the boat is sinking or on fire. This distress call has absolute priority over all other transmissions and may only be transmitted on the authority of the skipper or the person responsible for the safety of the boat. Calls are made on distress frequencies, 27.88 MHz Call procedures:

- Mayday Mayday Mayday.
- This is - name and radio call sign of boat in distress (spoken three times).
- Mayday.

- Name and radio call sign of boat. • Details of boat's position.
- Nature of distress and assistance required.
- Other information including number of people on board, boat description and intentions.

Urgency Calls

The urgency call should be used when use of the distress call cannot be justified but a very urgent message concerning the safety of your boat or the safety of a person needs to be transmitted. For example, your boat is disabled and drifting onto a lee shore or a crewmember is seriously ill. You may make an urgency call only on the authority of the skipper or person responsible for the safety of your boat. Distress call frequencies (above) may be used for these calls. Call procedure:

- Pan pan, pan pan, pan pan.
- Hello all stations hello all stations hello all stations.
- This is - name and radio call sign of boat (spoken three times). • Details of the boat's position.
- Details of assistance required and other information.

Safety Calls

The safety call should be used if you wish to broadcast an important navigational warning to other stations. For example, you have sighted a large floating object that could damage the hull of a boat. A safety call is more likely to be made by a coast station or a limited coast station operated by a marine rescue group and may include important weather warnings such as severe thunderstorm, gale and cyclone warnings. Call procedure:

- Say-cure-e-tay say-cure-e-tay say-cure-e-tay.
- Hello all stations hello all stations hello ail stations.
- This is - name and radio call sign of boat or shore station (spoken three times).
- Details of the warning.

You may make the initial safety call to ail stations on a distress frequency. However, you should change to a working frequency to make the broadcast of the safety message.

Notes

8.0 Part 8 Phones

Phones have become a intrigue part of our live letting us communicate reliably over grate distances easily, but like everything else they have there draw backs and understanding theses and coping with them is very important.

8.1 Land Lines

Land Line phones as the name suggests are phones that require a fixed phone line coming to your location, be them copper or fiber optic typically theses phones are located in buildings. Land lines are the most reliable types of phone currently in existence, but can still be knocked out, the most common way is damage to the line be it from broken pole from a car crash, storm damage or someone digging it up, all Land line phones have a set of wires or fiber running back to a central exchange that will be some were in your area it may be a Shipping container in the middle of a field or a big brick building and even a big green box on a street Conner. Emergency services prefer you to call them on Land lines it makes it quicker and easier for them to trace were you are The other great advantage of Land lines is the calls are cheaper than throws of mobiles

8.1.1 Plane Old Telephone Service (POTS)

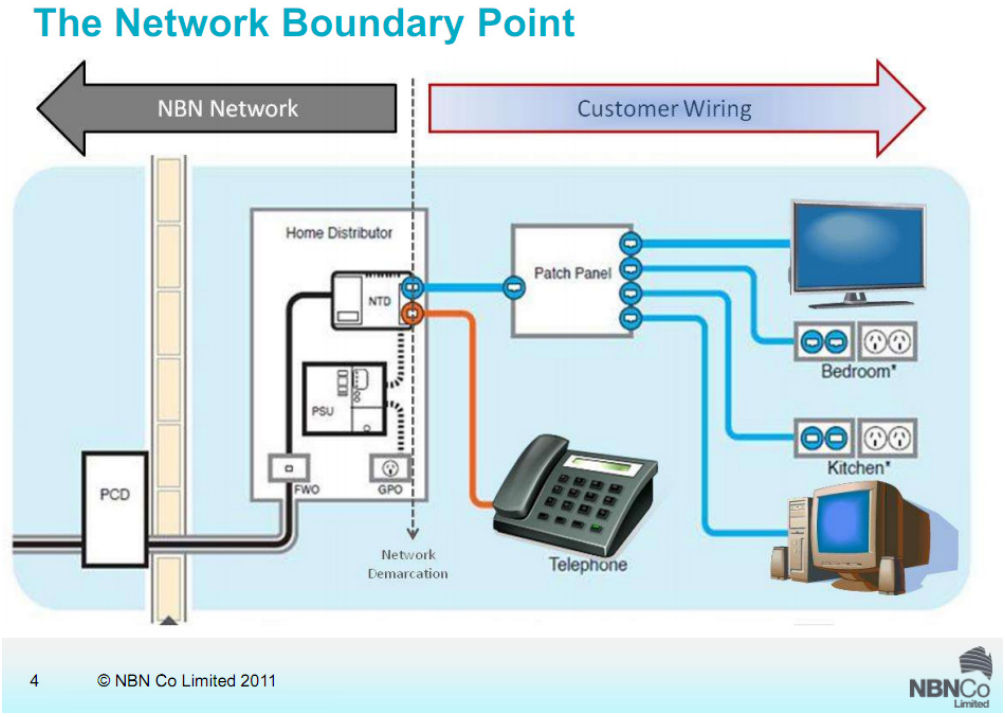
POTS are the typical phone service most house holds and scout halls have they have a set of copper wires running back to and exchange. In the event of a black out Land lines will still work (as long as you are not using a cordless phone) this is because all exchanges have batteries or a Generator to keep it going, this because but there is a limit to how long a exchange can run on batteries it is normally around 72 Hours after that some other form of power is required it is very rare of an exchange to be without power for that long but it can happen.

Pros	Cons
Reliable Service	Must be in a fixed location
Low cost calls	Infrastructure damage possible
Simple Operation	Line must be run from exchange to site

Low cost of Equipment	Line rental cost
Can be traced by Emergency services	Can suffer from network congestion
Low coast internet connections	
Will work in a power outage	

Table 10 Pros and Cons of POTS Phone

8.1.2 NBN Phones



With the increasing demand for internet access telephone company's have desired to start removing their copper wire and replacing it with fiber optic cable to allow faster internet access to the home. The phone connected to this system is a little different to that of the old copper network. Your voice I converted to data almost instantly and sent out as if it is a upload or down load from the internet. The big change is that extra equipment is required at your house or hall to use the NBN which is normally installed by the phone company, the only real problem with this is you must provide power to the new boxes so in the event of a black out the system will not work, optional batteries are available on request and at a extra cost at time of install.

Pros	Cons
Reliable Service	Must be in a fixed location
Low cost calls	Infrastructure damage possible
Simple Operation	Line must be run from exchange to site/ and equipment installed at site
Can be traced by Emergency services	Line rental cost
Low coast internet connections	Will not work in a power outage (unless battery added)

High speed internet	Install cost

Table 11 Pros and Cons of NBN Phone

On land lines you Dial Triple Zero (000) only 911 or other number such as 112 are not correct for land lines

8.1.3 Tips when calling Triple Zero (000)

1. Stay Calm.
2. You will be asked if you require police, fire or ambulance. Select the service/services you require.
3. You will then be connected to an emergency center who will ask you a series of questions.
4. May be asked to provide the Town, State details of the Emergency and Nearest cross street. This ensures you are connected to the correct locality for response.
5. It is vital to ensure that the correct information is provided so that the emergency service requested can attend your situation.

It is important to remember that the questions are asked to provide you with the best and fastest service for your needs. In time-critical situations the emergency services are being dispatched while you are being questioned. Your information will continue to be updated throughout the call.

8.2 Mobile Phones

Millions of people around the world use **cellular phones**. They are such great gadgets you can talk to anyone on the planet from just about anywhere!

These days, cell phones provide an incredible array of functions, and new ones are being added at a breakneck pace. Depending on the cell-phone model, you can:

- Store contact information
- Make task or to-do lists
- Keep track of appointments and set reminders
- Use the built-in calculator for simple math
- Send or receive e-mail
- Get information (news, entertainment, stock quotes) from the Internet
- Play games
- Watch TV
- Send text messages
- Integrate other devices such as PDAs, MP3 players and GPS receivers

But have you ever wondered how a cell phone works?

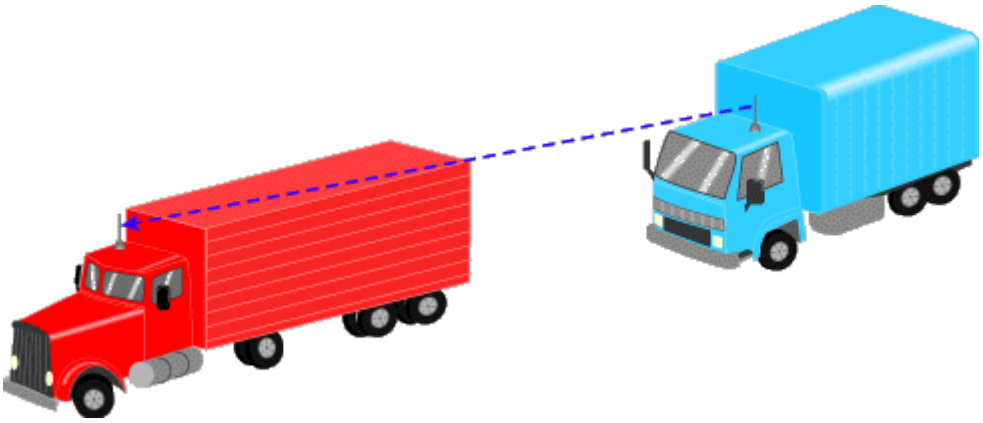
To start with, one of the most interesting things about a cell phone is that it is actually a radio -- an extremely sophisticated radio, but a radio nonetheless.

In the dark ages before cell phones, people who really needed mobile-communications ability installed **radio telephones** in their cars. In the radio-telephone system, there was one central antenna tower per city, and perhaps **25 channels** available on that tower. This **central antenna** meant that the phone in your car needed a powerful transmitter -- big enough to transmit about 70 km. It also meant that not many people could use radio telephones -- there just were not enough channels.

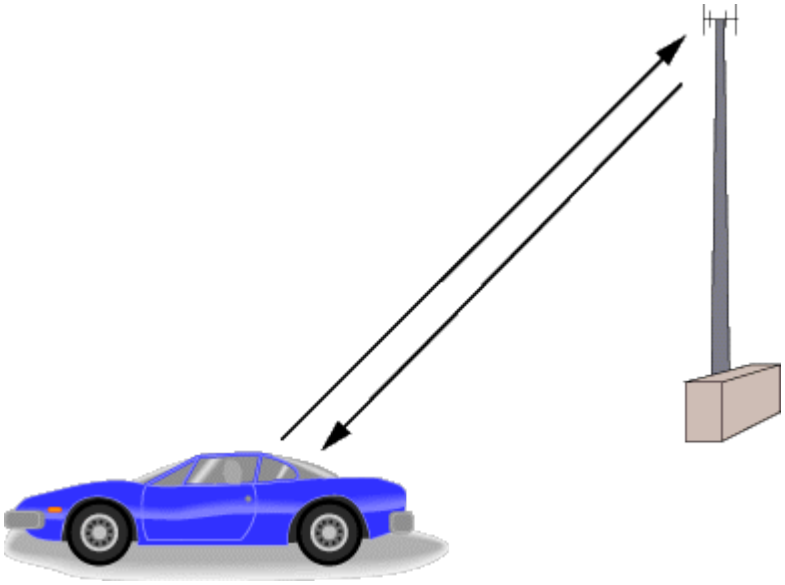
The genius of the cellular system is the division of a city into small **cells**. This allows extensive **frequency reuse** across a city, so that millions of people can use cell phones simultaneously.

A good way to understand the sophistication of a cell phone is to compare it to a CB radio or a walkie-talkie.

- **Full-duplex vs. half-duplex** - Both walkie-talkies and CB radios are **half-duplex** devices. That is, two people communicating on a CB radio use the same frequency, so only one person can talk at a time. A cell phone is a **full-duplex** device. That means that you use one frequency for talking and a second, separate frequency for listening. Both people on the call can talk at once.
- **Channels** - A walkie-talkie typically has one channel, and a CB radio has 80 channels. A typical cell phone can communicate on 1,664 channels or more!
- **Range** - A walkie-talkie can transmit about 1.6 km using a 0.25-watt transmitter. A CB radio, because it has much higher power, can transmit about 8 km using a 5-watt transmitter. Cell phones operate within **cells** and can switch cells as they move around. Cells give cell phones incredible range. Someone using a cell phone can drive hundreds of miles and maintain a conversation the entire time because of the cellular approach.
-



In half-duplex radio, both transmitters use the same frequency. Only one party can talk at a time.



In full-duplex radio, the two transmitters use different frequencies, so

both parties can talk at the same time.
Cell phones are full duplex.

Fig11. Simplex Duplex

In a typical analog cell-phone system the cell-phone carrier receives about **800 frequencies** to use across the city. The carrier chops up the city into cells. Each cell is typically sized at about 26 square kilometers. Cells are normally thought of, as hexagons on a big **hexagonal grid**, like this:

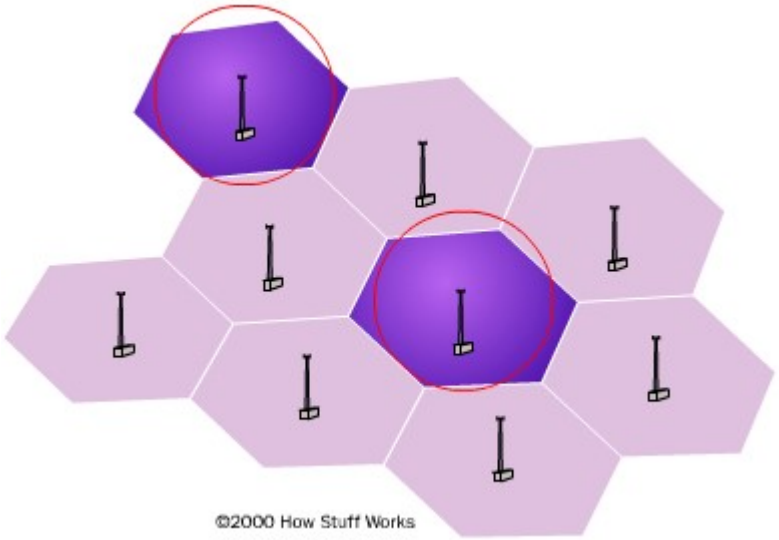


Fig12. Phone cells

Because cell phones and base stations use low-power transmitters, the same frequencies can be reused in non-adjacent cells. The two purple cells can reuse the same frequencies.

Each cell has a **base station** that consists of a tower and a small building containing the radio equipment. We'll get into base stations later. First, let's examine the "cells" that make up a cellular system.

A single cell in an analog cell-phone (1G) system uses one-seventh of the available duplex voice channels. That is, each cell (of the seven on a hexagonal grid) is using one-seventh of the available channels so it has a unique set of frequencies and there are no collisions:

- A cell-phone carrier typically gets **832 radio frequencies** to use in a city.
- Each cell phone uses two frequencies per call -- a duplex channel -- so there are typically **395 voice channels** per carrier. (The other 42 frequencies are used for **control channels** -- more on this later.)

Therefore, each cell has about **56 voice channels** available. In other words, in any cell, 56 people can be talking on their cell phone at one time if the cell runs out of channels no new calls can be made until one is freed up, the phone will show no signal and will not call out. Analog cellular systems are considered first-generation mobile technology, or **1G**. With digital transmission methods (2G), the number of available channels increases. For example, a digital system can carry three times as many calls as an analog system, so each cell has about 168 channels available.

Cell phones have **low-power transmitters** in them. Many cell phones have two signal strengths: 0.6 watts and 3 watts (for comparison, most CB radios transmit at 4 watts). The base station is also transmitting at low power. Low-power transmitters have two advantages:

- The **transmissions** of a base station and the phones within its cell do not make it very far outside that cell. Therefore, in the figure above, both of the purple cells can **reuse the same 56 frequencies**. The same frequencies can be reused extensively across the city.
- The **power consumption** of the cell phone, which is normally battery-operated, is relatively low. Low power means small batteries, and this is what has made handheld cellular phones possible.

The cellular approach requires a large number of base stations in a city of any size. A typical large city can have hundreds of towers. But because so many people are using cell phones, costs remain low per user. Each carrier in each city also runs one central office called the **Mobile Telephone Switching Office** (MTSO). This office handles all of the phone connections to the normal land-based phone system, and controls all of the base stations in the region.

Cell Phone Codes
Electronic Serial Number (ESN) - a unique 32-bit number programmed into the phone when it is manufactured

Mobile Identification Number (MIN) - a 10-digit number derived from your phone's number

System Identification Code (SID) - a unique 5-digit number that is assigned to each carrier by the ACMA

While the ESN is considered a permanent part of the phone, both the MIN and SID codes are programmed into the phone when you purchase a service plan and have the phone **activated**.
All cell phones have special **codes** associated with them. These codes are used to identify the phone, the phone's owner and the service provider.

Let's say you have a cell phone, you turn it on and someone tries to call you. Here is what happens to the call:

- When you first power up the phone, it listens for an **SID** on the **control channel**. The control channel is a special frequency that the phone and base station use to talk to one another about things like call set-up and channel changing. If the phone cannot find any control channels to listen to, it knows it is **out of range** and displays a "no signal" message.

- When it receives the SID, the phone **compares it** to the SID programmed into the phone. If the SIDs match, the phone knows that the cell it is communicating with is part of its **home** system.

- Along with the SID, the phone also transmits a **registration request**, and the MTSO keeps track of your phone's location in a database -- this way, the MTSO knows which cell you are in when it wants to ring your phone.

- The **MTSO** gets the call, and it tries to **find you**. It looks in its database to see which cell you are in.

- The MTSO **picks a frequency pair** that your phone will use in that cell to take the call.

- The MTSO communicates with your phone over the **control channel** to tell it which frequencies to use, and once your phone and the tower switch on those frequencies, the call is **connected**. Now, you are talking by two-way radio to a friend.

- As you move toward the edge of your cell, your cell's **base station** notes that your **signal strength** is diminishing. Meanwhile, the base station in the cell you are moving toward (which is listening and measuring signal strength on all frequencies, not just its own one-seventh) sees your phone's signal strength increasing. The two base stations coordinate with each other through the MTSO, and at some point, your phone gets a signal on a control channel telling it to change frequencies. This **hand off** switches your phone to the new cell.

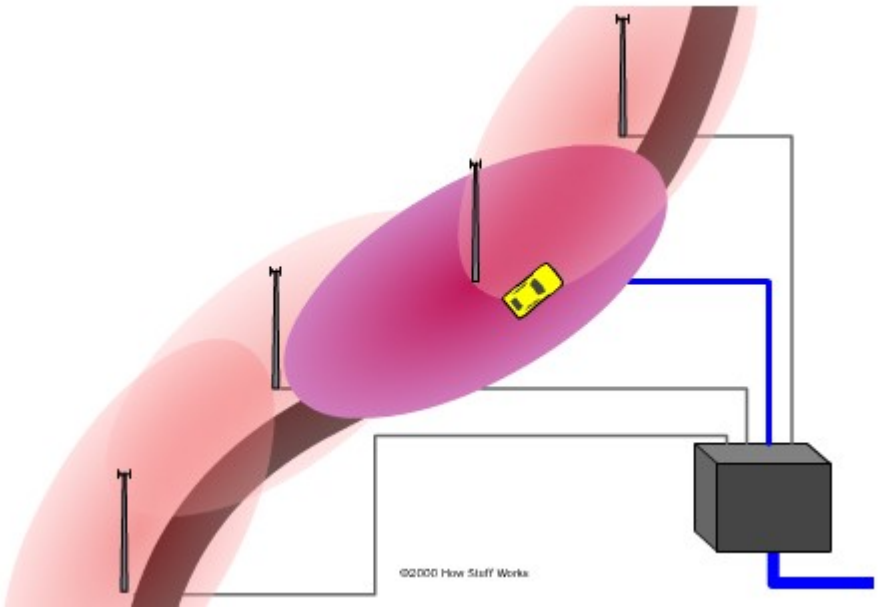


Fig13. Changing phone towers

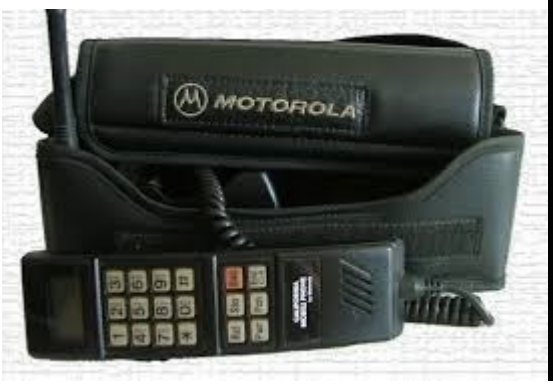
Let's say you're on the phone and you move from one cell to another -- but the cell you move into is covered by another service provider, not yours it drops the call unless you are using roaming

If the SID on the control channel does not match the SID programmed into your phone, then the phone knows it is **roaming**. The MTSO of the cell that you are roaming in contacts the MTSO of your home system, which then checks its database to **confirm** that the SID of the phone you are using is valid. Your home system **verifies** your phone to the local MTSO, which then tracks your phone as you move through its cells. And the amazing thing is that all of this happens within seconds.

The less amazing thing is that you may be charged insane rates for your roaming call. On most phones, the word "roam" will come up on your phone's screen when you leave your provider's coverage area and enter another's. If not, you'd better study your coverage maps carefully -- more than one person has been unpleasantly surprised by the cost of roaming. Check your service contract carefully to find out how much you're paying when you roam.

Note that if you want to roam internationally, you'll need a phone that will work both at home and abroad. Different countries use different cellular access technologies.

8.2.1 First Generation Mobile phones (1G)



1G Phones are often called analogue cell phones, Telstra lunched the first 1G system in February 1987 in Sydney this was first modern cell phone system in Australia it quickly spread across populated areas of Australia. Analogue cell phones are were not able to send any txt's / data or internet information, they were also very expensive at around $4.000 when the net work was first started but the price of the hand set soon dropped, early 1G phones were large and cumbersome some the size of hand bags while others were the size of bricks which gave rise to the term "brick phone' the 1G system become very popular and Telstra was soon running out of analogue channels to carry the calls in highly populated areas resulting in towers often filling up and people no longer being able to make calls. A security issue also soon appeared as it was found that people with radio scanners were able to ease drop on conversations of others using cell phones. Analogue cell phone are now days a thing of the past and confined to museums and dusty draws.

8.2.2 Second Generation Mobile phones (2G)

Second Generation or 2G phones or digital cell phones as they came to be called are still in use today and are often sold under the name of GSM phones as well as digital but only time will tell how long they last with the increasing spread of newer systems. 2G phones removed the analogue component of the cell phone system allowing allot more channels with in the limits of the old 1G system they are also secure and hard to ease drop on. With the newer digital system txt and short message services became

available. As a stop gap step in the late 90's Telstra setup a service called CDMA which used both 1G and 2G to keep services running as they upgraded the network to run 2G, CDMA phones would switch between 1G and 2G depending on what system was available were they were located. CDMA like the 1G network has now been shut down. In the early 2000's As the internet become more popular people started to want to check their emails and view web site while out and about, the 2G system is slow to pass data such as videos and music so another upgrade was needed

8.2.3 Third Generation Mobile phones (3G) / Next G

Third Generation phones build on the advances of the 2G phones by adding more computing power and using newer software and programming to allow faster data rates over the phone system. A 3G phone now has more computing power than a desk top computer from the 80's . The biggest advantage of the 3G system is the adding of internet on your phone. The only down side is that with this new speed the amount of towers to provide it must increase resulting In more towers being installed in high traffic areas the range of the phone is also reduced due to the complexity of the signals it is sending. The speed of the data also reduces with the distance you are from the tower. Most 3G phones will drop back to a 2G system in the absence of high speed signals. 3G phone are currently the stranded hand set modal in Australia. With 3G came the advent of picture messaging and video calling both are yet to take off in any big way.

8.2.4 Forth Generation Mobile phones (4G) and beyond

Forth Generation phones and another step forward providing more data speed and more computing power the direction phones are taking at the time of publishing mobile phone companies are trying to deliver ever faster data services to users it is expected that the speed of phone data will continue to increases and as a extra add on to make phone calls to. Most phone net works are trying to make 4G networks at this time but most are concentrated to major cities and region centers

8.2.5 Inside a Digital Cell Phone

2G and above phones convert your voice into binary information (1s and 0s) and then compress it. This **compression** allows between three and 10 digital cell-phone calls to occupy the space of a *single* analog call.

Let's take a good look inside a digital cell phone

On a "complexity per cubic inch" scale, cell phones are some of the most intricate devices people use on a daily basis. Modern digital cell phones can process **millions of calculations per second** in order to compress and decompress the voice stream.

The parts of a cell phone

Fig14. inside a phone

If you take a basic digital cell phone apart, you find that it contains just a few individual parts:

- An amazing circuit board containing the brains of the phone
- An antenna
- A liquid crystal display (LCD)
- A keyboard (not unlike the one you find in a TV remote control)
- A microphone
- A speaker
- A battery

The circuit board is the heart of the system. Here is one from a typical Nokia digital phone:

The front of the circuit board

The back of the circuit board

Fig15. Inside a phone

8.2.6 Cell-phone Towers

A cell-phone tower is typically a steel pole or lattice structure that rises 10's of meters into the air. This cell-phone tower near a freeway

Fig16. Mobile phone Tower

This is a modern tower with three different cell-phone providers riding on the same structure. If you look at the base of the tower, you can see that each provider has its own equipment, and you can also see how little equipment is involved today (older towers often have small buildings at the base):

Fig17. Base of Mobile phone Tower

Here is the equipment owned by one of the providers:

Fig18. Boxes at base of Mobile phone Tower

The box houses the **radio transmitters and receivers** that let the tower communicate with the phones. The radios connect with the antennae on the tower through a set of thick cables:

Fig19. Cables at Mobile phone Tower

If you look closely, you will see that the tower and all of the cables and equipment at the base of the tower are heavily **grounded**. For example, the plate in this shot with the green wires bolting onto it is a solid copper grounding plate:

Fig20. Mobile phone Tower cabule way

One sure sign that multiple providers share this tower is the amazing five-way latch on the gate. Any one of five people can unlock this gate to get in.

Fig21. Mobile phone Tower Gate

Cell-phone towers come in all shapes and sizes, but I do believe this one in Morrisville, North Carolina, is one of the weirdest looking.

Fig22. Mobile phone Tower looking like a tree

That is one tall, ugly tree!

Pros	Cons
Portable device	Must be within 25 Km of a tower
Low cost of Equipment	Can have infrastructure damaged and be affected by wether
Easy to use	Subject to network congestion
Texting	Medium call costs
	Medium cost low speed internet

Table 12 Pros and Cons of Mobile Phones

8.2.7 Tips when calling Triple Zero (000) or (112)

6. Stay Calm.
7. You will be asked if you require police, fire or ambulance. Select the service you require.
8. You will then be connected to an emergency call operator who will ask you a series of questions.
9. If you are on a mobile phone you will be asked to provide the Town and State details of the Emergency. This ensures you are connected to the correct locality for response.
10. It is vital to ensure that the correct information is provided so that the emergency service requested can attend your situation.

It is important to remember that the questions are asked to provide you with the best and fastest service for your needs. In time-critical situations the emergency services are being dispatched while you are being questioned. Your information will continue to be updated throughout the call.

Using your mobile in an emergency

When possible, it's recommended that you contact Emergency Services by calling Triple Zero (000) from a Land line.
At any one time, network capacity, topography, climate and even the number of users in a particular location, can affect your ability to make a call in an emergency using a mobile. That's why it's best not to rely on your mobile as the only way to communicate. So, if circumstances require it, consider carrying a specialised emergency communication device such as an HF, VHF or UHF radio, or a satellite phone/ ERIRB'S.

It's important to remember that the number to call in an emergency situation depends on whether your mobile uses the GSM or Next G™ network.

If you have a GSM / Next G™ mobile

To get help from police, fire or ambulance services in Australia, dial '000' or '112'. Contact can even be made if your mobile has been blocked or your security settings have been activated.

You can still attempt a normal '000'emergency call from a GSM or Next G™ mobile but if you do not have reception with your own carrier, you can dial '112' and your call will be carried by any available network if it is available.

Using the 106 Text Emergency Relay Service

- Simply dial 106, which is a toll-free number
- You will be asked if you want police (type PPP), fire (FFF) or ambulance (type AAA). Note Speak and read (or voice carry over) users just need to say 'police', 'fire' or 'ambulance' to the relay officer
- The relay officer will dial the correct service and stay on the line to relay your conversation
- As a TTY is connected to a fixed line, the emergency service can locate where you are calling from
- You will be asked to confirm your address
- The 106 service can only be dialled from a TTY, it cannot be used by:
    - an ordinary phone
    - text message (SMS) on a mobile phone, or
    - Internet relay

8.3 Satellite Phones

Fig 23 LEO and Geostationary Satellite Phones

A **satellite phone**, or **satphone** is a type of mobile phone that connects to orbiting satellites instead of Ground Towers. They provide similar functionality to mobile phones; voice, short messaging service and low-speed internet access are supported through most systems.

Depending on the architecture of a particular system, coverage may include the entire Earth, or only specific regions. Satellite phones Normally have a large retractable antenna or large dish type antennas. Some satellite phones are similar in size to a regular mobile phones were others are the size of a large case.

A fixed installation, such as one used aboard a ship, may include large, rugged, rack-mounted electronics, and a steerable microwave antenna on the mast that automatically tracks the overhead satellites. Satellite phones have notoriously poor reception indoors, though it may be possible to get a consistent signal near a window or in the top floor of a building if the roof is sufficiently thin. The phones have connectors for external antennas that can be installed in vehicles and buildings. The systems also allow for the use of repeaters, much like Normal mobile phone systems. Satellite phones may be seen at first aid posts on camp grounds were mobile phone signals are not preset or when in very remote location, Satellite phones are also carried by some specialist emergency services units

8.3.1 Satellite phone networks

8.3.1.1 Geosynchronous satellites

Some satellite phones use satellites in geostationary orbit (fixed Orbit), which are meant to remain in a fixed position in the sky. These systems can maintain near-continuous global coverage with only three or four satellites, reducing the launch costs. The satellites used for these systems are very heavy (approx. 5000 kg) and expensive to build and launch. The satellites sit at an altitude of about 35,000

kilometers (22,000 mi); a noticeable delay is present while making a phone call or using data services due to the large distance from users. The amount of bandwidth available on these systems is substantially higher than that of the Low Earth Orbit (LEO) systems making them more suited to high speed data applications like the internet, units capable of sending high power signals are also required as the distance the signal must travel is allot more than in LEO systems. Geosynchronous network hardware is often larger than LEO equipment around the size of a large case.

Another disadvantage of geostationary satellite systems is that in many areas—even where a large amount of open sky is present—the line-of-sight between the phone and the satellite is broken by obstacles such as steep hills and forest. The user will need to find an area with line-of-sight before using the phone. This is not the case with LEO services:

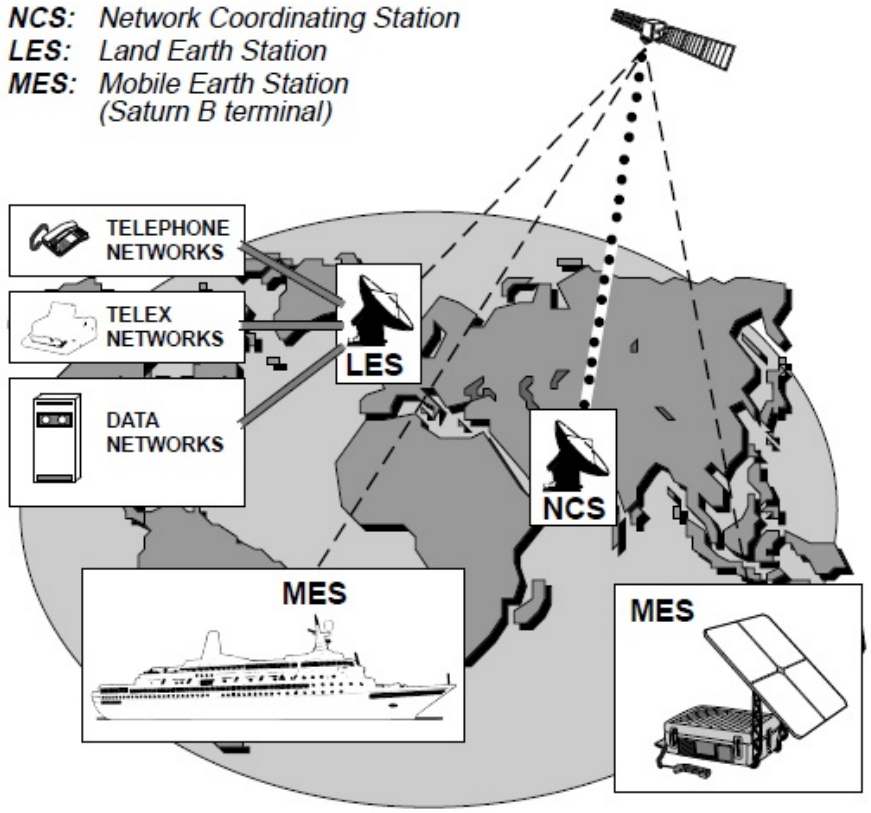


Fig 24 Geostationary Satellite Phone System

Pros	Cons
Will work any were you can see sky	Requires antenna aimed corectly at Satellite to make call
Not directly connected to Ground based infrastructure	Very High equipment cost
Fax capability	Harder to use than mobile phone
Constant Internet connection	High call costs

Location of satellites fixed	High cost low speed internet
	Signals may be blocked by mountains ect
	Large power hungry equipment
	Time delay in voice traffic

Table 13 Pros and Cons of Geostationary Satellite Phones

8.3.1.2 Low Earth orbit (LEO)

LEO telephones utilizes LEO (low Earth orbit) satellite technology. The advantages include providing worldwide wireless coverage with no gaps. LEO satellites orbit the earth in high speed, low altitude orbits with an orbital time of 70–100 minutes, an altitude of 640 to 1120 kilometers (400 to 700 miles), and provide coverage cells of about (at a 100-minute orbital period) 2800 km in radius (about 1740 mi). Since the satellites are not geosynchronous, they must fly complete orbits. At least one satellite must have line-of-sight to every coverage area at all times to guarantee coverage. Depending on the positions of both the satellite and terminal, a usable pass of an individual LEO satellite will typically last 4–15 minutes on average; thus, a constellation of satellites is required to maintain coverage

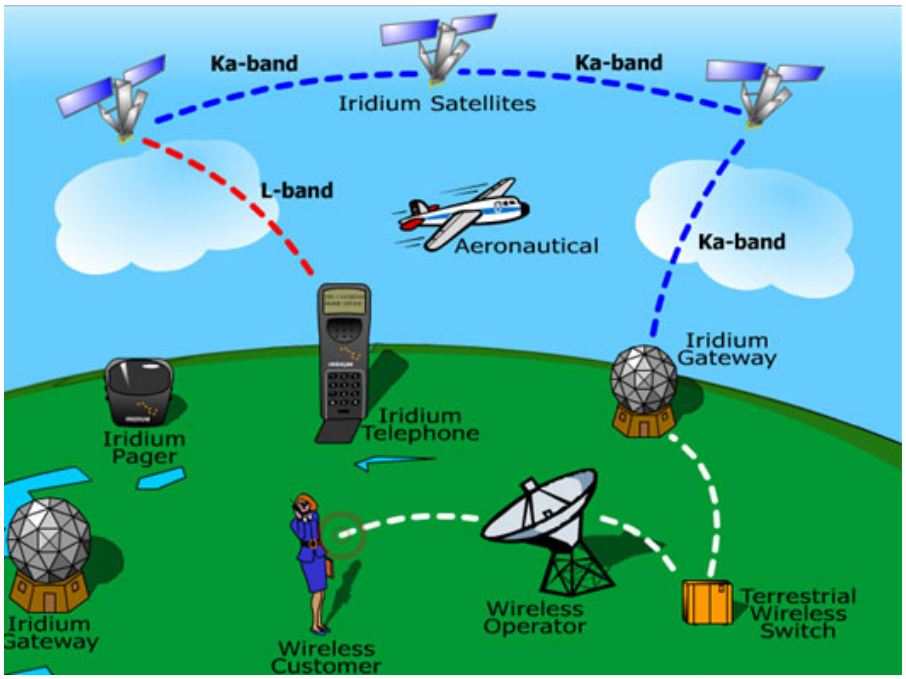


Fig 25 LEO Satellite Phone System

Pros	Cons
Portable device	Requires Satellite in view to make call
Will work any were you can see sky	High equipment cost
Not direct connected to Ground based infrastructure	Harder to use than mobile phone

Unlikely to have signal blocked	High call costs
Very small time delay for voice traffic	High cost low speed internet
	Drop outs in internet and voice traffic possible

Table 14 Pros and Cons of (LEO) Satellite Phones

8.3.2 Cost of a Satellite phone

While it is possible to obtain used handsets for the Thuraya, Iridium, and Globalstar networks for approximately US$200, the newest handsets are quite expensive. The Iridium 9505A(for LEO), released in 2001, sold in March 2010 for over $1,000 USD new. Since satellite phones are purpose-built for one particular network and cannot be switched to other networks, the price of handsets varies with network performance. If a satellite phone provider encounters trouble with its network, handset prices will fall, then increase once new satellites are launched. Similarly, handset prices will increase when calling rates are reduced.

Among the most expensive satellite phones are BGAN terminals (Most often Geostationary systems), often costing several thousand US dollars. These phones provide broadband Internet, voice and fax communications. Satellite phones are sometimes subsidised by the provider if one signs a post-paid contract but subsidies are usually only a few hundred US dollars or less.

Fig 26 Portable Geostationary system BGAN terminal or MES

8.3.2.1 Calling cost

The cost of making voice calls from a satellite phone varies from around $0.15 to $2 per minute, while calling them from landlines and regular mobile phones is more expensive. Costs for data transmissions can be much higher. Voice call Rates from landlines and mobile phones range from $3 to $14 per minute. The receiver of the call pays nothing, unless he is being called via a special reverse-charge service.

Making calls between different satellite phone networks is often similarly expensive, with calling rates of up to $15 per minute.

Calls from satellite phones to landlines are usually around $0.80 to $1.50 per minute unless special offers are used. Such promotions are usually bound to a particular geographic area where traffic is low.

Most satellite phone networks have pre-paid plans, with vouchers ranging from $100 to $5,000.

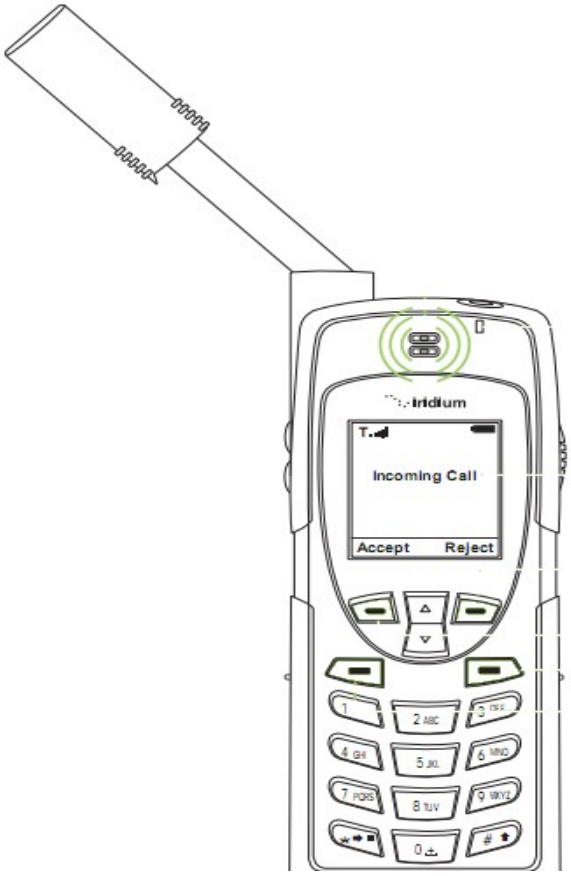


Fig 27 Iridium 9555 Satellite Phone

8.3.3 Using A Satellite Phone

Despite how a Satellite phone Looks it does not work the same as a mobile phone in most cases when you switch the phone on you have to hold off making a call until a suitable Satellite fly over head or the unit is aligned to a satellite the phones normally display 's [Searching For Network] or like until it connect with a Satellite once they do the phone will show [Register] or connected. One that is shown you can send or receive calls. But it is possible that the conversation may drop out at any time as the Satellite moves and if there is not another Satellite to pick up your signal in the case of a LEO system. It also helps if you extend the antenna when using the phone or position the antenna towards the Satellite. If you are using a LEO Satellite system it is recommended that you keep your conversations short so as to avoid drop out, and then there is the cost of the call when you make a call you must always enter the country code for the country you are calling as part of the number even if you are in it. For Australia this is +61 if your phone douse not have + you can use 0011. When receiving a call most units will show [Incoming Call] or similar if you see this extend the antenna (if using a LEO) and then press answer like you would on a normal phone

8.3.4 Tips when calling Triple Zero (000) or (112)

1. Stay Calm.
2. You will be asked if you require police, fire or ambulance. Select the service you require.
3. You will then be connected to an emergency call operator who will ask you a series of questions.
4. You will have to explain you are calling from a Satellite Phone you will be asked to provide the Town and State details of the Emergency. This ensures you are connected to the correct locality for response.
5. It is vital to ensure that the correct information is provided so that the emergency service requested can attend your situation.

It is important to remember that the questions are asked to provide you with the best and fastest service for your needs. In time-critical situations the emergency services are being dispatched while you are being questioned. Your information will continue to be updated throughout the call.

8.3.4.1 Using your Satellite Phone in an emergency

- Power on the Satellite Phone,

- Extend the antenna towards the open sky, coniform proper registration & signal strength on display,
- Dial Triple Zero (000) or 112 depending upon your service provider's instructions,
- Press the send key. Verbally report the situation and your location to the operator for assistance**. Most services do not provide enhanced emergency calling service which automatically identifies the caller location**.

Notes

9.0 Part 9 EPIRB'S and PLB'S

EPIRB'S and PLB'S

EPIRB'S (Emergency Position Indicating Radio Beacons) and PLB's (Personal Location Beacons) are a device's that when activated will transmit a signal saying that the person that is in possession of them is in grave or imminent danger

The main uses for EPIRB'S is on boat's, that go out to sea and air craft. An EPIRBS signal will tell rescue groups were you are, some EPIRBS will even activate when they are exposed to water or a large shock is detected in the case of a plain hitting the ground

In scouts the main place you will encounter an EPIRB/PLB is on a bush walk or boating trip

There are two types of EPIRB'S on the market

The first are what is the units on ships and plans commonly called a

9.1 EPIRB'S

pictured below

Fig28. EPIRB's

Pros	Cons
Can auto activate when submerged	Medium size units hard to carry in a pack
Will call For emergency assistance	Requires registration
Easy to use	High Equipment cost
Easy to obtain	Single use
Works every were	3 year sheath life
	Calls for emergency assistance only

Table 15 Pros and Cons of EPIRB's

9.2 PLB'S

(Personal Location Beacons) these devices are meant to be carried by a person, there are the type you will most likely see in Scouts, examples are pictured below

Fig29 PLB's

Pros	Cons
Are small enough to carry in a pack	Will not auto activate
Will call For emergency assistance	Requires registration
Easy to use	High Equipment cost
Easy to obtain	Single use
Works every were	3 year sheath life
	Calls for emergency assistance only

Table 16 Pros and Cons of PLB's

9.3 How they work

EPIRB'S and PLB'S uses a system called the COSPAS-SARSAT system which is a complete global search and rescue service using geostationary (satellites in a fixed orbit) and polar orbiting (North South polo orbiting) satellites. Many countries provide ground facilities known as Local User Terminals (LUTs).Polar orbiting satellites provide complete, although non-continuous, coverage of the earth (due to fact that these satellites can only view a portion of the earth at any given time) and can accurately resolve an active beacons' location. Additionally, geostationary satellites can give an immediate alerting function in many regions of the world.
The basic COSPAS-SARSAT concept is illustrated in the following diagram

Fig30. COSPAS-SARSAT

All Current beacons operate on 406 MHz and provide more accurate and reliable alert data to search and rescue agencies than the older 121.5/243 MHz systems presently being phased out. The older 121.5 MHz analogue system required that the satellite be within view of both the beacon and the LUT before it could transmit the beacons' position. This limited the coverage to an area immediately surrounding the LUT. However, the digital nature of the 406 MHz system means that the satellites are able to store the beacons' position and digital message, no matter where in the world it is received. These details are then relayed to the next LUT that comes into range, giving the 406 MHz system true global coverage.

9.4 Using a EPIRB or PLB

All EPIRB or PLB must be registered with the Australian Maritime Safety Authority Beacon Registration Section be fore you take one out, if you borrow or rent one for a trip make shore they are registered by there owner like wise if you own the device you need to register it as soon as you get it.

The full details of the Australian Maritime Safety Authority is

Beacon Registration Section, AusSAR Australian Maritime Safety Authority GPO Box 2181, Canberra City, ACT 2601. Phone: 1800 406 406 or International: +61 2 6279 5041. Fax: 1800 622 153 or International: +61 2 6230 6868. Email: ausbeacon@amsa.gov.au.

The information provided in the registration is used only for search and rescue purposes. Should the PLB or EPIRB be transferred to a new owner, as the previous owner you are obligated to inform the National Authority by email, fax, letter or telephone of the name and address of the new owner. The new owner of the beacon is also required to provide their National Authority with the information as shown on the registration form. This obligation transfers to all subsequent owners

Note: Each EPIRB or PLB has been programmed with a unique identifying code which will be transmitted by the beacon in an emergency. Registering your beacon provides the authorities with immediate access to your details when the beacon is detected. This means they will know who you are and who your emergency contacts are. In situations of accidental activation they can also immediately eliminate your beacon as an emergency situation by contacting you when activation is detected.

The signal from an EPIRB or PLB is regarded by authorities as an indication of distress and is given an appropriate response. It is the responsibility of every owner of an EPIRB or PLB to ensure that it is not activated unintentionally or in situations that do not justify its use. Most cases of accidental transmission result from poor or

inappropriate storage or failure to totally disable an old model beacon before disposal. The need to treat emergency beacons responsibly cannot be too highly emphasised.

Some EPIRB or PLB will not commence transmitting until approximately 60 seconds after activation, providing a period of audible and visual warning. If you hear a beacon beeping while it is being carried or stowed, you may still be able to deactivate it during this time period without actually transmitting a distress signal. If in doubt, report the incident to your local authorities just in case. To minimise the possibility of accidental activation, of EPIRB or PLB owners are urged to pay careful attention to the Following points:

1. Follow the self-testing procedures
2. Educate your travelling companions on how and when to correctly operate your PLB
3. Avoid stowing the EPIRB or PLB where it will be subjected to continuous direct sunlight. This could cause the beacon's internal temperature to exceed the maximum storage temperature. Long term stowage under these conditions could result in reduced battery life, poor performance or degradation of the plastics due to excessive U.V. light.
4. Do not allow children to interfere with the PLB.

9.5 Contacts for Reporting Activations

If you suspect that a PLB has been activated inadvertently, you MUST turn it off and report it immediately to the National Authority's Rescue Co-ordination Centre to prevent an unnecessary search.

9.6 Testing

It is recommended that you test the EPIRB or PLB at regular intervals to ensure it is fully functional. You should also test the beacon prior to an extended journey.

- **WARNING • DO NOT over test** – testing consumes some battery power, no more than once per month.
- **DO NOT deploy the antenna** as this will break the seal and activate the beacon to transmit a distress signal after 60 seconds.

You may test the PLB using the following procedure:

1. Remove the beacon from the carry pouch.

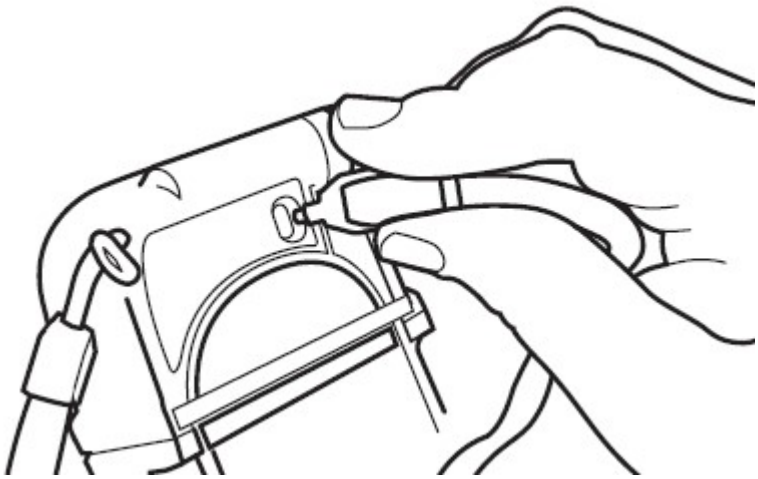


Fig31. Testing PLB

2. Use the key (attached to the lanyard) to slide the self test switch down and then release, a double beep and flash of the light will indicate the EPIRB or PLB is functioning correctly.

The standard self test procedure is more than sufficient to perform a comprehensive check of your beacon without consuming too much battery capacity. On occasions, and no more regularly than on average once a year, you may wish to perform a GPS satellite acquisition check if the device is equipped. Whereas the routine self test verifies the GPS receiver's circuitry, the full test will include the operation of the special GPS antenna as well.

1. This test consumes much more power than a standard self test so choose a test location with good visibility of the open sky above. A quick satellite acquisition means a short test, and less wasted power consumption.
2. Carry out a self test in the usual way but rather than releasing the key, continue to hold it in position. After the self test pass confirmation, both the light flash and the internal beeper will start. Count a further four flashes/beeps then immediately releases the key.
3. The EPIRB or PLB will continue to flash and beep whilst it searches for available satellites. This may continue for a number of minutes depending on the number and location of satellites present. It is not possible to abort the test once started, and note that distress signals are not radiated as part of this test.

4. _If no satellites are found after a predetermined time the repetitive flash and beep will stop. This may indicate a fault with the GPS receiver system within the EPIRB or PLB and you should contact your local service centre for advice. If the test terminates with a rapid sequence of flashes and beeps then GPS satellite acquisition and correct operation has been confirmed.

The safety seal which covers the antenna on the rear side of the beacon is designed to tear if the unit is switched on. A safety seal that is not broken serves to indicate that the beacon has never been manually activated. NEVER remove or break the seal

unless deploying the EPIRB or PLB in an emergency. If the beacon has been activated for any length of time, the batteries can no longer be guaranteed to have the capacity to operate for the minimum 24 hour period and therefore must be replaced.

EPIRB or PLB should only be activated in situations of grave and imminent danger. Deliberate misuse may well result in the unnecessary deployment of valuable Search and Rescue resources and could incur a severe penalty. Should there be an inadvertent activation it is the responsibility of the user to immediately switch the beacon off and notify the nearest RC (Rescue Coordination Centre).

9.7 Location for deployment

The EPIRB or PLB will deliver best performance where there is a clear view of the sky. Deploying the beacon within an enclosure, particularly one which is electrically conductive such as under a car roof, will reduce the signal strength and may mean that it cannot be detected by rescue satellites or overflying aircraft. If you find yourself In a narrow valley or ravine, you can greatly increase the chances of your beacon signal being detected by placing it on higher ground.

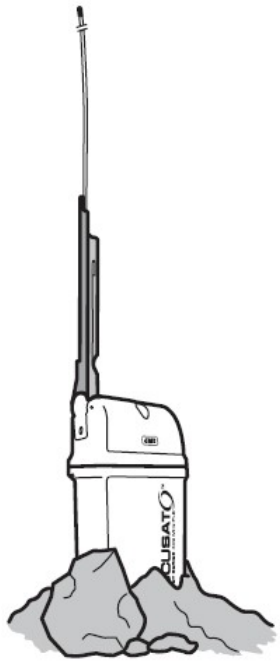


Fig32. Deployed Beacon

Deploy the beacon in an upright position with the wire antenna vertical and well clear of any surrounding obstructions such as trees or rocks. If adverse weather conditions exist, use any available props around the base of the beacon to ensure it will not topple over. Where on-person operation is unavoidable, choose an elevated position that also achieves good local clearance around the vertical wire antenna. Once the beacon has been activated, leave it switched on. A continuous signal is needed for Rescue Authorities to determine your location.

9.8 Activating the Beacon

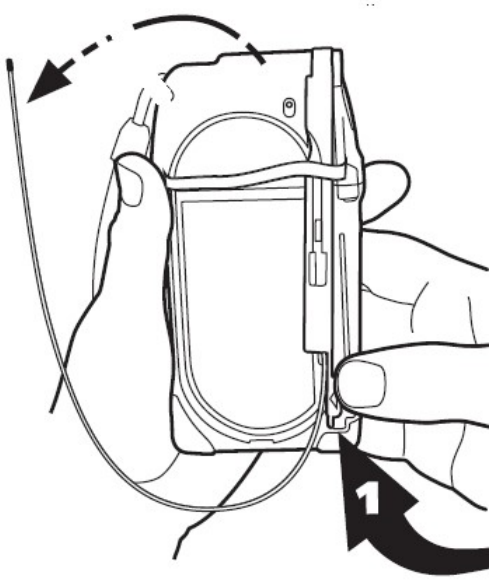


Fig33. Part 1 activating Beacon

1. _Hold firmly and release the antenna by pushing the black arm (where marked by a yellow triangle) inwards then upwards the antenna will quickly uncoil and extend.

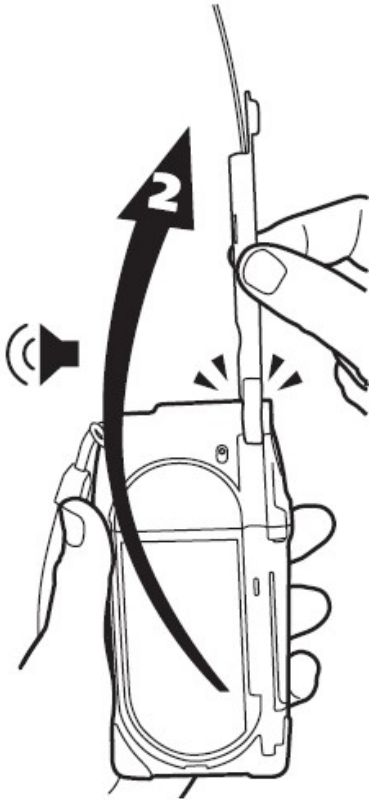


Fig34. Part 2 Activating Beacon

2. Swing the antenna fully upwards 180 degrees clockwise, breaking the safety seal. The antenna arm will click into place. The PLB is now active.
The EPIRB or PLB will 'beep' and pulse the inbuilt light 20-21 times per minute.
The EPIRB or PLB will emit a rapid series of 'beeps' and light flashes for a period of 6 seconds, indicating to the user that it has acquired a GPS position fix and is relaying this (if fitted) position along with the distress signal and the unique personal identifier to the COSPAS-SARSAT satellite system. After 6 seconds the EPIRB or PLB will continue to 'beep' and pulse the light 20-21 times per minute.

9.9 Deactivating the Beacon

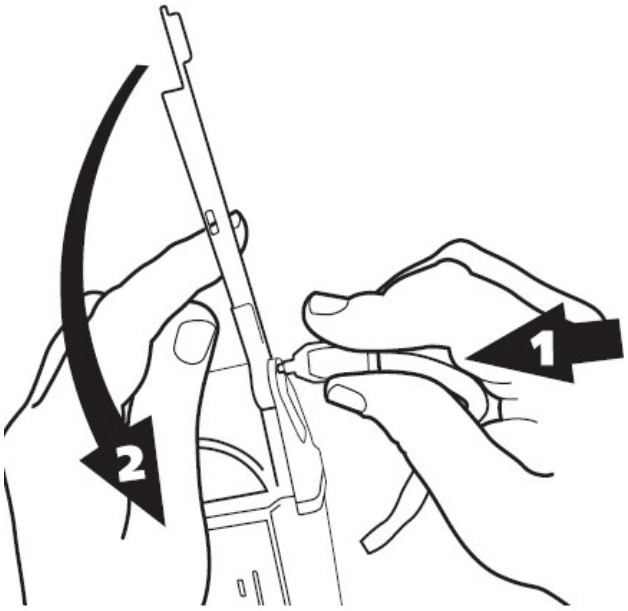


Fig35. Deactivating Beacon

1. Using the key (attached to the lanyard) depress the antenna latch.
2. Swing the antenna fully down 180 degrees anticlockwise and latch.
3. Re-wrap antenna around the groove on unit back. The EPIRB or PLB is now turned off and the audio and visual alerts will cease.

Special precautions must be taken when finally disposing of your beacon at the end of its useful life. Legislation may determine the specific requirements which apply to you. In the first instance, contact your National Authority for advice.

Notes

10.0 Part 10 GPS

10.1 The Global Positioning System

A GPS receiver can tell you where you are in the world, anywhere in the world, 24 hours a day, using signals transmitter from satellites.

The knowledge of where you are is a powerful tool indeed. Imagine being able to locate a favourite fishing hole or campsite.

The Global Positioning System (GPS) was designed for the US government to provide a personal positioning system for both military and civilian users. With a hand-held GPS receiver, you can determine your position, bearing, and speed, record waypoints and routes, and use a computer interface to plot your course on a map or to transmit your location to others.

Now that hand-held GPS receivers are becoming affordable to the average person, more and more people are taking advantage of this powerful technology. How does GPS work? What do you need to know about GPS to intelligently buy a receiver?

10.2 How It Works—The Short Story

The Global Positioning System is comprised of 28 Earth-orbiting satellites (Figure 32), each at an altitude of 12,500 miles and moving in orbits inclined 55° relative to the equator. Each satellite orbits the Earth about once every 12 hours. These GPS satellites are essentially orbiting beacon stations transmitting on 1575.42 MHz.

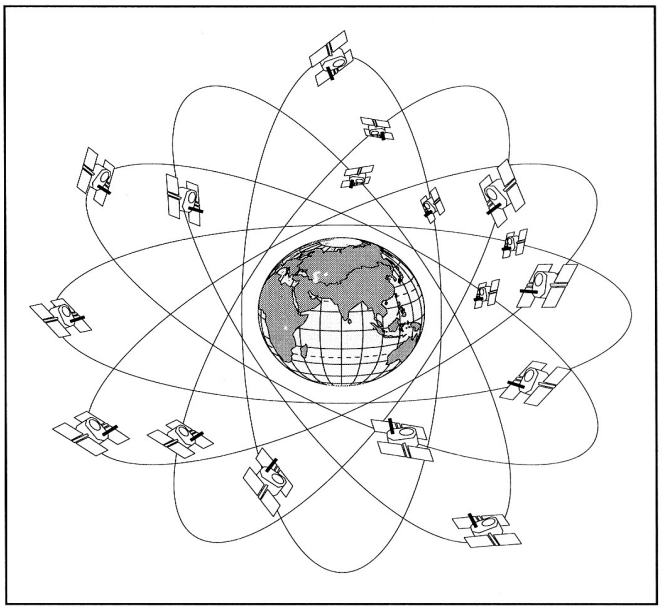


Fig36.Orbiting Satellites

Fig36.Orbiting Satellites

The GPS satellite constellation is a technological marvel, not only because of the satellite complexity itself, but also because of the difficulty of operating such a constellation and keeping the satellites in precisely defined orbits. Because the satellites must transmit very accurate time for the navigation technique to work, each satellite carries highly accurate (and very expensive) cesium- or rubidium-based oscillators as precise time and frequency references.

Down on terra firma, a GPS receiver must pick up beacons from at least four GPS satellites to determine your location. As small and attractive as it may be, there is nothing "ordinary" about this device. It's a sensitive spread-spectrum receiver, an ultra-accurate clock and a sophisticated mathematical calculator.

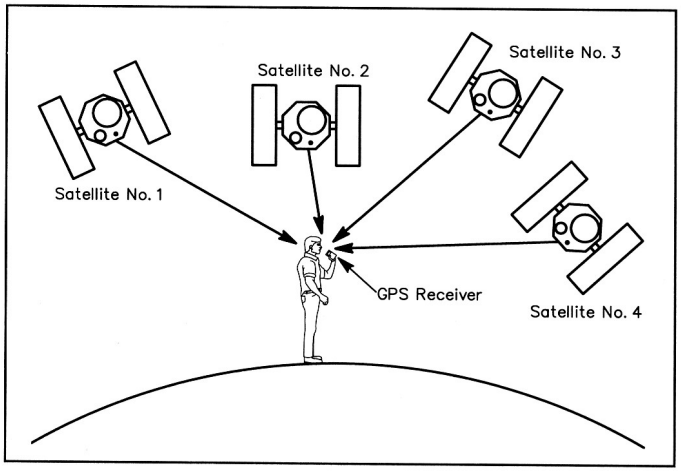
Once the GPS receiver is dancing in step with the transmitter, so to speak, the receiver grabs the data it needs from the satellite's signal. To calculate the distance to the bird, the GPS receiver must be able to determine the time difference between the moment the data was sent and the moment it was received—the total time required for the signal to travel between the satellite and the receiver. Since the signal moves at the speed of light (300,000 km/sec) the receiver can easily calculate the distance based on the travel time

Distance (km) = 300,000 (km/sec) x travel time (sec)

The transmission time is sent by the satellite itself (in what is known as a nav message) and the reception time is determined by the receiver's internal clock. For this technique to work with the kind of accuracy we expect, however, the GPS receiver needs a clock as accurate as the satellite clocks. This would require a very expensive clock indeed! To keep GPS receivers affordable for everyone, a fourth

unknown quantity, the clock offset, is calculated from the range measurements made by the receiver.

The clock offset, when combined with the super-accurate time markers transmitted by the GPS satellites, permits the receiver to display the time to less than one microsecond error, and to perform highly precise ranging. By combining the measured distances between you and the various satellites, the receiver can pinpoint your location anywhere on the globe (see Figure 33).



- Fig 37 Location on the globe using 4 Satellites

The instant you switch on your GPS receiver, it begins scanning for signals from satellites. Within seconds it acquires the signal from the first satellite (satellite number 1 in this example) and calculates the distance between the satellite and you. It does the same to satellite number 2 soon thereafter. Now it has enough information to calculate a rough latitude and longitude, but more data is still needed. Calculating the distance to satellite number 3 gives the Receiver enough information to determine your altitude above sea level. The range calculations to a fourth satellite (satellite number 4) are then added, to determine the clock offset.

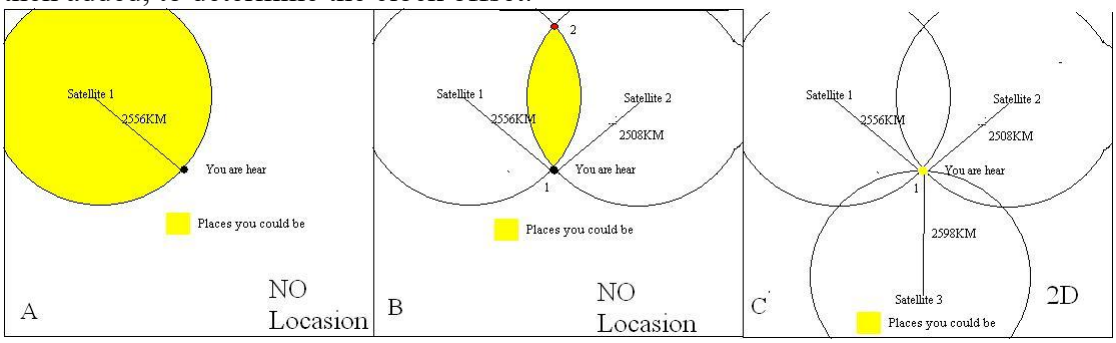


Fig38 2d Navigation

At a given time, anywhere from five to ten satellites may be in view, depending on the time of day and your location. How does the receiver know which satellites are in

view? It keeps an internal almanac of all the GPS satellites, in memory. This almanac is updated continuously via the nav message when the receiver is operating.

10.3 Waypoints

Way points or Land marks are a set of Coordinates sorted in the GPS's memory they can be named give a picture, they are often used to mark a fishing spot, were you left the car the site of the camp pretty much what ever you whish. It is possible to get the GPS to glide you back to the same spot, in the case of a Vehicle GPS's way points are things like speed cameras, red light cameras, street addresses, school zones. With Vehicle GPS's all the way point stuff is hidden in the software but it is there nun the less

10.4 2D Navigation

2D navigation is the name given to the most basic form of GPS Navigation this will give you the Latitude and longitude and time but the height above sea level is a estimation and should not be trusted, a 2D position is achieved when you have 4 Satellite locked in with good signal. **If you have less than 4 Satellites your position is a estimate and should not be used**

10.5 3D Navigation

3D Navigation is the best navigation fix you can get on a standard GPS, this will give you the Latitude, longitude, time and height above sea level, to achieve this you must have a minimum of 5 Satellites locked in with good signal

10.6 The Outdoor GPS

Fig 39 Magellan 315 (C) GPS (left) & Garman eTrex H (C) (Right)

Above is pictured a Magellan 315 GPS and a Garman eTrex H, both are examples of a typical outdoor GPS there are many different designs and makes but all unit work roughly the same the only differences are the naming and layout of screens and such, a Outdoor GPS dose not show roads street addresses but can display compass

bearings latitude and longitudes and some modals can even show Topographical information (Topographic Maps).

It is possible that you can get a unit that will do Vehicle and Outdoor as well as Marine Navigation but the more complicated you go the higher the price tag

A Outdoor GPS is designed for Someone who understands mapping and Compass's it is not something every one can use right off the sheath, it is recommended that you familiarise you sleuth with your GPS well before you take it on a trip.

In an emergency you can give the Emergency services your position as a WGS84 or a latitude and longitude make shore they understand which system you are using. They may ask for cross street give them one if you can.

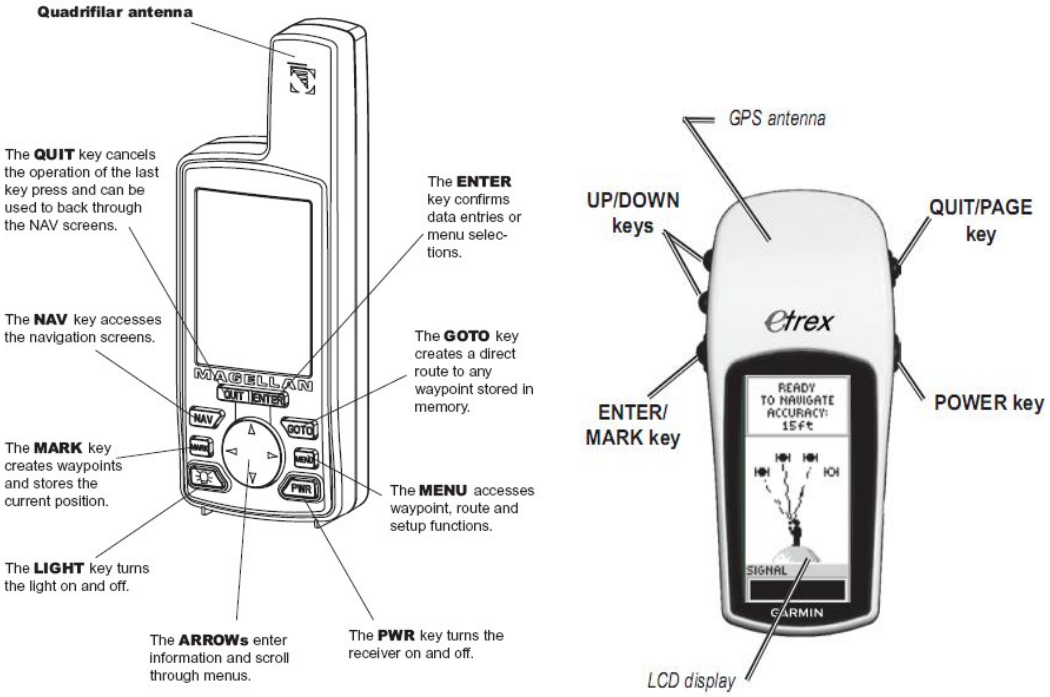


Fig40. Magellan 315 (C) GPS (Right) and Garman eTrex H (C) (left)

10.6.1 Units of Navigation

Name	Land	Marine
Speed	SPD	SOG
Bearing	BRG	BRG
Distance	DST	DST
Heading	HDG	COG
Velocity Made Good	VMG	VMG
Course To Steer	CTS	CTS
Estimated Time of Arrival	ETA	ETA
Time To Go	TTG	ETE

Cross Track Error	XTE	XTE
Recorded Position	Landmark	Waypoint
Units of Measure	KM/KPH or MILES/MPH	KM/KPH or NM/KNOTS

Table 17 units of Navigation

Speed:
Speed is your current speed in KM or Miles over ground or Water if you stop the speed will drop to 0

Bearing:
Bearing relates directly to the bearing you are on just like if you were using a compass. **Note, the Bearing is only valid if you are moving unless your GPS has a Flux gate compass installed always assume it douse not have one**

Heading: The Bearing you need to be on to get to your destination

Velocity Made Good: Average Speed

Course to steer: The Course you need to be on to get to your destination (Like Heading)

Estimated Time of Arrival: The time you will arrive at your Destination if you maintain your current speed and Heading

Time to Go: the Age-old question how long until we get there

Cross Track Error: how far you are off Track

WGS84: A worldwide Coordinate system used on most new Australian topographic maps

Pros	Cons
Small and light	Can use a lot of power from batteries
Will give you Lat and long as well as compass and WSG84 functions	High Equipment cost
Easy to obtain	Can be hard to use
Work every were you can see a good amount of open sky	Must be moving to get compass to work (unless unit has flux gate Compass)

Table 18 Pros and Cons of Outdoor GPS

10.6.2 GPS Screens

10.6.3 The Status Screen

The Status screen gives us an idea of the number as well as the positions of the available satellites and the power and type of navigation system being used. All GPS's have some form of this screen

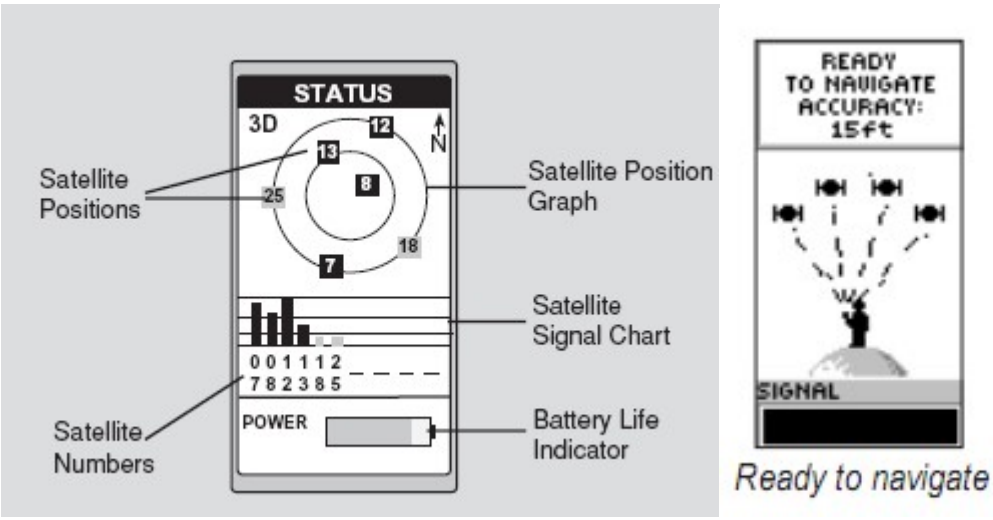


Fig41. Status Screen of the Magellan 315 (C) GPS (Right) and Garman eTrex H (C) (left)

Satellite Positions: Where the satellite is located relative to your position. You are always in the centre of the inner ring.

Satellite Numbers: Identifies the satellite shown on the chart and on the Satellite Position Graph.

Battery Life Indicator: Shows approximate remaining battery life for batteries in the receiver.

Satellite Signal: Chart Displays satellite signal strengths shown in grey for weak signals and black for strong signal on a black and white screen. When the receiver first tracks a satellite, the strength bar will not be solid black until enough data is collected. This takes about 30 seconds if uninterrupted signal.

Graph: The two circles indicate satellite elevation, the outer circle represents the horizon and the inner circle represents 45 degrees from the horizon. The centre of The circle is 90 degrees.

10.6.4 Position Screen

The Position screen shows the current location of the unit as well as Speed, time, date and lots of other useful information, all Outdoor GPS have this ability

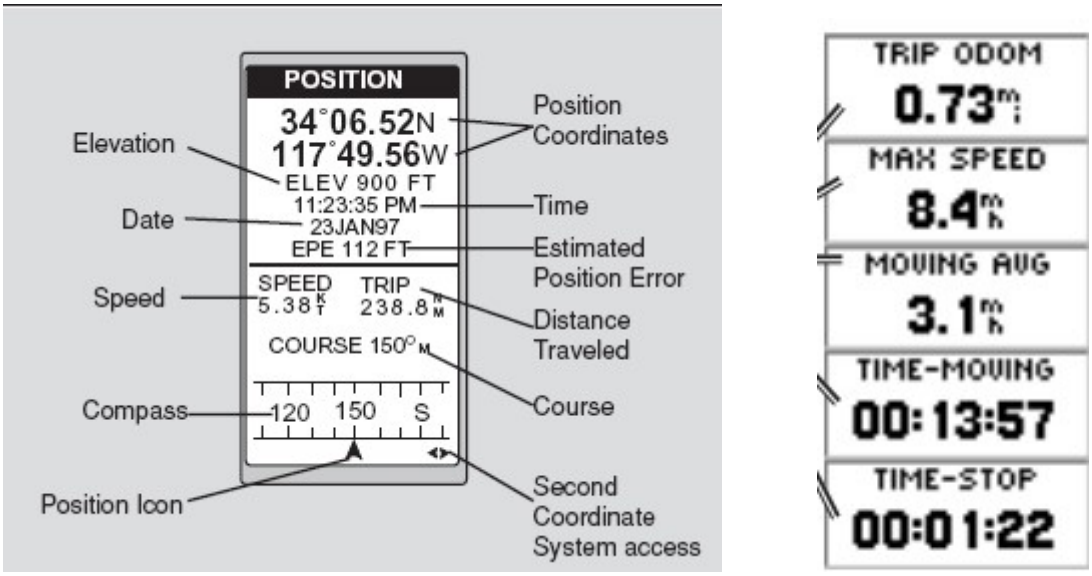


Fig42. Position Screen of the Magellan 315 (C) GPS (Right) and Garman eTrex H (C) (Left)

Position Icon: Your current position on the compass. Acts like the north on a compass used to take a bearing. **(Note you must be moving)** if you do not have a flux gate compass installed

Estimated Position Error: Displays the accuracy of the Position, this can be some time up to 100 meters or just 1, this roughly means that the Position is with in 1 meter if the Estimated Position error is 1

Second Coordinate System: This is a menu that is normally set by the user it is recommended that all GPS second Coordinate systems be set to WGS84 which is the world wide Coordinate system, on modem maps the coordinates will mach up.

10.6.5 Map Screen

The map screen is used to show us were we have been and how close you are to waypoints and such, this can also sometimes show topographic data or road maps as well

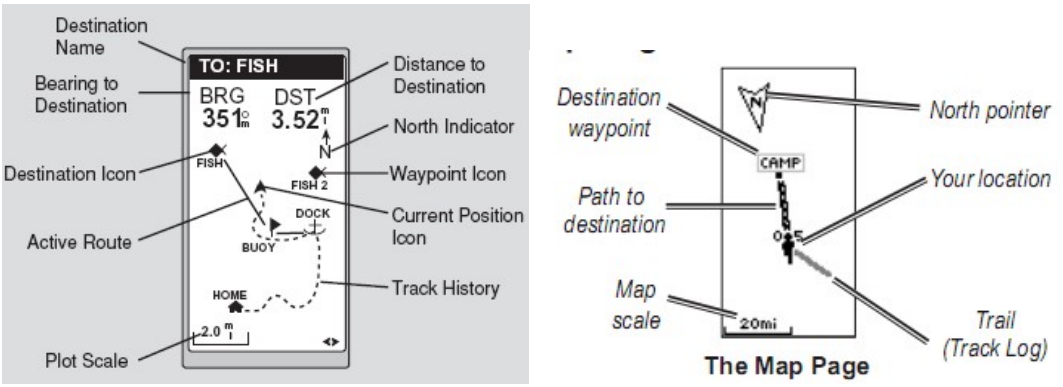


Fig43 Map Screen Magellan 315 (C) (Left) GPS and Garman eTrex H (C) (Right)

Active Route: Indicates the direction required to reach your destination. Plot Scale Can be changed

10.6.6 Pointer Screen

The pointer screen helps guide you to a destination. When navigating towards a destination. The pointer screen shows the name, the distance, Time to go and a direction arrow in the compass ring.

The compass ring reflects your heading (direction of movement). To navigate, walk in the direction the arrow is pointing. When the arrow is pointing at the moving direction line or steering indicator your destination is ahead

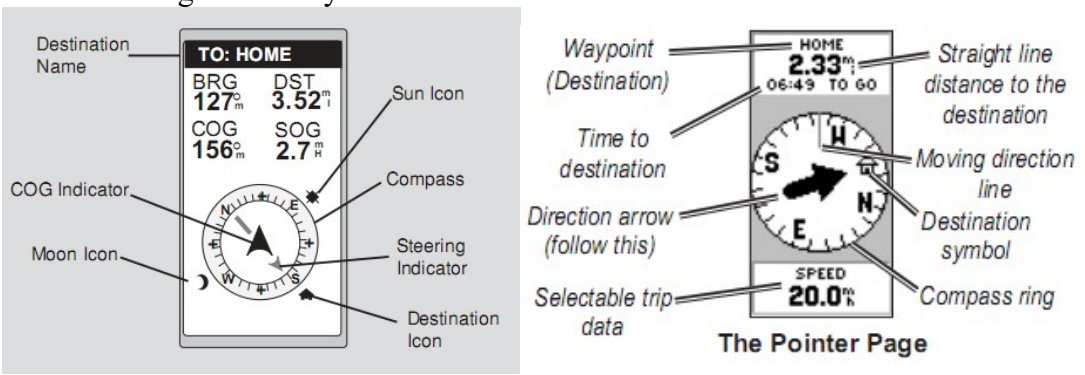


Fig44 Pointer Screen Magellan 315 (C) GPS and Garman eTrex H (C)

10.7 The Vehicle GPS

Fig45. Vehicle GPS

Above is pictured a Tom, Tom road GPS, there are many brands and types but that all have the same things in common

1. They all have a GPS receiver that supply's information to the computer in the unit
2. They all have a status screen just like a navigation GPS
3. You can get the Latitude and longitude of the unit

Road GPS are a very useful tool when on the road they can warn you of speed cameras tell you were to turn and guide you home or to a friends place, the important thing to remember is that they are designed for the road if you take them hiking they are useless unless you are standing on a road it knows about it can not guide you. It is also very important to keep them up to date, road conditions can change, things like speed limits, location and speed cameras no left or right turns and one-way streets do change from time to time.

To get the Latitude and longitude off a Car GPS you often need to go into a status or set up menu from the main screen, There you will find some thing very much like the status screen from the outdoor GPS with the Latitude and longitude near it. In an emergency a Road GPS can give you the nearest Cross Street and your location to give to the Emergency services, you can also give them your Latitude and longitude but they prefer address and cross street

Pros	Cons
Show roads and speed limits	Can be large
Gives useful driving information such as speed cameras/black spots	High Equipment Cost
Easy to obtain	Latitude and longitude are hidden behind menus,

	no WSG84 support
Work every were you can see a good amount of open sky	Only shows road information
Easy to use	

Table 19 Pros and Cons of Vehicle GPS

10.8 The Marine GPS

Marine GPS's are very similar to a Outdoor GPS the only difference is that it is based around the water, it shows things like docks shipping lanes and navigation markers. You can place your own way points for fishing spots and so on as well, there is usually very little data on land based locations on the units, they also tend to give you Marine units of measurement such as the Knot instead of Km/h

Fig 46 Marine GPS

Pros	Cons
Show River and speed limits	Can be large
Gives useful navigasion information such as sand bars and other hazards to shipping	High Equipment Cost
Easy to obtain	Only shows marine information
Work every were you can see a good amount of open sky	Marine units shown
Easy to use	

Table 20 Pros and Cons of Marine GPS

10.9 Activity idea: GPS Orienting

You and your group each take turns following a compass barring and a waypoint to a number of stations. Right down the Instructions in the space below

Notes

11.0 Part 11 Trackers

11.1 Spot:

Spot Trackers are a Small Portable device that can be used as a emergency Beacon and a Tracking transmitter, the Spot Trackers are becoming more popular with 4x4's and Bush walkers, it is possible that they may become more prevalent in scouts as well.

11.1.1 How it works:

The spot Tracker receives a Signal from the GPS system and then uses it as input for its message system, the Spots can send a number of massages back up to space to a commercial satellite system which is then send to earth receiving stations were the data is processed because of this the spot dose not require a Phone signal to send massages the real advantages of the SPOT's is that you can send real time tracking information to a Google maps web page and you can send Text/email message to nominated phone numbers saying you are ok or a custom message along with a call for assistance and a emergency button. The down side of all this is that it costs an yearly subscription fee to keep the services running on the unit.

11.1.2 SOS

Emergency assistance request sent with your GPS location to Satellites every 5 min until batteries die or until cancelled International Emergency Response alerts the appropriate agencies worldwide – for example contacting 000

IMPORTANT NOTE:
Even if SPOT cannot acquire its location from the GPS network it will still attempt to send a distress signal – without exact location – which will still notify your contacts of the signal and emergency services and continue to monitor the network for further messages.

11.1.3 Help

Requests help from friends and family every 5 min for 1 hour. Up to 10 contacts via SMS & email

HOW IT WORKS:
Once activated, SPOT acquires your location from the GPS network and routes it along with the HELP message through the SPOT satellite network every five minutes

for one hour or until cancelled. Your contacts will receive an SMS text message including coordinates, or an email with a link to Google Maps™ showing your location.

IMPORTANT NOTE:
Even if SPOT cannot acquire its location from the GPS network it will still attempt to send a HELP message – without exact location – to your personal contacts.

11.1.4 Check-in/OK 

Sends a pre-defined message allowing your friends and family know that all is OK along with your GPS location. With a push of a button a message is sent via email or SMS to up to 10 pre-determined contacts and your waypoint is stored in your SPOT account for later reference. Your stored waypoints can be easily integrated into a SPOT Shared Page or SPOT Adventure account.

HOW IT WORKS:
Once you have activated your SPOT Messenger and set up your account, you can change your contacts and customize your message at any time. When you push the Check-in/OK button, you send one pre-programmed message to your contacts. Your contacts will receive an SMS text message including coordinates, or an email with a link to Google Maps™ showing your location

11.1.5 Track Progress 

This feature allows you to send and save your location and allow contacts to track your progress in near real time using Google Maps. With your SPOT account you have the ability to set up a SPOT Shared Page which allows you to show your SPOT GPS locations to others on a Google Map. Additional service required which cost extra Per year

HOW IT WORKS:
Once activated, SPOT acquires and sends your GPS coordinates to your SPOT account automatically every 10 minutes for 24 hours or until cancelled. SPOT tracking must be reengaged to continue. Creating a SPOT Shared Page allows you to share your GPS route with your friends and family easily in near real time on the web through a personal link. You can make your Shared Page private or public. Your choice! Just share that url with your friends and family and they can easily track your adventures. You can also link your SPOT Messenger to SPOT Adventures, a social portal, where you can set up a profile and blog with others sharing their SPOT adventures.

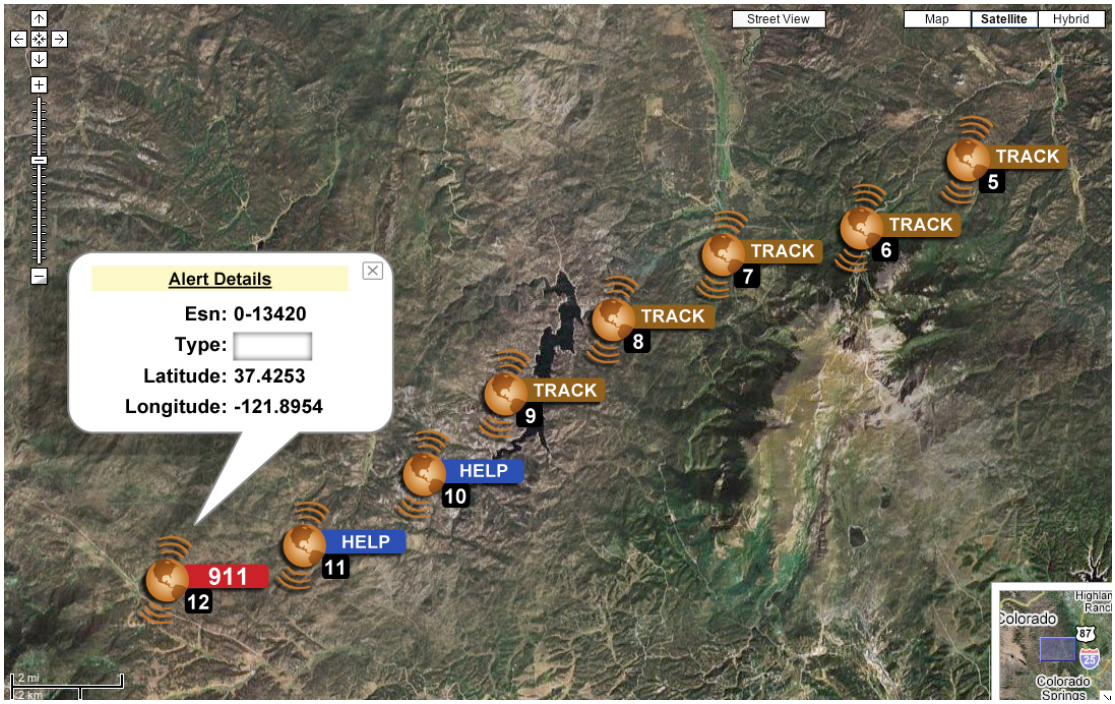


Fig 47 SPOT Sending emergency help

11.1.6 Type and Send

Use SPOT Connect to send custom email and text messages via satellites to your contacts. Create up to 41 character SOS, Help and Check-in/OK messages. Messages will be sent directly to the contact groups you select via email or SMS. You can even post custom messages on Twitter and Facebook. If you encounter problems, you can send custom SOS messages describing your situation, with your GPS position included.

11.1.7 Custom Massage

This feature allows you to let your friends and family receive a custom message along with your GPS location with a push of a button. Use this feature as a secondary OK message or point of interest marker

The Custom Message functions exactly like your Check-in/OK message You can also have access to your waypoints in your SPOT account so you can review your route at a later date. Or link your SPOT account to SPOT Adventures and save a map of your adventures using your SPOT waypoints, and enhance the story with photos and a blog.

11.1.8 Spot Hardware

Spot Personal Tracker

Fig 48 Spot Personal Tracker

Most Basic of all Spot trackers has 

Functions runs on 3x AAA Batteries run time 3 days. This unit is good for a hike if you do not require tracking

Pros	Cons
Gives Emergency GPS location and calls for help	Only reports is location when a button is pushed
Can call for non emergency help	High Equipment Cost
Can send ok message	Requires yearly registration
Work every were you can see a good amount of open sky	
Easy to use	

Table 21 Pros and Cons of Spot Personal Tracker

SPOT Satellite GPS Messenger

Fig 49 Spot Satellite GPS Messenger

Middle Range Spot tracker have 

Functions runs on 3x AAA Batteries run time 3 days. This unit is good for a hike if you do require tracking and waypoint marking

Pros	Cons
Gives Emergency GPS location and calls for help	High Equipment Cost
Can call for non emergency help	Requires yearly registration
Can send ok message	Have to pay extra for tracking
Work every were you can see a good amount of open sky	Messages cost if sent to a phone (except Emergency)
Easy to use	
Can real time track	
Can save way points	

Table 22 Pros and Cons of Spot Satellite Tracker

SPOT Connect

Fig 50 Spot Connect

Top of the range Spot tracker have 

Functions runs on 2x AA Batteries run time 3 days. This unit is requires a smart phone with blue tooth pared with it to allow all functions apart from SOS

Pros	Cons
Gives Emergency GPS location and calls for help	High Equipment Cost

Can call for non emergency help	Requires yearly registration
Can send ok message	Have to pay extra for tracking
Work every were you can see a good amount of open sky	Smart phone required for all functions except emergency
Can real time track	Messages cost if sent to a phone (except Emergency)
Can send custom messages from a smart phone	

Table 23 Pros and Cons of Spot Connect

11.2 GPS Tracker

Fig 51 GPS Tracker

GPS Tracker are a device that can be used to monitor a person or asset, applications for the unit are as follows

1. Rental Equipment/ Fleet management
2. Protection of major equipment from theft
3. Protection of children, Elderly , Pets
4. Personal management
5. Covert tracking

GPS Trackers relay on the mobile phone network to send the data back to a nominated number, the problem with this is as soon as the unit is out of coverage it will not work, unlike the spot. GPS Trackers have a number of systems which makes them very versatile.

11.2.1 Real time tracking

Real time Tracking is a system that allows a nominated mobile number to call the unit and request a GPS location. All of this is done without the unit having to be touched

11.2.2 Auto Track

Auto tracking works like Real time Tracking only the unit will automatically send a SMS to a nominated mobile number with all the location data on a pre programmed interval.

11.2.3 Voice Surveillance

It is possible to get the unit to send the sound from its on board microphone to your mobile so that you can lessen to a conversations, this is not regally used for scout activities

11.2.4 Geo Fence

Geo Fence is a system that sends a SMS to a nominated mobile number if the unit steps outside a nominated area, this is a good way of keeping an eye on equipment that may be stolen, you could set it up so that if it left your grounds it sends you a SMS so you know it has been stolen, it could also be used as a way of knowing when someone has left the site and you know that they will no longer be able to help out

11.2.5 Movement Alert

Like Geo Fencing this system will send a SMS if it steps outside a preset range but unlike with Geo Fencing this distance is normally much smaller.

11.2.6 Speeding Alarm

This system sends a SMS with a pre set speed is exceeded

11.2.7 SOS Button

If the SOS button is pressed for longer than 3 seconds a Help message is send with the GPS location to all authorised numbers and is resent every 3 minuets until one of the mobiles call it

11.2.8 Goggle Maps and SMS

The SMS will be Received in following format: Lat 46.5110980 long: 6.49999560 speed: 043.0 20/01/10 13:42 bat:F imei 32483234343
Lat = Latitude // Long = longitude // speed = speed in km/hr // date // time // Bat F = full, L = low / signal F = full, L = low
Got to http://maps.google.com 1st enter “lat” 2nd ender “long” data (the other data such as speed are irrelevant for tracking

Pros	Cons
GPS location	Requires a Sim card
Low equipment Cost	Costs each time it send a massage
Can be used as an anti theft device	Needs mobile phone signals to work
Allows real time asset management	Help SMS's go to nominated numbers not 000 or 112
Can request Help	

Table 24 Pros and Cons of GPS Tracker

Notes

12.0 Part 12 Extreme Remote Communications

In some cases a location is so remote that even UHF and VHF radios can not reach another user, places like these included but are not limited to deserts, and vast areas of bush, the basic problem with these areas is there is no one around for 100's of km's all around VHF and UHF signal cannot reliably cover that distance, in this situation you could use a satellite phone/BGAN terminal or a HF radio, Australia has a proud history of remote communications using HF radio, most HF radios are large and bulky and normally mounted in a vehicle making them hard to transport, currently there are a number of systems available.

12.1 Base station services

12.1.1 Sellcall:

Sellcall is a system that operates like a telephone; the radio is programmed with its own unique Selcall identification number in the case of HF services it is also your call sign. If this number is called by another radio your radio will beep to alert you.

If you do not wish to hear any other activity while waiting on a channel, you can activate a quiet mode; the radio will then remain quiet to all incoming signals until your Selcall number is called this system can be used as a paging system or a way minimise traffic on a channel or to ping a base station

12.1.2 Beacon Call:

Beacon Calls are used on to test if a radio path to the station is open HF radio can fade in and out very quickly and it is important to make shore that a reliable communications path is available. When a Beacon call is used a small bit of data is sent over the air to the base station and if received the base will automatically respond with a tone, this then tells you that you have a reliable communications link at the current time and you may now make a voice or telephone call to that base, if you do not hear the tone then there is no link so try another frequency of base

12.1.3 Voice Calls:

Voice calls are made by putting in the Sell call number or call sign of the station or base you wish to talk with and hitting send, this will send a small data signal over the air and if the station you are wishing to contact is in range their radio will alarm and send a tone back to you to say the signal has gone throw. The person on the other end if they can will then call to you using their voice and you can have a chat, the other person will know who called them because your Sell cal number / Call sign will be shown on the screen

12.1.4 Telephone calls

Most HF networks provide the ability to connect to the standard telephone system over the HF radio, note that is system is not securer and anyone with a HF radio can lessen in to the conversations, a phone call can only be carried by a base station by sending what is called a TEL call with is a sellcal number followed by a standard phone number, the link is only one way at a time so only one person can talk at a time also on compression of the call the user must hang-up the phone at the base by sending a disconnect Sellcal number. Phone calls are normally changed to your account with the network owners at a rate per minette.

12.1.5 Emergency Call

All HF networks have the ability for emergency calls, almost all HF radios have a Emergency or alarm button on them. Basically to operate chose a channel and hit the button, a digital signal will be transmitted and any base station in range will pick it up and send a tone back saying it got there. In the base station the operator will be immediately alerted and will call back to you using voice to ask the details of the emergency, pleases note doing this is the same as calling 000, if you do not get a tone back change the channel and try again.

12.1.6 Skids

Skids are meeting of radio users on a sated channel at a sated time to check in things like locations, welfare and to pass any non critical messages to the users, all bases host a skid at some time

12.2 HF Channels

All HF Services have a number of frequency's for the users to chose from this is very important as depending on time of day and wether the range can change dramatically on different HF frequency's. The basic rule of thumb is the higher the sun in the sky the higher the frequency you need to use to achieve communication over distance. At night signals travel longer distances were at mid day the signals do not go as far. Working out which channel to use where and when is more art than science and takes allot of practise and Esperance.

12.3 HF radio Networks

12.3.1 Radtel

Radtel is a Commercial radio network consisting of 9 HF frequency's that subscribers can use to communicate with other Radtel users or base stations throw out Australia. Each base station provides a number of services to users of the system Radtell also provides Location logging services which means that if you do not log in each skid they will send out the emergency services to find you. To use the Radtel system you must apply to the network operators for a permit to operate on the network, failure to do so is an offence. Each user is given a call sign in the form of a 4 digit number that indentifies them on the net work.

12.3.2 HF OZ

HF OZ is a Commercial radio network consisting of 15 HF frequency's that subscribers can use to communicate with other HF OZ users or base stations throw out Australia HF OZ also provides for a fee Email and GPS real time tracking over the network. Each base station provides a number of services to users of the system. To use the HF OZ system you must apply to the network operators for a permit to operate on the network, failure to do so is an offence. Each user is given a call sign in the form of a 4 digit number that indentifies them on the net work.

12.3.3 VKS737

VKS737 is Commercial radio network run by the Australian 4WD Club consisting of 7 HF frequencies's that subscribers can use to communicate with other VKS737 users or base stations throw out Australia. Each base station provides a number of services to users of the system the main one for VKS737 is a link between the Bases and The royal flying doctors service (RDFS) . To use the VKS737 system you must apply to the network operators for a permit to operate on the network, failure to do so is an offence. Each user is given a call sign in the form of a 4 digit number that indentifies them on the net work.

12.3.4 Royal flying doctors service (RDFS)

The RDFS is a public service provide by ACMA for the safety of people in remote area the RDFS do not use Sellcal as much as other networks and do not provide telephone or skids on their base stations, they are emergency only network, To use the RDFS system you must apply to ACMA for a Licence to operate on the network, failure to do so is an offence. Each user is given a call sign in the form of a VZXNNN (X is a letter and N a number 0-9) number that indentifies them on the net work.

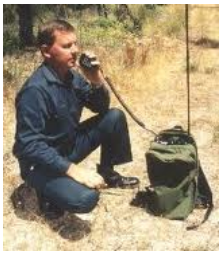
12.4 HF Vehicle Equipment

Most HF radio Equipment is Vehicle mounted due to is size, most HF antennas are also very large and hard to handle. To add to this problem most HF radios requires a large power supply to run them, in some cases a user can install a Corse Patch unit that will link the HF radio to a smaller UHF or VHF unit in the Vehicle the user can the n carry a portable radio with them the only problem with this is that the user must be in VHF or UHF range of the Vehicle to use the HF Radio

Pros	Cons
Australian wide coverage	High equipment cost
Monitored emergency channels	Large antennas
High Transmit power	Requires a licence to use
Connection to phone system	Large equipment
	High power demand

Table 25 Pros and Cons of Vehicle HF equipment

12.5 HF Man Pack Equipment



Man pack Equipment is a HF radio mounted in a backpack they often cay their own power supply antenna and all accessory's this type of unit is used allot by emergency services and military in remote areas. A Man pack does not have the same coverage or power of Vehicle unit as they often run lower power levels and have heavily loaded Antennas which result in deceased performance. Man packs also do not have a long operational life due to limitations of battery size, some units have winders to provide a recharge in the felid from turning the handle as an option. Man packs can be very useful at times as they do allow the user to transport a HF radio to an extremely remote location, they are a trade off between being portable and performance. I have seen them deployed from helicopters in bush land, due to the batteries they are also very heavy it is common for them to come in at 5 to 10KG per unit which dose not seem much but when you add water, a tent cloths food to the pack you can get up to 20KG very fast. I can say from Esperance that lugging one around is taxing

Pros	Cons
Monitored emergency channels	Very High equipment cost
Connection to phone system	Large antennas
Portable unit	Requires a licence to use
	Limited coverage

Table 26 Man pack pros and cons

12.5 Emergency Situations

1. Stay Calm.
2. Press Alarm/Emergency call or Call “Mayday, Pan Pan , Emergency” with your voice
3. Someone will respond most likely a base station, Respond with the nature of the incident, exact location and other information. The Monitor will ask you for the information that he/she needs in order to notify the required services.

Notes

13.0 Part 13 Conclusion

We hope you have enjoyed the information in this booklet if there is any questions you would like to ask now is it time, if there is anything you would like to see added or changed pleases let us no, we hope this gives you a better understanding of the world of radio communications in scouting. Please be aware this is just a introduction and a lot of technical detail has been brushed over. If you have had your interest sparked pleases ask the GWS radio science and technology activity team about other information you can look into.

Thanks

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Extra information

13.1 ACMA

Citizen band radio fact sheet
http://www.acma.gov.au/WEB/STANDARD/pc=PC_1688

Distress beacons fact sheet http://www.acma.gov.au/WEB/STANDARD/pc=PC_1690

Radiocommunications (Citizen Band Radio Stations) Class Licence 2002
http://www.acma.gov.au/WEB/STANDARD/pc=PC_287

Maritime ship station – 27 MHz and VHF
http://www.acma.gov.au/WEB/STANDARD/pc=PC_1303

Radiocommunications (Maritime Ship Station - 27 MHz and VHF) Class Licence 2001 Maritime Ship Station - 27 MHz and VHF.

13.2 Out back radio

VKS737 http://www.vks737.on.net/

HF radio Club VKE237 http://www.hfradioclub.com.au/

HF Oz http://www.hfoz.com.au/

Radtel http://www.radtelnetwork.com.au/

13.3 Emergency Services

NSW RFS http://www.rfs.nsw.gov.au/
NSW Police http://www.police.nsw.gov.au/
NSW Fire and Rescue http://www.fire.nsw.gov.au/
NSW Ambulance http://www.ambulance.nsw.gov.au/
NSW SES http://www.ses.nsw.gov.au/
NSW VRA http://www.rescue.org.au/
Cost guard http://www.coastguard.com.au/home.html
NSW Maritime http://www.maritime.nsw.gov.au/
Civil Aviation
http://www.casa.gov.au/scripts/nc.dll?WCMS:HOMEPAGE::pc=HOME
CREST http://www.crest.org.au/joomla/
WICEN http://www.nsw.wicen.org.au/
ACREM: http://www.acrem.org.au/
Royal Flying Doctor Service http://www.flyingdoctor.org.au/

13.4 Amateur Radio

WIA http://www.wia.org.au/

13.5 Radio suppliers

GME http://www.gme.net.au/

ICOM http://www.icom-australia.com/

Uniden http://www.uniden.com.au/AUSTRALIA/index.asp

Action Communications: 198 Grate Western Highway Kingswood NSW 0247322788

13.6 SPOT Trackers

Spot http://au.findmespot.com/en/index.php

13.7 Satellite Phones

Satellite Phones Iridium: http://www.iridium.com/default.aspx

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Jargon Glossary

Volts (V)	Unit of electrical Pressure
Amps (I)	Unit of electrical Flow
Ohms (Ω)	Unit of Electrical Resistance Or impedance
Hertz (Hz)	Number of energy waves per second
Watts (W)	Electrical power V Times I
DC	Direct current
AC	Alternating Current
K	Multiply by 1000
M	Multiply by 1000000
G	Multiply by 1000000000
RF	Radio Frequency 3KHz to 300GHz
VLF	Very low Frequency's 3 KHz – 30 KHz
LF	Low Frequency's: 30 KHz – 300 KHz
MF	Medium Frequency's, 300 KHz – 3 MHz
HF	High Frequency's, 3 MHz – 30 MHz
VHF	Very High Frequency's, 30 MHz – 300 MHz
UHF	Ultra High Frequency's, 300 MHz – 3 GHz
SHF	Supper high Frequency's 3 GHz – 30 GHz
EHF	Extremely high Frequency's 30 GHz – 300 GHz
VSWR	Voltage standing wave ratio
Carrier	Single Frequency in Hz
CW	Morse Code
AM	Amplitude Modulation
SSB	Single side Band
USB	Upper sideband
LSB	Lower Sideband
FM	Frequency Modulation
CB	Citizens band
CQ	Any Station
AF	Audio Frequency
CTCSS	Continuous Tone Coded Squelch System
Sellcall	Selective Call
EPIRB'S	Emergency Position Indicating Radio Beacons
PLB	Personal Location Beacon
GPS	Global Positioning System
SOS	Save our soles (Emergency)
SMS	Simple Message Service
NCS	Net Control Station
Radio Traffic	Messages being passed over the radio
Traffic	See Radio Traffic
POTS	Plane old Telephone service
NBN	National Broadband network
BGAN	Advanced Satellite phone
MES	Mobile Earth Station
Manpack	A radio transported as a back pack
Portable radio	A radio held in the hand or on belt

Mobile radio	A radio mounted in a Vehicle
Base radio	A radio located in a fixed state (i.e located in a building or camp site)
1G	First Generation Cell phone
2G	Second Generation Cell phone
3G	Third Generation Cell phone
4G	Forth Generation Cell phone
Next G	Telstra 3G system
CDMA	Code Division Multiple Access, discontinued Telstra 1G/2G
GSM	Global System for Mobile. 2G Stranded systems
TXT	Same as SMS
LEO	Low Earth Orbit Satellite